

Scottish Confidential Audit of Severe Maternal Morbidity: **reducing avoidable harm**

10th Annual Report



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Scottish Confidential Audit of Severe Maternal Morbidity

10th Annual Report (Data from 2012 and 10-year summary)

Healthcare Improvement Scotland

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Headline Summary

- One in every 140 pregnancies is affected by severe maternal morbidity, most commonly major obstetric haemorrhage (MOH).
- There are deficiencies in the prevention and the management of MOH.
- The need for hysterectomy in the management of MOH has fallen from one in seven women with MOH in 2003 to one in 17 in 2012.
- Not all episodes of MOH are reviewed by the local risk management team.
- A consultant obstetrician does not attend every woman who experiences MOH or eclampsia.

What should happen next?

- A formal review of each maternity unit's own results should take place through local clinical governance arrangements, ie a formal review at local quality or clinical governance committee.
- Each maternity unit should use their local data to support improvements in the management of MOH particularly in the following areas:
 - reliable antenatal risk assessment
 - consistent adherence to established guidelines
 - formal clinical governance and risk management review of all cases via local adverse event or incident reporting systems.
 - direct involvement of senior staff, and
 - adequate labour ward staffing 24 hours a day.
- Each maternity unit should provide an adequate local resource to allow continuing audit of cases of severe maternal morbidity, particularly of those with MOH.
- Each maternity unit should work with the national Maternity and Children Quality Improvement Collaborative (MCQIC) in the identified priority areas.

1 Summary

This tenth annual report of the Scottish Confidential Audit of Severe Maternal Morbidity (SCASMM) describes severe maternal morbidity fulfilling defined criteria reported from all 17 consultant-led maternity units in Scotland in 2012. Detailed assessments of cases of major obstetric haemorrhage (MOH) and of eclampsia, and of their care in relation to national guidelines are reported. Data collection for SCASMM ceased on 31 December 2012 and, as this is the final SCASMM report, a summary of the findings in the ten years of the audit is included, with a description of trends and of changes in practice with time. Recommendations for practice based on the findings of the audit for 2012 and earlier follow this summary. A final discussion reviews the strengths and weaknesses of SCASMM over ten years, the changes it has reported and explores the potential impact it may have had on clinical care.

Each maternity unit will receive a report detailing all cases that were reported on and managed in that unit in 2012. The report will provide comparisons with that unit's performance in previous years and with overall data for Scotland in 2012.

1.1 Findings for SCASMM 2012

1.1.1 All morbidities

- During 2012, 423 women were reported experiencing 492 morbidities, giving a rate of 7.3 affected women per 1000 births.
- MOH remains the most frequent cause of severe maternal morbidity, being responsible for 80% of cases.
- The perinatal mortality rate among women experiencing severe maternal morbidity was the lowest reported by the audit, at 17.4 per 1000 births, but remained above the rate for all women giving birth in Scotland (6.5 per 1000 births).
- There was a significantly higher rate of severe maternal morbidity in women with a body mass index (BMI) of 30 or more.

1.1.2 Major obstetric haemorrhage

- The causes and associations of MOH were similar to previous years with bleeding related to the postpartum problems of uterine atony or retained placenta responsible for 81% of cases and caesarean section birth associated with 52%.
- Deficiencies were reported in antenatal identification of increased risk of MOH, in certain elements of resuscitation and in the medical management of uterine atony, but adherence to guidelines was generally high.
- The rate of use of conservative surgical procedures for the treatment of MOH was stable in 2012 compared to recent years and the proportion of women requiring hysterectomy fell.
- A consultant obstetrician was directly involved in the care of 82% of women with MOH and was less likely to be involved during night hours but more likely to be involved in more severe cases.
- The proportion of cases of MOH with optimal care as self assessed by maternity units was, at 70%, lower than in recent years, but this may be related to the increased proportion of cases assessed by a risk management team (77%).

1.1.3 Eclampsia

- The incidence of eclampsia in Scotland remained low, with eight cases reported in 2012.
- The management of eclampsia generally adhered to guidelines. A consultant obstetrician was directly involved in the care of five of the women.

1.2 Findings for SCASMM 2003-2012

1.2.1 All morbidities

- 3475 women were reported as having experienced at least one of the defined severe morbidities during the ten years of the audit.
- The steady increase in the annual rate of women experiencing severe maternal morbidity is almost entirely due to a rise in the rate of MOH which is consistently the most frequently reported morbidity.
- There has been a steady fall in the occurrence of eclampsia in Scotland.
- The rate of admission to an intensive care unit (ICU) of women with severe maternal morbidity has been consistent at about one admission for every 700 births.
- The perinatal mortality rate among women experiencing severe maternal morbidity has been consistently above the rate for all births in Scotland but has declined since 2010.
- A BMI of 30 or more was associated with an increased rate of severe maternal morbidity.
- Women in the least deprived quintile were significantly more likely to experience severe maternal morbidity.
- The proportion of women of 35 years and over experiencing severe maternal morbidity was significantly higher than the proportion of all women in the same age group giving birth in Scotland.
- Further analysis showed that women 40 years and over were more likely than those aged between 20-39 years to be in the least deprived quintile which suggests that maternal age was the main demographic contributing factor.

1.2.2 Major obstetric haemorrhage

- Uterine atony has consistently been the most frequent cause of MOH and emergency caesarean section the most frequent method of delivery.
- The majority of women at high risk of MOH were identified antenatally, with 80-90% being identified each year, but an action plan was completed and followed for fewer women (50-70% of women at high risk).
- Intraoperative red blood cell salvage and elective interventional radiology have not been well established in Scottish management practice in the anticipation of MOH.
- The cross matching of four units of blood when MOH occurs has become the modal amount, in line with current guidelines.
- There has been a decline in the volume of blood transfused to women with MOH and the mean has been just above four units in all recent years.

- The resuscitation and monitoring of women with MOH has been good but there is consistent overtransfusion of clear fluid prior to the administration of blood in many maternity units.
- Guidelines for the pharmacological management of uterine atony have been inconsistently followed.
- A steady rise in the use of conservative surgical procedures, particularly intrauterine balloon tamponade has been associated with a significant decline in the proportion of women with MOH requiring peripartum hysterectomy, from 15.1% in 2003 to 5.9% in 2012.
- As self assessed by maternity units, major suboptimal care of women with MOH has been rare (3% or fewer of women every year) and the proportion of women assessed to have received optimal care has steadily increased from 60% in 2004 to 80% in 2011.
- The proportion of women with MOH who received direct care from a consultant obstetrician has varied between 68% (in 2004) and 82% (in 2010).
- A consultant obstetrician was more likely to attend women who experienced MOH with large volumes of blood loss, with more serious conditions and where major surgery was performed but were less likely to attend women at night.

1.2.3 Eclampsia

- The presentation of women with eclampsia was often atypical.
- The management of eclampsia has shown a high level of compliance with guidelines; magnesium sulphate has been universally administered in recent years.
- Since 2008, no woman with eclampsia has received major suboptimal care as self assessed by maternity units.
- The direct involvement of a consultant obstetrician in the care of women with eclampsia has varied between 46% and 100% (in 2011).

2 Recommendations

Chief Executives should ensure that mechanisms are in place to enable a formal review of each maternity unit's results which should take place through local clinical governance arrangements. Each unit should use their local data to achieve the improvements detailed below which will contribute to the aims of the national Maternity and Children's Care Quality Improvement Collaborative (see Appendix 7).

2.1 Continuing audit

1. **Heads of Midwifery** and **Clinical Directors** should provide an adequate local resource to allow maintenance of a system for auditing cases of severe maternal morbidity, particularly those with MOH and admissions to ICU.

2.2 Prevention and planning

1. All pregnant women should be assessed for the risk factors associated with MOH and an appropriate management plan should be recorded and followed.
2. Local clinical governance or risk management teams should review all cases of severe maternal morbidity.
3. With a view to improved prevention and management, risk review of all cases of MOH should particularly examine:
 - The identification of risk factors and the development and implementation of an action plan
 - Resuscitation and monitoring in relation to guidelines
 - The amount of blood cross-matched and the use of uncross-matched blood
 - The drugs used to treat uterine atony in relation to guidelines
 - The involvement of consultant staff in the woman's care.
4. Particular vigilance should be taken over fetal wellbeing in the presence of severe maternal morbidity.
5. A consultant obstetrician should be present or immediately available at all emergency caesarean sections performed at full cervical dilatation.
6. Maternity units require adequate staffing 24 hours a day to manage acute episodes of severe maternal morbidity.

2.3 Management

1. **Clinicians** should specifically ensure that the recommended cascade of uterotonic agents in the management of haemorrhage due to uterine atony are followed with, in particular, early use of ergometrine in the absence of hypertensive disease.
2. In the likelihood or the presence of MOH, four units of blood should be cross matched in the first instance.
3. Prior to the transfusion of blood, no more than 2000 mls of crystalloid solution and no more than 1500 mls of colloid (3500 mls in total) should be administered.
4. A modified obstetric early warning chart should be used to monitor all women with severe maternal morbidity and should be used for all women requiring regular observation. Prompt action when indicated by the observations is an essential component of good practice.

5. A consultant obstetrician should be directly involved in the management of all cases of MOH and of eclampsia.
6. Staff in all maternity units should ensure that they are familiar with and have ready access to reminders of the standard recommendations for resuscitation, monitoring and investigation of women experiencing eclampsia and MOH.

3 Introduction

Since 2003, following a successful pilot¹, a continuous audit of severe maternal morbidity in Scotland has been conducted in all consultant-led maternity units, collecting data on consistently defined events. The included events and their definitions are based on work by Mantel et al in South Africa². The categories and their definitions are described in Appendix 1.

This is the tenth and last annual SCASMM report to be produced. A summary of the results of data collected covering events in 2012 is provided, followed by a separate results section which describes trends and changes in the occurrence and management of severe maternal morbidity in Scotland throughout the 10 years of the audit. Separate appendices provide more detail of results for 2012 and for 2003-2012. A final discussion comments on the strengths and weaknesses of SCASMM, the changes in practice and outcomes which it has audited and whether it has made a difference.

Where relevant, practice is compared to published guidance and identifies deficiencies and good practice. Other information on the incidence and associations of severe maternal morbidity in pregnancy will assist NHS boards and maternity units to provide and organise the delivery of an appropriate service and will help to inform the Maternity and Children Quality Improvement Collaborative (MCQIC).

Limited unit specific data are reported here, but, as has been the case since the report for 2009, each consultant-led maternity unit will also receive a detailed report on its own performance highlighting local good practice and deficiencies in relation to clinical guidelines and to Scotland's overall performance.

This full report (together with all previous annual reports) is available as a web-based version and is sent as an email attachment to a large number of health professionals working in reproductive health in Scotland. Previous annual reports are also available; the links are in Appendix 5.

The audit would not have been possible without the dedicated support and co-operation of the unit co-ordinators and their work is gratefully acknowledged. A list of the co-ordinators is included in Appendix 4.

The report is produced by the Reproductive Health Programme of Healthcare Improvement Scotland. Comments on this report are welcome and should be directed to Leslie Marr, Reproductive Health Programme Manager, at leslie.marr@nhs.net

4 Methods

From 1 January 2003 to 31 December 2012, a designated co-ordinator (usually a senior midwife) in each consultant-led maternity in Scotland notified the Healthcare Improvement Scotland Reproductive Health Programme (RHP) (or predecessor organisations) of all women meeting one or more of the severe maternal morbidity definitions. The Programme was also notified for each month when no events were identified. If monthly returns were not received, the unit co-ordinator was contacted by telephone or email. The co-ordinators submitted a minimum dataset (see Appendix 6) on each woman who met the inclusion criteria.

Cases of major obstetric haemorrhage (MOH) and of eclampsia were subject to detailed case assessment. If a case was submitted in the minimum dataset form but no detailed case assessment form was received, the unit co-ordinator was contacted by telephone or email. Missing or incomplete data was also retrieved by the same method. No patient identifiable information was sent to Healthcare Improvement Scotland or predecessor organisations. A limited amount of information was requested for cases of successful preventive interventional radiology from 2010 to 2012.

Data received from each maternity unit was entered into an Access database. More comprehensive data on MOH and eclampsia were entered into Statistical Package for Social Sciences (SPSS) data files for subsequent analysis. Data was cleaned and quality assured by staff from the RHP and has been sent to an external statistician for analysis each year since 2009 (2008 data).

National rates per 1000 births for each severe maternal morbidity category were calculated using routinely published data on births from the National Records of Scotland (NRS) as denominators³. Standards of care for MOH and eclampsia were assessed against national guidelines current during 2012^{4,5,6,7} and units were asked for their own evaluation of the quality of care. No external assessment or case review was carried out.

A detailed description of the audit methodology was included in the sixth annual SCASMM report⁸.

5 Results for events in 2012

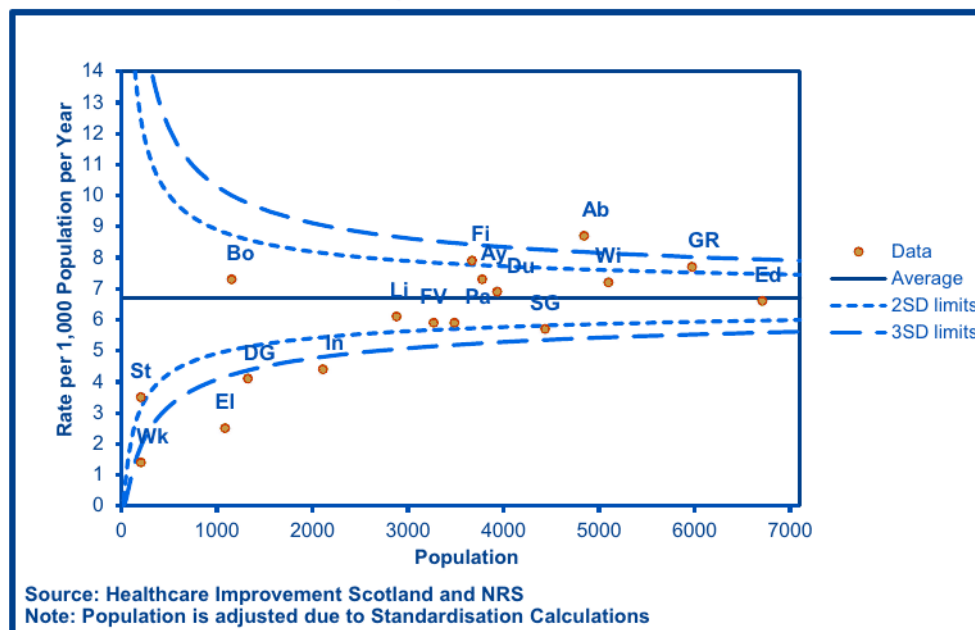
Two sections of results are provided. Data from events reported during 2012 are summarised in this chapter (5) with occasional reference to earlier years where it is particularly relevant to the context. More detailed results pertaining to Chapter 5 are included in Appendix 2. Chapter 6 describes events, trends and changes in practice during the 10 years of the audit with further details in Appendix 3.

5.1 All morbidities 2012

5.1.1 Numbers and rates

During 2012, the details of 423 women experiencing a total of 492 morbidities fulfilling the audit criteria were reported. The rate of severe morbidity was 7.3 women per 1000 births registered at the National Records of Scotland (NRS)³ (95% confidence interval, 6.6-8.0). This national rate is calculated from all births in Scotland, but rates for individual consultant maternity units (Appendix 2, Table 2.1) are calculated from the number of births in that unit. This may not, however, reflect the number of births taking place within that unit's geographical catchment area. In 2012, there were 1575 births in community midwifery units, 720 domiciliary births and 17 elsewhere. Together, this represents 4.0% of all births in Scotland. Some consultant-led units are located in geographical areas with a greater proportion of these births than others. In Tayside, 613 births (13.5% of all Tayside births) took place outwith Ninewells Hospital and in Aberdeenshire, 320 births (5.8%) took place outwith Aberdeen Maternity Hospital. This, together with variable case ascertainment, is partly responsible for the differences in rates reported from different units. To diminish the impact of fluctuations from year to year and of low annual births in some units, Figure 1 shows, in a funnel plot, the aggregated rates for different units over seven years compared to the overall Scottish rate.

Figure 1: Aggregated rates of severe maternal morbidity reported from different consultant-led maternity units, 2006-2012



Each labelled point represents the rate of severe morbidity per 1000 births at each maternity unit; the continuous line is the Scottish average rate with the dashed lines 2 and 3 standard deviations from the mean. "Population" is the estimated average number of births at each maternity unit during the period 2006 to 2012.

Explanation of labelling:

Ab = Aberdeen, Ay = Ayrshire, Bo = Borders, DG = Dumfries, Du = Dundee, Ed = Edinburgh, EI = Elgin, Fi = Forth Park (Victoria since January 2012), Fife, GR = Glasgow Royal, In = Inverness, Li = Livingston, Pa = Paisley, SG = Southern General, FV = Forth Valley, formerly Stirling, St = Stornoway, Wk = Wick, Wi = Wishaw.

5.1.2 Causes

In 2012, as throughout the duration of the audit, MOH was substantially the most frequent of the defined categories of severe maternal morbidity, affecting 339 women, 80.1% of all women identified with severe maternal morbidity, or one in every 172 women giving birth in Scotland. Sixty four women were recorded with more than one severe maternal morbidity (Table A2.2), most frequently because of admission to an intensive care unit (ICU) which is itself categorised as a separate morbidity. In total, 87 women were admitted to an ICU, 40 of them with MOH. The numbers and rates of all 14 categories of severe maternal morbidity are shown in Table A2.3 and the reasons for admission to ICU in Table A2.4.

Specific information on multiple pregnancy was sought in 2012. Of the 421 women with the information recorded, 27 were twin pregnancies (6.4%). This is substantially above the rate for all twin births in Scotland in 2012, which was 1.5%⁹.

5.1.3 Perinatal mortality

The perinatal mortality among women experiencing severe maternal morbidity is higher than among all women giving birth. In 2012, there were seven perinatal deaths among the 403 women with severe morbidity for whom the information was available and who gave birth to a potentially viable fetus. This is a perinatal mortality rate of

17.4 per 1000 births; the overall Scottish rate in 2012 was 6.5 per 1000 births⁹. The rate among women with MOH was 12.2 per 1000 births and among those with all other severe morbidities, 40.0 per 1000 births.

5.1.4 Sociodemographic factors

Three sociodemographic factors have been examined in recent years for an association with severe maternal morbidity: deprivation, body mass index (BMI) and smoking. This is described further in later results looking at trends over time. Details of deprivation and BMI for 2012 are included in Appendix 3, Tables A3.7 and A3.8. Smoking information for 2012 is in Table A2.5. In 2012, no association was found between the occurrence of severe maternal morbidity and levels of either deprivation or of smoking. The distribution of both was similar to the overall population of Scotland giving birth. However, of the women who experienced severe maternal morbidity, 29.1% had a BMI of 30 or more, compared to 21.0% of all women giving birth in Scotland. This difference is highly significant ($p < 0.001$).

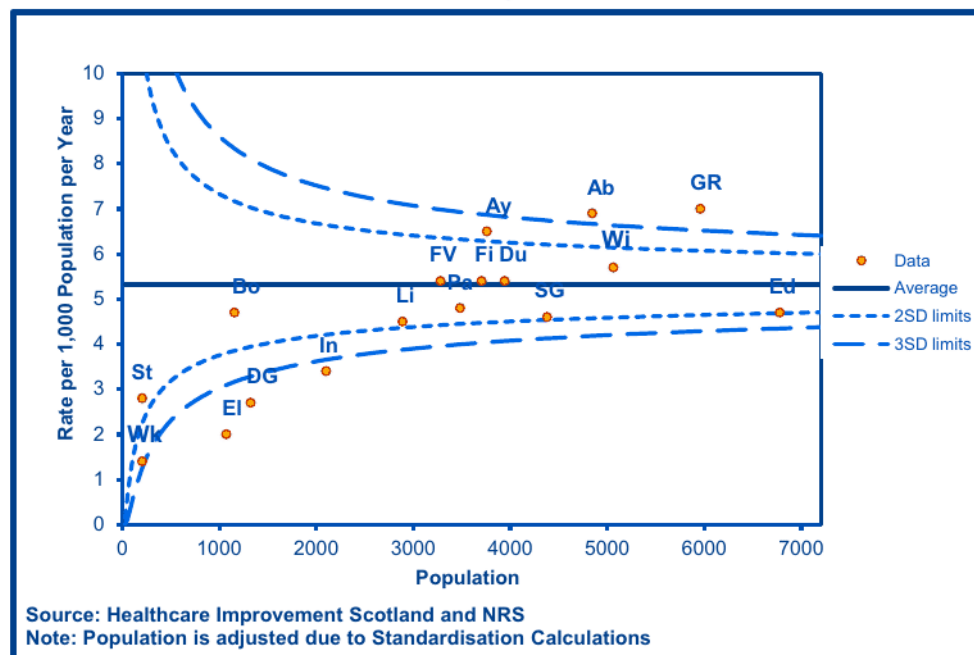
Information on the age and gestation of women experiencing severe maternal morbidity in 2012 is shown in Tables A2.6 and A2.7.

5.2 Major obstetric haemorrhage 2012

5.2.1 Incidence

Throughout this audit, MOH has been defined as an estimated blood loss $\geq 2500\text{ml}$, and/or the transfusion of five or more units of blood and/or the administration of other blood products for coagulopathy. Detailed case assessment proformas were returned for all of the 339 women experiencing MOH meeting one or more of the criteria in 2012, although data was not complete for all cases. Appendix 2 provides detailed information and important features are summarised here. The overall rate of MOH in Scotland was 5.8 per 1000 births [95% CI 5.2 – 6.5]. The numbers and rates of MOH in the maternity units reporting to the audit in 2012 are shown in Table A2.8. The aggregated rates of MOH reported from these units in the past seven years are shown in a funnel plot (Figure 2). The comments made above (5.1.1) concerning variation in rates for all morbidities also apply.

Figure 2: Aggregated rates of major obstetric haemorrhage reported from different consultant led maternity units, 2006-2012



Each labelled point represents the rate of major obstetric haemorrhage per 1000 births at each maternity unit; the continuous line is the Scottish average rate with the dashed lines 2 and 3 standard deviations from the mean. "Population" is the estimated average number of births at each maternity unit during the period 2006 to 2012.

Explanation of labelling:

Ab = Aberdeen, Ay = Ayrshire (Ayrshire Central and Crosshouse), Bo = Borders, DG = Dumfries, Du = Dundee, Ed = Edinburgh, El = Elgin, Fi = Forth Park (Victoria), Fife, GR = Glasgow Royal, In = Inverness, Li = Livingston, Pa = Paisley, SG = Southern General, FV = forth Valley formerly Stirling, St = Stornoway, Wk = Wick, Wi = Wishaw.

5.2.2 Causes

Post partum uterine atony contributed to 194 cases of MOH (57.2%) and 81 women (23.9%) retained the placenta or membranes. These postpartum problems were responsible for 81.1% of MOH. The distribution of causes is shown in Table A2.9 and is similar to previous years although the number of uterine ruptures (9) was higher than in any previous year.

5.2.3 Timing and location

Most MOHs (75.1%) first developed postpartum; 8.3% developed antepartum and 16.6% intrapartum. The great majority (92.3%) first occurred in a consultant-led maternity unit but 13 women (3.8%) first bled outwith professional care, most of them antepartum (see Table A2.10).

Elective caesarean births, which usually take place during the working day, were associated with 12.9% of cases of MOH. Allowing for this, the distribution of the time of MOH events was evenly spread throughout the 24 hour period. (Figure A2.11).

5.2.4 Associations

More than half of MOHs (51.7%) were associated with delivery by caesarean section, particularly emergency caesarean section (Table A2.12). Of the 129 emergency caesarean sections associated with MOH, 23 (17.8%) were performed at full cervical dilatation.

Information on deprivation, BMI and smoking for women who experienced MOH in 2012 is shown along with other recent years in Tables and Figures A3.13 – A3.16. As with all morbidities, there was a higher proportion of women with a BMI of 30 or more who experienced MOH (30.4%) compared to all women giving birth in Scotland (21.0%) but in 2012 there was no significant association with smoking or with the level of deprivation (unlike other years).

Among the 339 women experiencing MOH in 2012, 22 were twin births (6.5%). This is substantially higher than the rate of twin births among all births in Scotland in 2012, which was 1.5%.

5.2.5 Anticipation and prophylaxis

All 17 consultant-led maternity units reported that they held practice drills for MOH at least once a year.

Recognition and anticipation of the possible risk of MOH in individual cases during 2012 is summarised below:

- Two out of 54 women with a previous caesarean section (4%) were reported as not having received antenatal ultrasonography for placental localisation.
- 94 women (28%) of all 339 cases of MOH were potentially identifiable antenatally as being at high risk of haemorrhage; 88 (94% of the 94 women) were actually identified antenatally and an action plan was developed for 63 (67% of the 94). The action plan was followed completely for 50 of the 63 women (79%) and partially for a further 7 (11%), leaving three (5%) for whom the plan was not followed and three where the outcome was unknown.
- Placenta praevia and/or accreta was anticipated in 27 women. Elective caesarean section was planned for 19 (70%) of these and a consultant obstetrician was present at the delivery of 26 (96%).
- A consultant obstetrician was present at 21 (91.3%) of the 23 emergency caesarean sections performed at full cervical dilatation.

Among the 161 women who gave birth vaginally, information on third stage uterotonic prophylaxis was recorded for 158. Of these, 129 (81.6%) were given syntocinon for prophylaxis and 38 (24.1%) syntometrine; some were given both agents. Two women were reported to have received no prophylaxis.

5.2.6 Resuscitation and blood transfusion

The mean estimated blood loss among all cases of MOH was 3485 ml, with a range of 1900 to 30000 ml. Venous access was achieved in all women and 91% had two large bore cannulae sited (Table A2.13). For initial resuscitation prior to blood transfusion, no more than 2000 ml of crystalloid and 1500 ml of colloid solution is recommended⁴; this amount of crystalloid was exceeded in 22.6% of cases and the amount of colloid was exceeded in 8.8% (Table A2.14). The variable amounts of blood cross matched when MOH was recognised are shown in Table A2.15a. Four units (the recommended number⁴) was the modal amount (50.8% of the 305 women for whom the information was recorded). Six units were cross matched for 25.9% of

women and two units for 13.8%. Blood transfusion was given to 274 women (80.8% of all women with MOH) who received a mean 4.2 units each, the highest amount being 37 units. O negative blood was transfused to 40 women and group specific uncross-matched blood to 32. Among those receiving a blood transfusion, 42.3% also received fresh frozen plasma, 20.4% platelet transfusion and 9.1% cryoprecipitate. Details are in Table A2.15b. One woman was given recombinant activated factor VII (rFVIIa) in 2012.

5.2.7 Investigations and monitoring

There was generally a high level of compliance with guideline recommendations for investigation and monitoring of MOH⁴ except that an obstetric early warning chart was used to record observations for only 80.5% of women (Table A2.16). Forty women (11.8% of all women with MOH) were admitted to an ICU.

5.2.8 Medical management

Postpartum uterine atony is the most frequent cause of MOH. After “rubbing up the uterus” to encourage contractile activity, the use of uterotonic pharmacological agents is recommended in a specified order⁴. Of the 194 women with MOH caused by uterine atony in 2012, 136 (70.1%) were reported to have received “rubbing up the uterus”.

Evidence from recent SCASMM reports has suggested inconsistent application of the guideline use⁴ of uterotonic pharmacological agents for the treatment of uterine atony. In 2012, 61% of the 194 women received an intravenous syntocinon bolus injection, 66% intravenous ergometrine and 93% an intravenous syntocinon infusion. The preponderance of the latter is partly due to the high rate of caesarean section delivery among women with MOH. Intravenous ergometrine was used as one of the first three pharmacological agents in 78 of the 128 women (61%) who received it.

The use of uterotonic agents since 2009 is shown in Tables 3, 4 and 5 (page 27) and described in more detail in Chapter 6 which presents trends over time.

5.2.9 Surgical management

Of the 315 women for whom the information was available, an examination was conducted under anaesthetic for 261 (82.9%). In considering the surgical methods used to control MOH, procedures such as the removal of a retained placenta, additional or repeat suturing of caesarean section wounds and the control of bleeding from the lower genital tract are not described or discussed here. The audit has concentrated on the newer conservative surgical techniques to control MOH. In 2012, 119 conservative techniques were used, controlling haemorrhage sufficiently to avoid a hysterectomy in 101 cases (84.9%). Individual procedures with their success rate in avoiding hysterectomy are shown for 2012 in Table 1. Of the 11 occasions when interventional radiology was used, four were emergency interventions and in the remaining seven, planned elective interventional radiology failed to control bleeding sufficiently to avoid MOH. Five successful instances of interventional radiology preventing MOH were also reported.

Table 1: Use of haemostatic surgical procedures among 339 women with major obstetric haemorrhage, 2012

Procedure	Women undergoing procedure	Successful (hysterectomy avoided)
	Number (%)*	Number (%)
Intra-uterine balloon tamponade	82 (24.2)	75 (91)
Uterine artery embolisation (interventional radiology)	11 (3.2)	6 (60)
Bilateral ligation of uterine arteries	3 (0.9)	3 (100)
Bilateral ligation of internal iliac arteries	2 (0.6)	1 (50)
Haemostatic brace uterine suturing (e.g. B-Lynch)	21 (6.2)	16 (76)
Hysterectomy	20 (5.9)	

*Percentage is of all 339 women experiencing MOH

After the slight rise in the rate of peripartum hysterectomy among women with MOH in 2011, arresting the steady decline since the audit commenced, the rate in 2012 fell again to 5.9%.

5.2.10 Quality of care and of case records

In 2012, 70.2% of women with MOH were deemed by units' self assessment to have received optimal care. Six women were assessed as having received major sub-optimal care. Details of all recent years, including 2012, are shown in Appendix 3, Table A3.21. Risk management assessment was reported to have taken place in 257 of the 336 cases of MOH (76.5%) for which the information was available (Table A2.18). This is a considerable increase from the 41.6% so assessed in 2011 and may partly explain the assessed decline in optimal care from 80.2% in 2011.

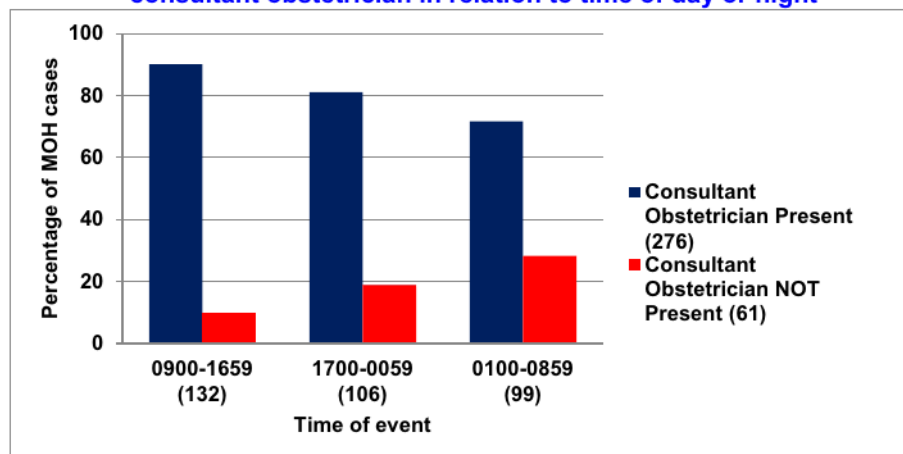
A consultant obstetrician was directly involved in the care of 277 women with MOH (81.7%) and a consultant anaesthetist in 207 women (61.1%). The direct involvement of other staff is shown in Figure A2.19. In 2012, of the 62 women with MOH not attended directly by a consultant obstetrician, 52 were cared for by a senior trainee obstetrician within two years of completing training (a ST6 or ST7). Ten women (2.9% of all women with MOH) had no direct care by a consultant obstetrician or by a ST6 or ST7.

The reported mean blood loss among women not attended by a consultant obstetrician (2814 ml, standard deviation 414, range 2500-4500 ml) was significantly less ($p < 0.001$) than among women who were so attended (3634 ml, SD 2450, range 1900-30000).

There was a high level of consultant involvement for the particularly serious causes of MOH, notably placenta praevia, morbidly adherent placenta, uterine rupture and uterine inversion. In 2012, a consultant obstetrician attended 35 of the 38 women with at least one of these four causes, and was reported as not attending one (out of 24) women with placenta praevia and two (of nine) with uterine rupture. In all three cases, an ST6 or ST7 was present.

The attendance of a consultant obstetrician was less likely if MOH occurred during the night (Figure 3). The difference between the 90.2% consultant obstetrician attendance between 0900 and 1659 and 71.7% between 0100 and 0859 is highly significant ($p < 0.001$).

Figure 3: Proportion of women with MOH in 2012 attended or not attended by consultant obstetrician in relation to time of day or night



(Number in brackets is the number of cases in each category)

The direct involvement of a consultant obstetrician was reported for all of the more complicated interventions (ligation of the uterine or internal iliac arteries, uterine brace sutures and hysterectomy). A consultant obstetrician was not present for one of the 11 cases involving interventional radiology and for four of the 82 intrauterine balloon placements (Table A2.20). In all 20 cases where a hysterectomy was performed, the opinion of a second consultant obstetrician was sought prior to proceeding.

The overall quality of care as self-assessed by maternity units showed a similar distribution whether or not there was direct care by a consultant obstetrician. No woman not directly attended by a consultant obstetrician was deemed to have received major suboptimal care.

Most case records (94.9%) were deemed “excellent” or “good” as was the documentation of 94.6% of episodes of MOH (Table A2.21). Four case records were “chaotic” and one episode of MOH was reported as “not documented”.

Additional information on women with MOH in 2012 is shown in Tables A2.22-26.

5.3 Eclampsia 2012

5.3.1 Incidence, associations and circumstances

In 2012, eight women were reported to the confidential audit as experiencing eclampsia. Case assessment proformas were returned for all of the women. Details of the responses are shown in Appendix 2 (Tables A2.27 – A2.36) and are summarised here.

There were no multiple pregnancies, six of the women were primigravida, their mean age was 25.5 years, none smoked and there was no obvious association with deprivation.

The mean gestation at which the eight women developed eclampsia was 35.5 weeks with the earliest 26 and the latest 41 weeks. Four women developed eclampsia antepartum (one of these in transport), and four intrapartum. There was no pattern to

the time of day when a seizure occurred. Three women had been diagnosed with pre-eclampsia and one had no prodromal symptoms or signs. Details of these latter features are included with that for all recent years in Table A3.23.

5.3.2 Management and quality of care

Royal College of Obstetricians and Gynaecologists (RCOG) guidelines⁷ contain recommendations for resuscitation, treatment, investigation and monitoring. The number of women complying with these features in all recent years is shown in Tables A3.24 and A3.25. Allowing for missing data in some cases, these show a generally high adherence to guidelines, although there was insufficient testing of deep tendon reflexes and inadequate availability of calcium gluconate at the bedside. One woman required admission to an ICU.

A consultant obstetrician was directly involved in the care of five women and a consultant anaesthetist in the care of three. Other staff who were involved are shown in Table A2.35. Self assessment at maternity unit level found that four women (50%) received appropriate care. There was no significant sub-optimal care. Seven cases were discussed at a risk management forum.

All eight of the case records were deemed to be “good” or “excellent” but the documentation of one case was reported as inadequate (Table A2.36).

6 Overview of SCASMM results 2003-12

This chapter of results shows changes and trends identified in ten years of SCASMM. An increasing amount of information was collected with time. This is reflected in the results as many of the Tables and Figures do not provide information for all ten years. The chapter contains separate sections for the results of all severe maternal morbidities combined, for MOH and for eclampsia. Some Tables and Figures are within this section. Others are in Appendix 3.

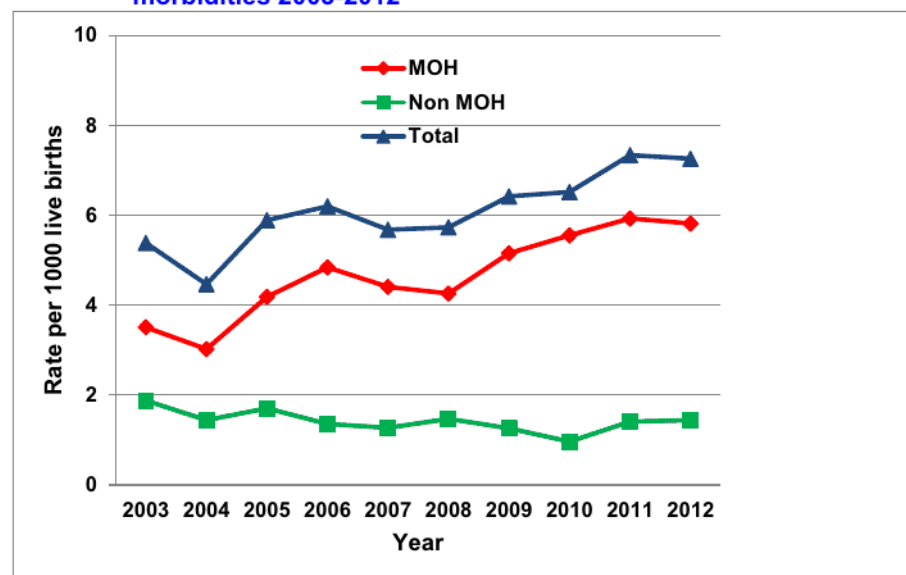
6.1 All morbidities 2003–2012

6.1.1 Numbers and rates

In total, 3475 women were reported as having experienced at least one of the defined severe morbidities during the 10 years of the audit. The total number of women reported from each consultant-led maternity unit with the rate for that unit is shown in Table A3.1. During the 10 years, the number of consultant-led maternity units has fallen from 22 to 17 due to closures and amalgamations. Table 3.1 includes births which took place in the five closed units (except for Vale of Leven Hospital) but have been allocated to the appropriate current maternity unit. The table footnote explains the allocation. The overall Scottish rate was 6.1 women reported with severe maternal morbidity per 1000 births (95% confidence interval 5.9-6.3), with a range from 2.4 per 1000 births (in Wick) to 8.9 per 1000 births in Aberdeen. Possible reasons for this variation are described in section 5.1.1 of Chapter 5 and are discussed in Section 7.1.

The number and rates of instances of each morbidity reported over 10 years are shown in Table A3.2. The rates of severe maternal morbidity in each of the 10 years of the audit are plotted in Figure 4. All morbidities other than MOH are combined as the number of each individual morbidity is small. The overall rise can be almost entirely attributed to MOH. The rate of all other morbidities (non-MOH) has either declined or changed little over 10 years.

Figure 4: Rates of women with major obstetric haemorrhage and other morbidities 2003-2012



The rate of admission to ICU of women with severe maternal morbidity has varied little since 2003 (Figure 5) with one woman requiring ICU admission for approximately every 700 births. Most admissions to ICU have been for one of the other defined criteria of severe maternal morbidity, particularly MOH which accounted for 76.9% of all admissions to ICU with severe maternal morbidity in 2003-12. The reasons for admission to ICU with severe maternal morbidity are shown in Table A3.3. This information was accurately available from 2007. Reasons for ICU admission other than one of the defined categories of severe maternal morbidity have been documented since 2008 and are shown in Table A3.4. Morbidities other than MOH or ICU admission can be described as either infrequent (50 or more events in the 10 years of the audit) or rare (less than 50 events reported in 10 years). While there is no pattern to the reporting of rare morbidities (Figure A3.5), infrequent morbidities have shown an overall decline, although there have been fluctuations among individual morbidities (Figure 6). Eclampsia is not included in Figure 6 as changes over ten years are described in Section 6.3 below.

Figure 5: Rate of admission of women with severe maternal morbidity, to intensive care units, 2003–2012

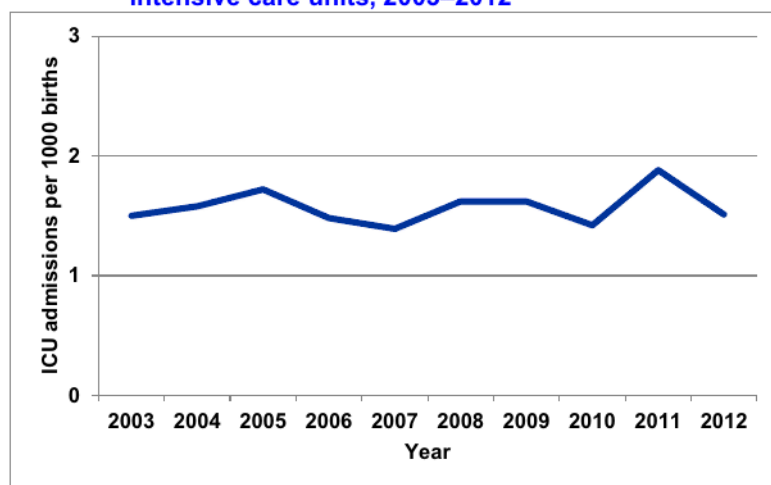
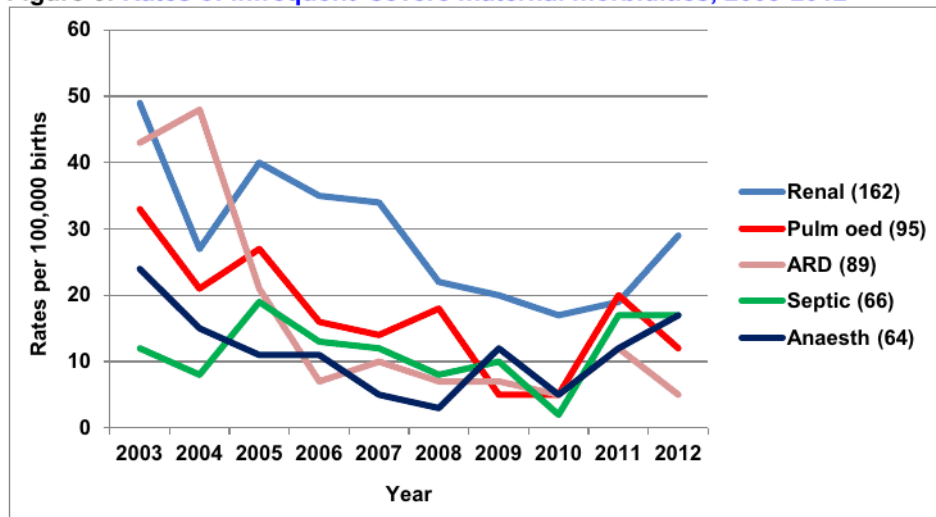


Figure 6: Rates of infrequent* severe maternal morbidities, 2003-2012



* 50 or more morbidities reported in 10 years, but excluding MOH and eclampsia.

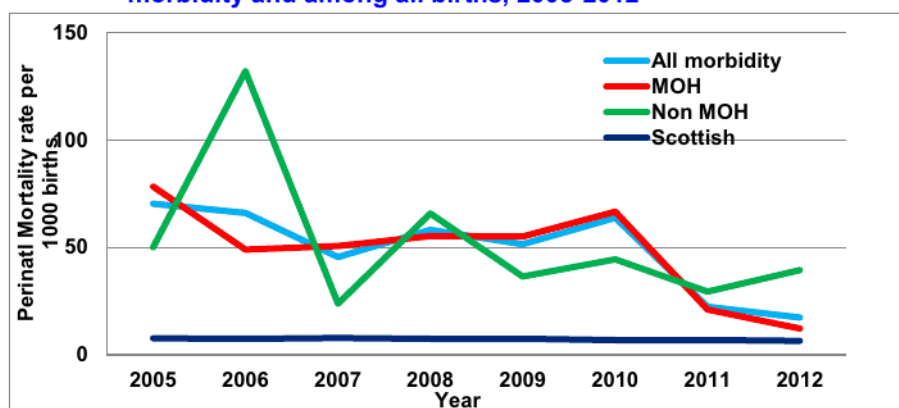
Renal=renal or liver dysfunction; Pulm oed=pulmonary oedema; ARD=acute respiratory dysfunction; Septic=septicaemic shock; Anaesth=anaesthetic problem.

The number in brackets after each is the total number of cases reported in 10 years.

6.1.2 Perinatal mortality

The perinatal mortality rate among women experiencing severe maternal morbidity has been consistently higher than that among all births in Scotland but has declined since 2010. Information on perinatal mortality was not collected by SCASMM before 2005 and was inconsistently recorded initially, but has been much more complete in recent years. The perinatal mortality rates shown in Figure 7 are of those women for whom the information was available. The numbers on which these rates are based are shown in Table A3.6. Women with all morbidities other than MOH are grouped together because of small numbers. Data since 2009 has been more complete and reliable than earlier years and the decline in perinatal mortality since then, especially among women with MOH is notable, although still consistently above the rate for all births in Scotland⁹.

Figure 7: Perinatal mortality rates per 1000 births among women with severe morbidity and among all births, 2005-2012

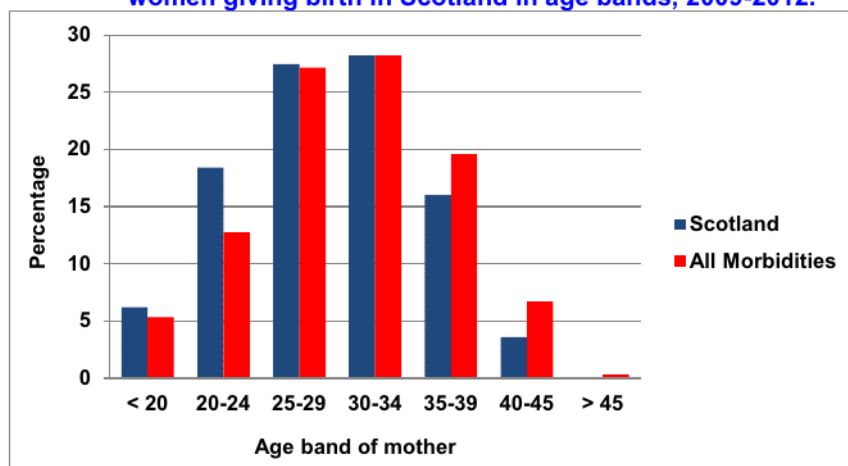


6.1.3 Maternal age and sociodemographic factors

Full information on these factors has been collected since 2009.

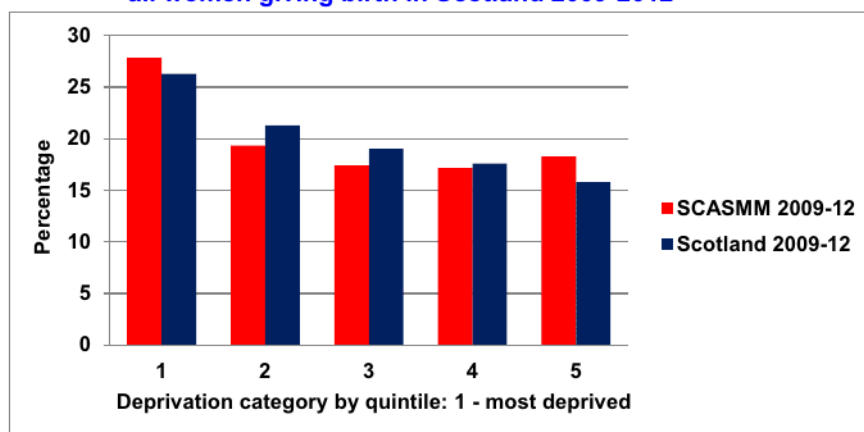
Increasing maternal age was associated with an increase in the rate of severe maternal morbidity (Figure 8). The proportion of women under 25 years experiencing severe maternal morbidity in 2009–2012 was significantly lower ($p<0.001$) than the proportion of all women under 25 years giving birth in Scotland in the same period. The proportion of women of 35 years and over and experiencing severe maternal morbidity was significantly higher ($p<0.001$) than the proportion of all women in the same age group giving birth in Scotland.

Figure 8: Percentage of women with severe maternal morbidity and of all women giving birth in Scotland in age bands, 2009-2012.



In the period 2009–2012, there were significantly more women ($p<0.001$) with severe maternal morbidity in the least deprived quintile when compared to all women giving birth in Scotland (Figure 9). A stepwise logistic regression analysis showed that women 40 years and over were more likely than those aged between 20-39 years to be in the least deprived quintile which suggests that maternal age was the main demographic contributing factor.

Figure 9: Deprivation quintile of women with severe maternal morbidity and of all women giving birth in Scotland 2009-2012



Details of deprivation by decile and of BMI since 2009 are shown in Tables A3.7 and A3.8. Of the women who experienced severe maternal morbidity in 2009-2012, 27.8% had a BMI of 30 or more. During the same period, 17.6% of all women giving birth in Scotland had a BMI ≥ 30 (S Wigglesworth, Information Analyst, Information Services Division. Personal Communication, 25th April, 2014). This difference is highly significant ($p < 0.001$).

Overall, smoking did not influence the occurrence of severe maternal morbidity for the cohort of women with severe maternal morbidity. Smoking at the time of antenatal booking was reported by 21.0% of all women with severe morbidity between 2009 and 2012, very close to the overall smoking rate among all women giving birth (20.4% in 2011-12) (S Clarke, Information Analyst, Information Services Division, personal communication 11 December 2013). However, logistic regression analysis showed that those relatively few women with severe maternal morbidity under 20 years were more likely to smoke and to come from the more deprived quintile when compared to women aged between 20 and 39 years.

6.2 Major obstetric haemorrhage 2003–2012

From 2003 to 2012, 2727 women were reported to SCASMM as having experienced MOH fulfilling one or more of the audit criteria. Where there has been little change in any aspect of reporting throughout the 10 years, there is no detailed analysis here. Over time, the amount of information collected for cases of MOH has increased, partly because of improved reporting but mainly through a more detailed questionnaire. Information on a number of aspects of MOH is, therefore, not available for all of the 10 years.

6.2.1 Incidence, causes and associations

As shown in Figure 4, there has been a steady rise in the reported rate of MOH during the 10 years of the audit. The lowest rate was reported in 2004, at 3.2 per 1000 births and the highest in 2011 (5.9 per 1000 births). Aggregated rates for the past seven years from each of the current consultant maternity units have been shown in Figure 2 (page 13).

It is assumed that all women who experience MOH will be managed in a consultant-led maternity unit, even if some women were not within one when the bleed commenced. The location of the onset of bleeding has been recorded since 2010. Since then, of 1004 cases with the information recorded, 24 (2.4%) first bled in a community maternity unit, 35 (3.5%) at home/outwith a healthcare setting and one woman bled during transportation (a home birth with a retained placenta). Of 1534 women with information on the stage of pregnancy at which bleeding commenced (recorded since 2008), 9.2% first bled antepartum, 15.2% intrapartum and 75.6% postpartum. As reported in 2011 and 2012, the time of bleed within a 24 hour period was evenly distributed allowing for an excess of bleeds during working daytime hours associated with elective caesarean sections.

The distribution of causes (Table A3.9) and of the mode of delivery (Table A3.10) throughout the audit has changed little with uterine atony consistently the most frequent, accounting for 52.7% of causes in 2006-2012 and caesarean section being associated with 55.3% of cases of MOH from 2003-2012. Of the caesarean sections, 75.4% were emergencies. Emergency caesarean section at full cervical dilatation appeared to be particularly associated with MOH; 20.8% of the emergency caesarean sections associated with MOH performed between 2004 and 2012 were

performed at this stage (Table A3.11). The proportion of all emergency caesarean sections in Scotland performed at full cervical dilatation is not known but is likely to be lower.

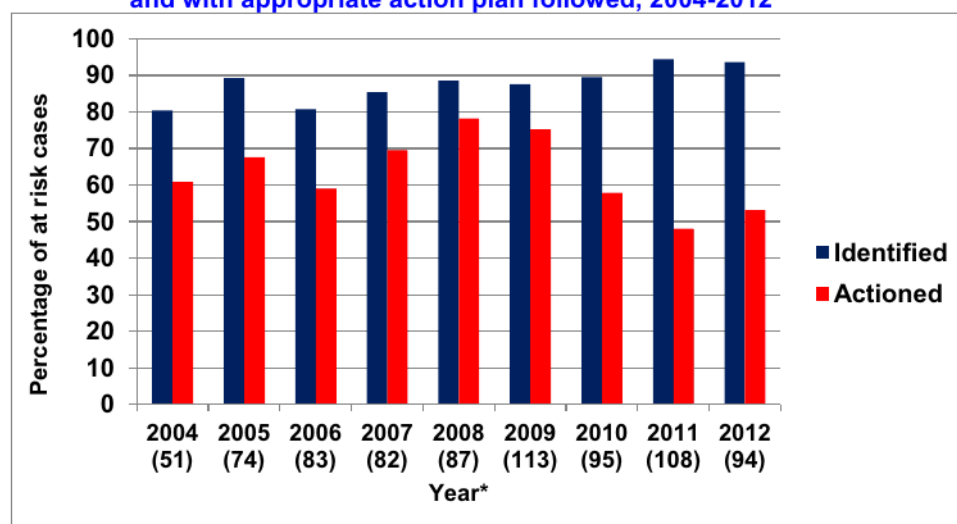
The known association between morbidly adherent placenta (placenta accreta) and previous caesarean section delivery is confirmed by data collected from 2006-2012 (Table A3.12). Of 95 women with this condition, 62 (65.3%) had a previous caesarean section. This association is statistically significant ($p < 0.001$).

The distribution of sociodemographic factors among women experiencing MOH in 2009-2012 was very similar to that of all morbidities (as would be expected as MOH is the main contributor to severe maternal morbidity). Data is in Tables A3.13-A3.16. Increasing maternal age, being in the least deprived quintile, and having a BMI of 30 or over were all associated with an increased rate of MOH when compared to all births in Scotland over the same time period ($p < 0.001$ for all three factors). Stepwise logistic regression analysis showed that women 40 years and over were more likely than those aged between 20-39 years to be in the least deprived quintile.

6.2.2 Anticipation and prophylaxis

Changes in the data collected concerning risk assessment and anticipation of MOH have occurred during the audit. However, the identification of antenatal risk factors for MOH has been collected consistently since 2004 and the proportion of at risk women identified antenatally and who subsequently had an appropriate action plan followed completely are shown in Figure 10.

Figure 10: Percentage of women with risk factors for MOH identified antenatally and with appropriate action plan followed, 2004-2012



*Number in brackets is the number of potentially identifiable women each year at risk of MOH

Guidance recommending placental localisation for all women with a previous caesarean section scar was published in 2011⁶. Since 2010, the audit has asked for this information. In 2010, 10 out of 53 such women (18.9%) did not have antenatal placental localisation. In 2011 (73 women) and 2012 (53 women), two women (2.7% and 3.8% respectively) did not receive an ultrasound scan for placental localisation. Further aspects of the care of women with suspected placenta praevia and/or accreta

since 2010 are shown in Table 2. There has been some increase in the use of planned interventional radiology and of red blood cell salvage since 2010.

Table 2: Planning and action for suspected placenta praevia/accreta

Planning and action	2010	2011	2012
	Number of women [% of 20 cases]	Number of women [% of 37 cases]	Number of women [% of 27 cases]
Elective caesarean section planned	15 [75]	31 [84]	19 [70]
Obstetric consultant present for these reasons	18 [90]	33 [89]	26 [96]
Intervention radiology took place	2 [10]	11 [30]	6 [22]
Blood cell salvage was planned	3 [15]	16 [43]	10 [37]
Blood cell salvage took place	2 [10]	15 [41]	8 [30]

Emergency caesarean section at full cervical dilatation can also be anticipated as a situation at high risk for MOH. From 2010 to 2012, there were 77 such caesarean sections reported to the audit, for which a consultant obstetrician was present at 68 (88.3%). The proportion has been similar for each year.

Intraoperative cell salvage was recorded as being attempted on 23 occasions in 2011 and 13 in 2012. In seven cases over both years was a litre or more of blood obtained. In 642 cases in which cell salvage was definitely not attempted, the most frequently reported reason was that the case was not appropriate (70.1%). Of the remaining cases, equipment was not available or not working for 14.2% and suitably trained staff were not available for 15.7%. Many of these were, however, probably also not appropriate.

Since 2010, data has been requested about elective Interventional Radiology (IR) successfully performed to prevent major haemorrhage. There were three such cases in 2010, four in 2011 and five in 2012. It is not known if additional cases were not reported but it is likely. As these 12 women did not experience MOH, they are not included in any other analysis except for one woman in 2011 and one in 2012 who were admitted to ICU in relation to the procedure and are included for that reason alone.

Although not a direct part of the audit, the use of prophylactic uterotonic agents has been analysed since 2009 and is shown in Table A3.17. Current guidance⁴ recommends the use of syntocinon alone as prophylaxis to prevent post partum haemorrhage. Its use has increased since 2009, accompanied by a decline in the use of syntometrine.

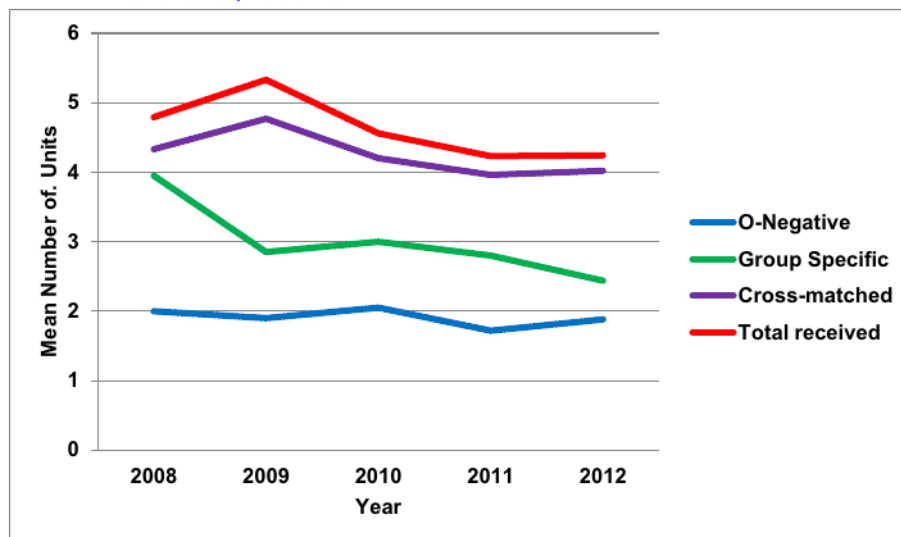
6.2.3 Resuscitation and blood transfusion

Aspects of blood loss, resuscitation and blood transfusion between 2003 and 2012 are summarised below. Not all aspects were recorded throughout the 10 years. Details of blood transfusion in recent years are in Table A3.18.

- The mean estimated blood loss has varied little from a minimum of 3000 ml (2003) to a maximum of 3900 ml (2004). The maximum reported blood loss was 30000 ml (2006, 2009 and 2012).

- Allowing for missing data, venous access was achieved universally, the placement of two wide bore cannulae in nine out of ten cases and oxygen administered in eight out of ten. This pattern has not changed during the audit.
- All women received clear intravenous fluid. Each year, there has, however, consistently been administration of more than the maximum 3500mls recommended⁴ before transfusing blood in between 6 and 12% of cases.
- MOH guidelines published in 2009⁴ recommended the initial cross matching of four units of blood when MOH occurs. These replaced previous guidance to cross match six units¹⁸. This was reflected in the audit results. The modal number of units cross matched was six until 2008; in all subsequent years it has been four.
- The proportion of women with MOH who were transfused blood has been consistently between 81% (in 2012) and 91% (in 2004), with no particular time trend.
- There has been a decline in the volume of blood transfused since 2008. (Figure 11). This has probably been the case for the duration of the audit but there was inconsistent reporting in some early years.
- There has been an increase in the proportion of women receiving uncrossmatched O negative blood from a mean of 10% in 2003-2007 to 16% in 2008-2012. The overall decline in blood transfusion has been in the use of uncrossmatched group specific and crossmatched blood as is shown in Figure 11.
- The proportion of women with MOH receiving blood products has been fairly constant, with a mean of 39% of women receiving fresh frozen plasma (FFP), 12% cryoprecipitate and 22% platelets.

Figure 11: Mean number of blood units transfused to women with MOH by type and total, 2008-2012



6.2.4 Management of MOH

Postpartum uterine atony is the most frequent cause of MOH and is the only cause which can generally be managed medically as opposed to requiring surgical intervention.

Guidelines first published in 2009⁴ recommend the use of uterotonic pharmacological agents in a specified order. Table 3 lists these in the order recommended for administration and shows the proportion of women with MOH caused by uterine atony receiving them since that year. The use of all of the agents increased after publication of the guideline⁴. Tables 4 and 5 provide information on the order in which these agents were given since 2010. Missing data means that it is not possible to accurately report the information in Tables 4 and 5 as percentages, therefore only numbers are given. Syntocinon (either as an intravenous bolus or infusion) has widely been the first agent used. Ergometrine is recommended as the second agent in the treatment cascade and there is evidence that this use is increasing slowly. By contrast the use of other agents (such as carboprost) early in the cascade has diminished. Overall, compliance with the guideline has increased since 2010.

Table 3: Uterotonic agents used among 163 women with uterine atony in 2009, 193 in 2010, 184 in 2011 and 194 in 2012

Uterotonic agent	Number (%) of women receiving agent			
	2009	2010	2011	2012
Syntocinon 5 iu iv	70 (43)	116 (60)	104 (56)	118 (61)
Ergometrine 0.5mg iv	70 (43)	120 (62)	101 (55)	129 (67)
Syntocinon iv infusion	135 (83)	185 (96)	164 (89)	181 (93)
Carboprost 0.25mg im ¹	54 (33)	137 (71)	129 (70)	128 (66)
Misoprostol	n/a*	52 (27)	36 (20)	65 (34)
Gemeprost	n/a*	2 (1)	18 (10)	11 (6)

*Information on these agents not available for 2009

¹ Carboprost was administered directly into the myometrium in nine women in 2009, 18 in 2010, 10 in 2011 and four in 2012.

Table 4: Use of pharmacological uterotonic agents as one of first three treatments for uterine atony causing MOH in 193 women in 2010, 184 women in 2011 and 194 in 2012*

Uterotonic agent	Given as first agent			Given as one of the first three agents used		
	2010	2011	2012	2010	2011	2012
Syntocinon bolus	59	57	54	88	88	105
Ergometrine	3	5	10	60	68	78
Syntocinon infusion	20	27	20	131	130	142
Carboprost	2	3	1	37	37	27
Misoprostol/gemeprost	0	0	1	7	10	17

*Numbers in the Table are the number of women given this agent at these points in the cascade of treatment

Table 5: Administration of ergometrine and carboprost as treatment for women with uterine atony for 193 women in 2010, 184 women in 2011 and 194 in 2012*

Agent	Order in which agent was given							
	1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th
Ergometrine 2010	3	29	28	30	6	1	-	1
Ergometrine 2011	5	28	35	20	6	1	-	-
Ergometrine 2012	10	28	40	30	7	4	4	-
Carboprost 2010	2	7	28	35	23	10	2	-
Carboprost 2011	3	5	29	46	29	6	1	1
Carboprost 2012	1	7	19	37	44	15	1	-

*Numbers in the Table are the number of women given these agents at each point in the cascade of treatment

During the life of SCASMM, there has been a marked change in the use of conservative surgical techniques in the management of MOH with an increase in the use of intra-uterine balloon tamponade, uterine brace sutures and interventional radiology. The annual changes in the numbers of each procedure (including hysterectomies) are shown graphically in Figure A3.19. Part of the rise may be accounted for by the increase in the occurrence of MOH. Figure 12 shows the annual percentage of women with MOH treated with each of the conservative surgical procedures, combining iliac and uterine arterial ligations due to small numbers. After 2003 (when the rates of all conservative procedures were low), the only technique which has shown a continuing increase has been intra-uterine balloon tamponade which has not risen further since 2010. The increase in conservative procedures has been associated with a statistically significant fall ($p=0.001$) in the proportion of women with MOH requiring a hysterectomy to control bleeding (Figure 13).

Figure 12: Percentage of cases of MOH treated by various haemostatic surgical procedures by year, 2003-2012

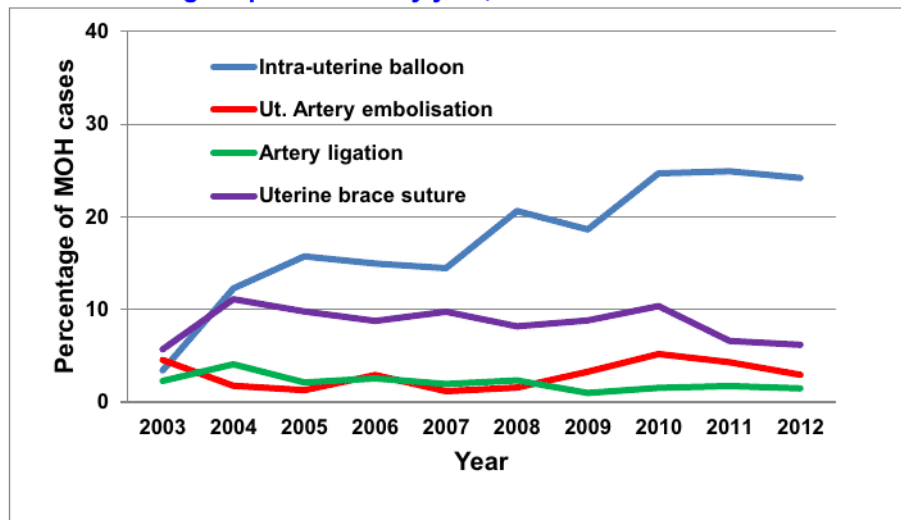
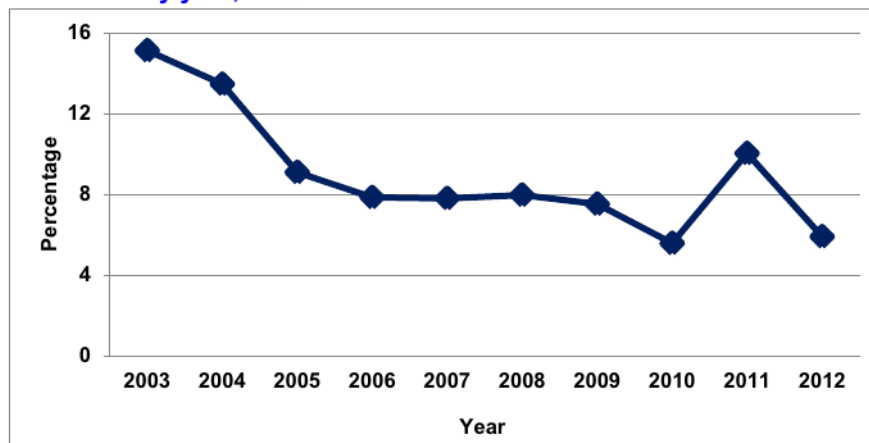


Figure 13: Rates of hysterectomy for women with major obstetric haemorrhage by year, 2003-2012



The overall combined success rate (ie avoiding a hysterectomy) of the conservative surgical procedures performed on 909 women in the 10 years of the audit is 79%, with a rise from 64% in 2003 (Figure A3.20). When individual techniques are considered (Figure A3.21), intra-uterine balloon tamponade appears to be the most successful, with a hysterectomy avoided in 88% of the 503 women in whom a balloon was placed. Ligation of either uterine or iliac arteries had a success rate of 54% among the 61 women on whom the procedure was carried out. However, the differing success rates for the four different procedures illustrated is likely to be partly explained by the degree of difficulty and invasiveness of each procedure and the differing degrees of severity of the MOH being treated.

6.2.5 Quality of care

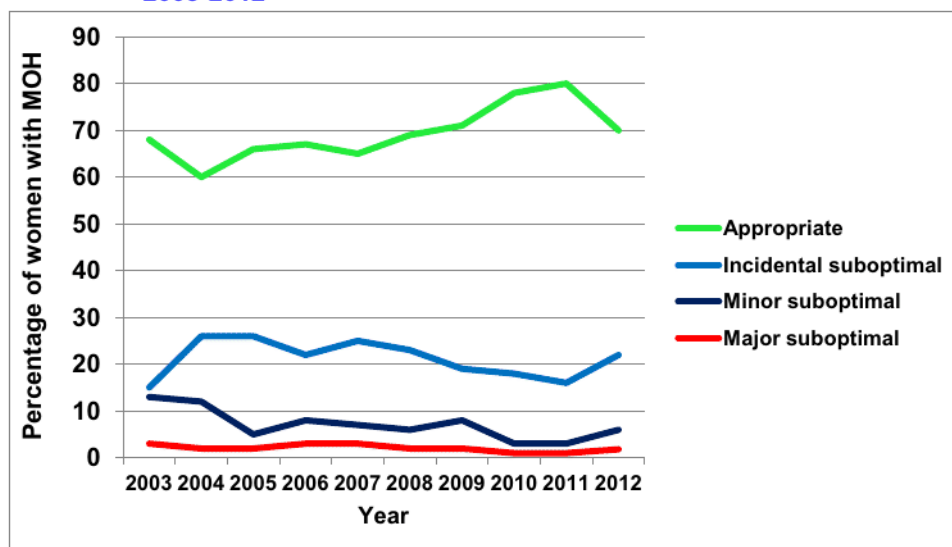
Since the start of the audit, each maternity unit has been asked to submit an opinion on the overall quality of care of each case of MOH, as assessed by the local risk management team. Four grades of care are used, as in the long standing UK-wide confidential enquiries into maternal deaths¹⁰, ie, appropriate care, and incidental, minor or major suboptimal care. These are further defined in Table A3.22 which shows the numbers in each category of care since 2007; numbers were not available prior to 2007. Percentages in each category of care were available from 2003 and are shown in Figure 14. Numbers were, however available since 2003 for women classified as receiving major suboptimal care. Each year has seen a small number of these women, with a maximum of seven (in 2006) and a minimum of three (in 2004 and 2011).

Until 2012, there has been a steady rise in the proportion deemed to have received appropriate care with the lowest proportion (60%) reported in 2004 and the highest (80%) in 2011 (Figure 14).

In 2012, the proportion reported to have received appropriate care fell to 70% which may reflect the increased involvement of risk management teams. Data collected since 2010 identified the source of the local assessment. In 2010, 59% of cases of MOH were assessed by a local risk management team. This fell to 42% in 2011 and rose to 77% in 2012. The same evidence suggests that risk management teams tended to rate care more poorly than other more informal methods of assessment.

1. rose to 77 % in 2012
[Anchor Name: Postpartum Hemorrhage](#) [Agency
Switzerland
m.waldis@fatzerimbach.ch]

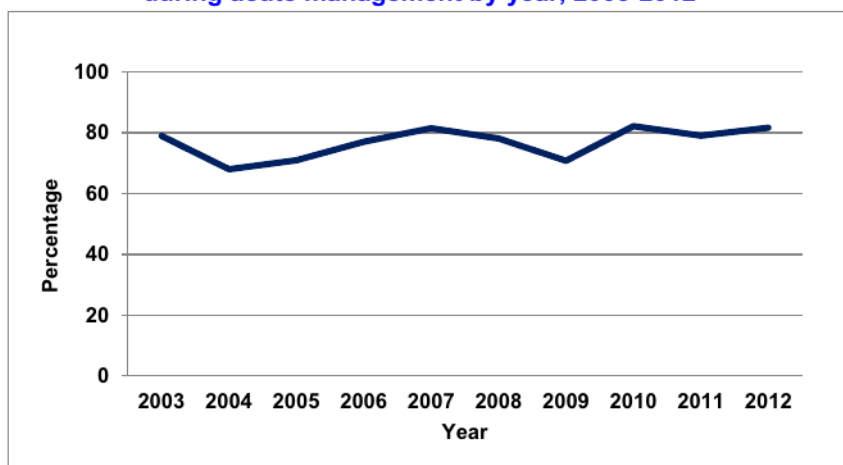
Figure 14: Quality of care* for women with MOH as assessed by maternity unit, 2003-2012



*An explanation of the levels of care is included in Table A3.22

A specific aspect of the quality of care which has been assessed throughout the audit has been the involvement of a consultant obstetrician. RCOG guidelines⁴ recommend direct involvement by senior obstetric staff in the management of MOH. The proportion of cases with direct consultant care has varied throughout the audit (Figure 15), but has rarely risen above 80%.

Figure 15: Percentage of cases of MOH with a consultant obstetrician present during acute management by year, 2003-2012

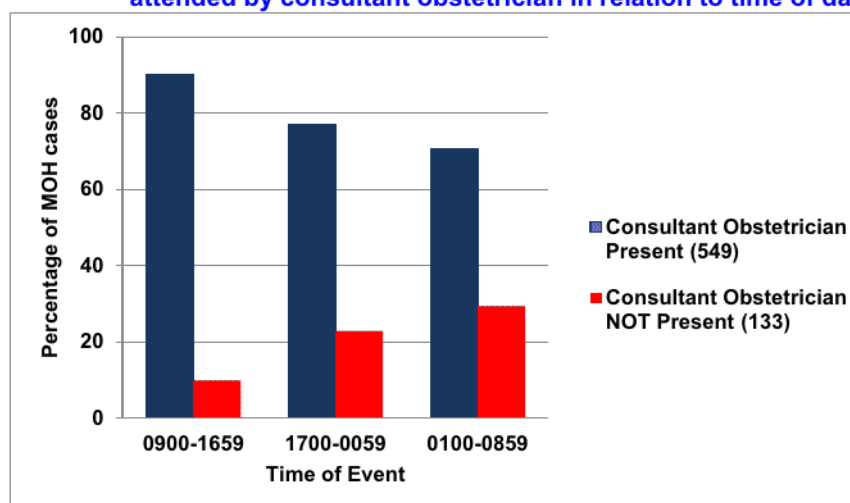


Data for 2011 and 2012 has been analysed to identify features of those cases of MOH where there was no reported direct involvement by a consultant obstetrician. The findings are summarised below:

- Those women without consultant obstetrician involvement had a significantly lower mean volume of blood loss ($p < 0.001$).

- A consultant was more likely to be involved with the more severe causes of MOH, notably placenta praevia and/or accreta, uterine rupture and uterine inversion.
- A consultant was more likely to be involved where surgical procedures to control bleeding were carried out and all women requiring a hysterectomy were directly treated by a consultant obstetrician.
- A consultant obstetrician was significantly more likely to be directly involved in the care of women with MOH during normal working hours ($p < 0.001$). Figure 16 combines information from 2011 and 2012.
- Maternity units' self assessment of the quality of care did not seem to be dependent on the presence or absence of a consultant obstetrician.

Figure 16: Proportion of women with MOH in 2011 and 2012 attended or not attended by consultant obstetrician in relation to time of day or night



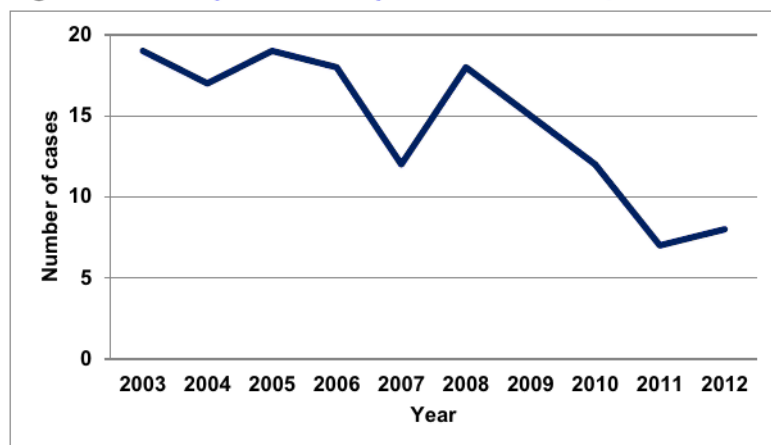
Good case records and documentation of the episode of MOH can also be considered a measure of the quality of care. In 2010, questions concerning the quality of case records and documentation were reframed and comparisons with previous years are not valid. From 2003-2009, up to 10% of at least one element of these was deemed inadequate. Since 2010, an improving trend has been reported, with 94% of case records and of MOH documentation deemed "excellent" or "good". Each year, however, a small number of each are reported as inadequate. When the three years (2010-2012) were combined, three case records and four case documentations were reported as having significant deficiencies and there was no reported documentation at all of one episode of MOH.

6.3 Eclampsia 2003-2012

6.3.1 Incidence, associations and circumstances

There has been a decline in the number of cases of eclampsia reported to SCASMM since 2003 (Figure 17).

Figure 17: Eclampsia cases reported to SCASMM, 2003-2012



Detailed information on cases of eclampsia has been sought from 2004 since when 126 cases have been reported. Case assessment proformas were returned for 111 of these (88%). The following summary, therefore, mainly includes information from those 111 cases and the information was not complete in all cases. Although all cases with a submitted proforma have been included, in a small number the diagnosis of eclampsia was uncertain.

As expected, the majority of women experiencing eclampsia (78%) were primigravida. The mean age was 26.3 years of age (youngest 15 years, oldest 46 years). The gestation at which eclampsia occurred was available from 2007. From 2007-2012, the mean gestation was 36.6 weeks with a median of 38 weeks and a range of 25 to 42 weeks. No trends were apparent in any of these parameters.

Sociodemographic information was collected from 2009. Small numbers mean interpretation is limited but 11 (31%) of 35 women with eclampsia were in the most deprived quintile compared to three (9%) in the least deprived quintile. The mean BMI of those with eclampsia from 2009-2012 was 25.4 (lowest 17 and highest 38). There was no association found with smoking.

Fifty four cases of eclampsia occurred antenatally (50%), 21 intrapartum (19%) and 33 (31%) postpartum. This overall pattern has shown no particular change over the nine years. Information on the location and timing of the first seizure has been sought from 2010 since when 17 occurred in a consultant-led maternity unit, seven at home (or similar environment) and one in transport. None occurred in a community maternity unit. No association was found between the time of day and the onset of seizures.

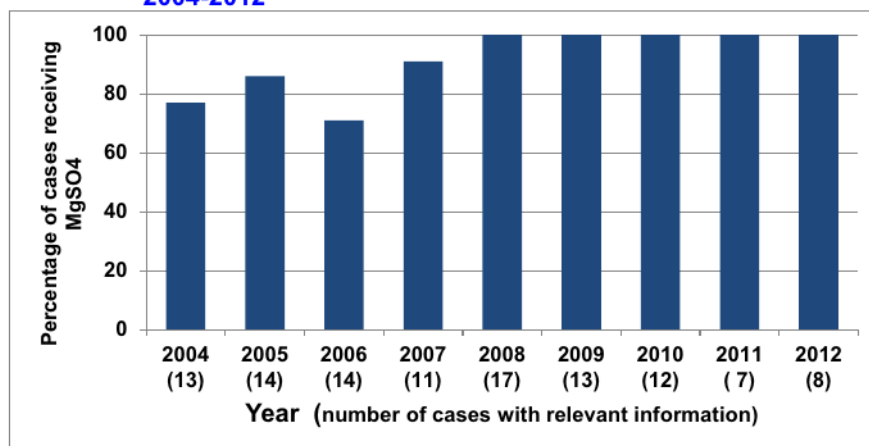
A consistent feature has been the lack of prodromal signs and symptoms. Twenty seven per cent of the 111 women reported no symptoms before a seizure, 43% reported a headache and 42% were already diagnosed with pre-eclampsia. Details of recent years are in Table A3.23. The last blood pressure recorded prior to the eclamptic seizure was rarely markedly elevated with a mean for all women of 140-150/80-90.

6.3.2 Management and quality of care

Guidelines for the management of eclampsia⁷ were published early in the life of the audit and data collected for SCASMM has been compared with those guidelines. Sufficient detail has been collected since 2009 to allow the construction of Tables A3.24 and A3.25 which show most of the recommendations for resuscitation, treatment, investigation and monitoring with the number of women experiencing these features. These show a generally high level of adherence to guidelines, although there has been insufficient testing of deep tendon reflexes and inadequate availability of calcium gluconate at the bedside.

The important role of magnesium sulphate in the control and prevention of seizures¹¹ is now well established, and the RCOG guidance with this recommendation was published in 2006⁷. The impact of this guidance is demonstrated in Figure 18 which shows the proportion of women receiving this treatment since 2004. Since 2008 it has been administered to all women in Scotland with eclampsia.

Figure 18: Proportion of women with eclampsia receiving magnesium sulphate, 2004-2012



Women were almost universally managed in a maternity high dependency unit although two women in 2011 and one in 2012 were admitted to an intensive care unit.

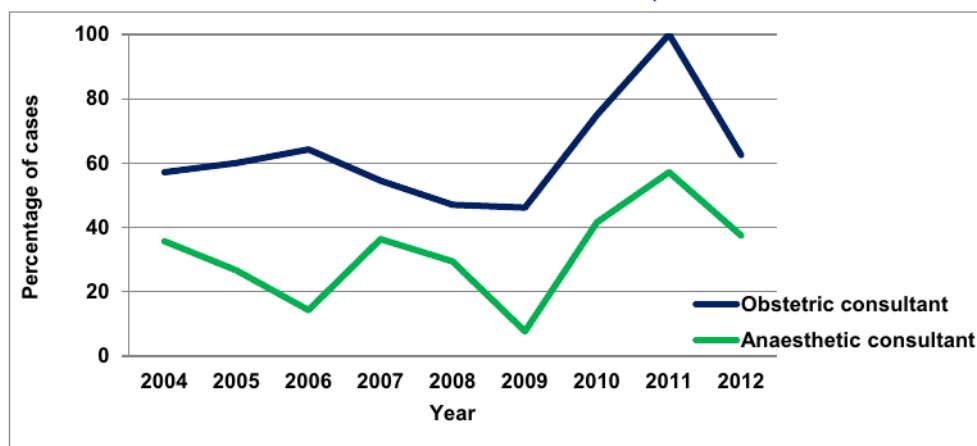
Table 6 shows the percentage of women with eclampsia each year reported as having received optimal or significantly suboptimal care by self assessment by the maternity unit. While the reported proportion receiving appropriate care has been variable, no woman has received significant suboptimal care since 2008. Information on risk management assessment was collected in 2011 and 2012. Five out of seven and seven of eight cases respectively were reviewed each year by a local risk management team.

Table 6: Unit level assessment of optimal and significantly suboptimal care of eclampsia, 2004-2012

Year	Number of reported assessments	Received appropriate care (%)	Received significantly sub-optimal care (%)
2004	13	8 (62)	2 (15)
2005	14	9 (64)	1 (7)
2006	14	10 (71)	0
2007	11	3 (27)	3 (27)
2008	17	7 (41)	1 (6)
2009	12	10 (83)	0
2010	12	5 (42)	0
2011	7	5 (71)	0
2012	8	4 (50)	0

The proportion of women with eclampsia receiving direct care from an obstetric and an anaesthetic consultant since 2004 is shown in Figure 19. Although this shows a tendency to increased involvement, in only one year (2011) did all women receive direct care from a consultant obstetrician.

Figure 19: Percentage of cases of eclampsia with direct involvement in care from obstetric and anaesthetic consultants, 2004 -2012



Information on the quality of case records and episode documentation has been reported for eclampsia since 2008 with a change to the framing of the questions on this from 2010. In 2008 and 2009, 16 of 30 case records (53%) were reported to have no deficiencies. In 2010 and 2011 all of the case records and episode documentation were deemed "excellent" or "good". This was also reported for case records in 2012 but the documentation of one eclamptic episode that year was considered to be "inadequate".

7 Discussion

7.1 Scope of SCASMM and trends over time

Between 2003 and 2012, the SCASMM provided continuous consistent information on the nature, incidence, clinical management and quality of care of a defined range of causes of severe maternal morbidity related to pregnancy, intrapartum and immediate post partum care in Scotland. This long running audit appears to be unique as data were collected directly from the clinical staff of maternity units over a 10 year continuous period, a wide range of conditions were identified, and management was assessed in relation to clinical guidelines. Other audits of maternal morbidity have generally been time limited, have depended on routinely collected national data and have been more limited in their scope^{12,13,14,15}. The SCASMM case inclusion criteria embrace all three of the approaches recommended by a World Health Organisation (WHO) working group on maternal mortality and morbidity classifications (specific disease entities, intervention based criteria and organ system dysfunction)¹⁶. Scotland's size lends itself well to this kind of study; with a population of just over five million, nearly 60,000 births per year and 17 consultant-led maternity units, it is large enough to provide sufficient numbers for meaningful analysis but small enough for good communication and networking among clinical staff from various maternity units.

There is no mandatory requirement to register maternal morbidity (unlike mortality) and the information in national clinical data collected routinely is variable in its quality and often incomplete. There is, therefore, no method of verifying that every woman with one of the defined causes of severe maternal morbidity is identified through SCASMM. It is very unlikely that every episode is reported by the clinical co-ordinator in each maternity unit. As the years have passed, however, awareness and knowledge of SCASMM has increased in the clinical community and relevant case recognition has become more complete. This may partly explain the apparent rise in severe maternal morbidity, especially in the early years of the audit. More detailed study of the data shows that the rise is virtually entirely attributable to the increase in MOH. As the rate of admission to an intensive care unit (the second most frequent of the defined categories of severe maternal morbidity) has remained constant throughout the audit and the reported incidence of most other causes of morbidity has declined, it seems likely that the rise in MOH is genuine. This is also compatible with the reported rise in the incidence of post partum haemorrhage in Scotland (Chalmers, J, Information Services Division, personal communication, 2010) and elsewhere¹⁷.

It is more difficult to be certain of the reason for the varying rates of morbidity reported from different maternity units. Larger units are likely to care for a higher proportion of women with pregnancies at increased risk of complications and some areas (particularly Aberdeen and Dundee) have an above average proportion of births in community maternity units. These births are not included in the denominator for each consultant-led unit when calculating rates of morbidity and this will tend to increase the rate at these units. The voluntary nature of the reporting also contributes to variation; some units, for example, appear to have an increase or decrease in reported cases when there is a change in the reporting co-ordinator.

Within the overall decline of all morbidities other than MOH over 10 years, that of renal or liver dysfunction and of eclampsia is of note. They may be related as severe pre-eclampsia is often associated with renal and/or liver dysfunction. During the life

of the audit, the use of magnesium sulphate in the management of eclampsia became universal. It is now established as an integral part of the management of severe pre-eclampsia and its use may well have contributed to the decline in both conditions. A further feature of note in the pattern of reporting of severe maternal morbidities is the relatively stable rate of septicæmic shock despite its emergence in recent years as an increasingly important cause of maternal death¹⁰, although the rate rose in 2011 and 2012 after a steady decline since 2005 and there has been a small increase in admissions to ICU with sepsis since 2009.

The audit has collected sociodemographic data since 2009. Although there is slight variation in the sociodemographic profile of women giving birth in different maternity units, this is not sufficient to explain the variation in rates.

Aggregating the data on sociodemographic features and maternal age from 2009 to 2012 has shown an association between severe maternal morbidity and a BMI over 30 and with maternal age over 40 years. There was also an association between severe maternal morbidity and women from the least deprived quintile of the Scottish population but logistic regression analysis demonstrates that this was largely explained by the increased proportion of women over 40 years in this group compared to all women giving birth in Scotland. The association between severe maternal morbidity and smoking among those under 20 years of age may be an influence of deprivation. The proportion of women experiencing severe maternal morbidity who were under 20 years was lower than the proportion of all women under 20 years giving birth in Scotland. Overall, smoking did not appear to influence the occurrence of severe maternal morbidity.

The scope of the audit also increased in other ways but the original concept of basic information about the 14 defined categories of severe maternal morbidity with much more detail about the two specifically obstetric morbidities (MOH and eclampsia) has remained unchanged. The inclusion of ICU admission as a category in its own right has ensured that it is unlikely that any seriously ill woman would not be included although this has resulted in a relatively high proportion of women with two or more reported morbidities. Between 2008 and 2012 (when this data was most reliably recorded), 72% of the 465 ICU admissions had at least one of the defined other morbidities, most commonly MOH which was the condition responsible for 55% of all ICU admissions with severe maternal morbidity. There was a range of conditions outwith the 14 defined categories which required admission to ICU, the most frequent being cardiac conditions, sepsis (as opposed to septicæmic shock which was a defined condition) and respiratory infections. None of these conditions were, sufficiently frequent to justify being reported or recorded as a separate defined category. Some of the defined categories were so infrequent that their inclusion could not be justified were SCASMM to continue and all would probably be identified as admissions to ICU. "Status epilepticus" and "coma" with three and two cases respectively reported in 10 years would be obvious candidates for exclusion.

7.2 Management of MOH and eclampsia

Guidelines for the management of MOH and for eclampsia were published by the RCOG, in 2009 (updated 2011)⁴ and 2006⁷ respectively; further guidance of relevance to MOH was also published in 2011^{5,6}. Earlier guidance on the management of postpartum haemorrhage was published in 1998¹⁸.

Throughout the audit, standards of care and practice have been compared to the then current guidelines. There is, inevitably, delay between the publication of a

guideline and the implementation of its recommendations in practice, but adherence to the guidelines has generally been high, especially for eclampsia. Mention has already been made of the now universal use of magnesium sulphate and the plausible association of this with the decline in the incidence of eclampsia and of severe renal and/or liver dysfunction.

MOH is often a more complex condition to manage as it has differing degrees of severity and a number of causes. It is more difficult to identify specific changes in practice related to publication of guidelines but the reduction of the modal number of blood units initially crossmatched from six to four is one example. The audit has demonstrated that this is an appropriate recommendation as the mean number of units transfused has been just over four for a number of years. Although the management of MOH has generally complied with guidance, some areas have persisting deficiencies, particularly in the over transfusion of clear fluid prior to blood transfusion, the unsystematic use of uterotonic agents in the treatment of uterine atony and a failure to monitor care using a modified obstetric early warning chart in all cases of severe maternal morbidity.

It is recognised that some women are at increased risk of MOH. Examples include a past history of post partum haemorrhage (PPH), suspected placenta praevia and multiple pregnancy (the rate of twin pregnancies among those with MOH in 2012 was four times that among all women giving birth in Scotland). The audit has provided evidence of increased identification of such cases, from 80% identified antenatally in 2004 to 94% in 2011 and 2012, with a mean over nine years of 87.7%. However, the proportion of women at high risk who experienced MOH and who had a prepared action plan for management followed was 63.3% over the nine years with evidence of a declining proportion in recent years. The lowest proportion was 48.1% in 2011, despite that year having the highest proportion of women identified as high risk antenatally.

The audit has recorded profound changes in the surgical management of MOH. At the outset (in 2003) very few conservative surgical procedures were performed and the percentage of women with MOH undergoing a peripartum hysterectomy was 15.1%. By 2010 this had fallen to 5.6% and was 5.9% in 2012 after a rise in 2011. The overall decline over the 10 years is significant ($p=0.001$). This fall has been associated with a marked increase in the use of conservative techniques, particularly in the placement of intrauterine balloons, the insertion of uterine brace sutures and uterine artery embolisation using interventional radiology. The rate of use of these three techniques has plateaued since 2010 and may have reached an optimum level. It may be difficult to achieve a hysterectomy rate below 5% among women with MOH. The audit has also demonstrated that the use of interventional radiology (both electively and in an emergency) and red blood cell salvage in the management of MOH is not well established in Scotland.

7.3 Quality of care and use of resources

The overall quality of care provided to women with MOH and eclampsia was not subject to external assessment by the audit, although individual elements of management were compared to recommended guideline practice, as described above. The audit asked each maternity unit to provide their own assessment of the quality of care for each case. The presumption had been that this would be the opinion of a risk management team review but information collected in the last two years of the audit suggested that such a review did not always take place. One of the recommendations made in SCASMM annual reports in recent years has been to

encourage such a review and the proportion so reviewed did increase markedly between 2011 and 2012. A possible effect of this was an increase in the proportion of cases for which care was deemed sub optimal.

The perinatal mortality rate may be a surrogate marker for the quality of care provided to women with severe maternal morbidity. Although still above the rate for all births in Scotland (6.5 per 1000 births in 2012⁹), there has been an encouraging decline in the perinatal mortality rate among women with severe maternal morbidity from 70.4 per 1000 births in 2005 (the first year in which adequate information was reported) to 17.4 per 1000 births in 2012. Scotland's overall perinatal mortality rate has declined in this time (although not so markedly), particularly among "high risk" pregnancies such as multiple pregnancies and those in women with high levels of deprivation and who are 40 years of age or older⁹. Pregnant women may be benefitting from improved recognition and care of all women at increased risk.

Scottish medical workforce reports¹⁹ show a steady increase since 2002 in the number of consultant obstetricians and anaesthetists in post. SCASMM has provided evidence that there has not been an increase in the proportion of women with MOH or eclampsia who have received care directly from a consultant obstetrician. The proportion of women with MOH receiving such care has been less than 80% in all but three of the years of the audit. In 2011, all women with eclampsia were seen by a consultant obstetrician, but the proportion fell in 2012 and has generally been below 60%. There is evidence from recent years, however, that a consultant obstetrician has been in attendance at the great majority of the more severe cases of MOH and in most circumstances where MOH occurred having been anticipated, such as suspected placenta praevia (86.9% attendance in 2010-2012) or emergency caesarean section at full cervical dilatation (88.3%).

In addition to the issue of senior staff involvement, SCASMM has provided other information which may be of value to NHS boards in planning and managing services. Examples are the need for the availability of one ICU bed for every 700 births, for maternity units to be able to manage a major emergency at all hours and to expect an episode of MOH once every 170 births. The information within SCASMM should also assist with planning the requirements of blood transfusion and other laboratory services in association with obstetric emergencies.

7.4 Impact of SCASMM

The audit has observed and reported many changes in the incidence and management of women with severe maternal morbidity over 10 years. Has the audit itself influenced any of these changes? There is evidence that the conduct of a study or audit can in itself influence practice²¹. The knowledge that severe maternal morbidity, especially MOH, was being studied over several years could have affected practice although it seems unlikely that this would be at the forefront of the minds of clinicians managing critically ill women. A further difficulty in assessing the impact of SCASMM lies in the identification of areas where SCASMM reported change which would have happened anyway as opposed to areas where information from SCASMM resulted in a change in practice. The conduct of the audit has improved with time; a greater depth of information was collected, the data became more complete and the number of cases of severe maternal morbidity reported increased. A true increase in the incidence of severe maternal morbidity (especially of MOH) contributed to the increase but part of the apparent rise was almost certainly due to improved reporting. Within obstetric consultant-led maternity units, the general awareness of clinical staff of the continuing conduct of the audit increased with time

and probably influenced the culture within each unit, encouraging the reporting of cases and the promotion of clinical guidelines.

Arguable weaknesses of the early years of the audit were a lack of recommendations and the availability of very limited unit specific information. Both of these issues have been addressed in recent years with recommendations for practice published with each annual report since the one covering events of 2008 and individual maternity unit reports including unit specific recommendations since 2009. As there has generally been a lapse of 18 months after the end of the year being analysed before a full and detailed report with recommendations was published, there has been a delay before clinical staff could assess and implement any recommendations. This makes it more difficult to assess any impact.

Specific examples of improving practice since the audit commenced and which may have been influenced by SCASMM include the following:

- The maintenance of a generally high standard of adherence to guidelines in the resuscitation, monitoring and investigation of women with MOH.
- A reduction in the number of units of blood initially cross matched in the event of MOH.
- A reduction in the amount of blood transfused to women with MOH.
- An improvement in the proportion of cases of MOH deemed to have received "optimal care".
- An increase in the proportion of cases of MOH assessed by each maternity unit's risk management team.
- A rise in the proportion of cases of MOH directly attended by a consultant obstetrician in some maternity units.
- An increase in the proportion of women with MOH who gave birth by emergency caesarean section at full cervical dilatation and whose delivery was attended by a consultant obstetrician.
- An improvement in most aspects of the care of women with eclampsia and a reduction in the number of reported cases.

Areas where SCASMM identified the need for change but there was little evidence of improvement included:

- Inadequate development of clinical action plans for women at high risk of MOH.
- At some consultant-led maternity units, a persistent failure to use an obstetric early warning chart for all observations.
- Poor adherence to the recommended use of pharmacological agents in the treatment of uterine atony.
- Persistent over administration of clear intravenous fluids prior to blood transfusion.
- At some consultant-led maternity units, a persisting proportion of women with MOH who did not receive direct clinical care from a consultant obstetrician and/or consultant anaesthetist.

There have also been changes in clinical outcomes and practice over time reported by SCASMM. Examples include:

- A decline in the perinatal mortality rate among women with severe maternal morbidity (although awareness of this issue was probably heightened by SCASMM).
- A rise in the use of conservative haemostatic surgical procedures in the treatment of MOH.
- A decline in the rate of peripartum hysterectomy among women with MOH.
- An increase in the use of magnesium sulphate in the management of eclampsia.

SCASMM's embedding within the culture of Scottish maternity units has been a catalyst in promoting the discussion of issues surrounding the care of women with severe maternal morbidity. The publication in recent years of the audited details of each individual maternity unit's own practice in managing women with severe maternal morbidity has encouraged risk management assessment and has been a powerful agent in the promotion of "reflective practice".

Although this is the last SCASMM report to be published, it is hoped that maternity units in Scotland will continue to audit their management of women with severe maternal morbidity and maintain the high standards of clinical practice which the 10 year audit has demonstrated.

References

1. Brace V, Penney G, Hall M. Quantifying severe maternal morbidity: a Scottish population study. BJOG. 2004;111(5):481-4.
2. Mantel GD, Buchmann E, Rees H, Pattinson RC. Severe acute maternal morbidity: a pilot study of a definition for a near-miss. BJOG. 1998; 105(9): 985-90.
3. General Register Office for Scotland. Births, deaths and other vital events [online]. 2012 [cited 2014 May 15]; Available from: <http://www.gro-scotland.gov.uk/statistics/theme/vital-events/general/bmd-quarterly/archive/index.html>
4. Royal College of Obstetricians and Gynaecologists. Prevention and management of postpartum haemorrhage. Green-top Guideline No. 52. 2009 [cited 2011 May 05]; Available from: <http://www.rcog.org.uk/files/rcog-corp/GT52PostpartumHaemorrhage0411.pdf>
5. Royal College of Obstetricians and Gynaecologists. Antepartum haemorrhage. Green-top Guideline No. 63. 2011 [cited 2011 May 05]; Available from: http://www.rcog.org.uk/files/rcog-corp/GTG63_05122011APH.pdf
6. Royal College of Obstetricians and Gynaecologists. Placenta Praevia and Placenta Accreta: Diagnosis and Management. Green-top Guideline No. 27. 2011 [cited 2011 May 05]; Available from: <http://www.rcog.org.uk/files/rcog-corp/GTG27PlacentaPraeviaJanuary2011.pdf>
7. Royal College of Obstetricians and Gynaecologists. The management of severe pre-eclampsia/eclampsia. Guideline No. 10(A). 2006 [cited 2011 May 05]; Available from: <http://www.rcog.org.uk/files/rcog-corp/uploaded-files/GT10aManagementPreeclampsia2006.pdf>.
8. NHS Quality Improvement Scotland. Scottish Confidential Audit of Severe Maternal Morbidity. Sixth annual report 2008 [online]. 2010 [cited 2011 May 05]; Available from: <http://www.healthcareimprovementscotland.org/his/idoc.ashx?docid=c27f7f72-63c7-4619-a6e7-a2c90e6e85f6&version=-1>
9. Healthcare Improvement Scotland. Scottish Perinatal and Infant Mortality and Morbidity Report 2012 [online]. [cited 2014 May 07]; Available from: http://www.healthcareimprovementscotland.org/our_work/reproductive_maternal_child/reproductive_health/spimmr_2012.aspx
10. Centre for Maternal and Child Enquiries (CMACE) Saving Mother's Lives: reviewing maternal deaths to make motherhood safer: 2006-08. The Eighth Report on Confidential Enquiries into Maternal Deaths in the United Kingdom. BJOG. 2011; 118 (Supl.): 1-203
11. Which anticonvulsant for women with eclampsia? Evidence from the Collaborative Eclampsia Trial. Lancet. 1995; 345(8963):1455-63.

12. Zhang, WH, Alexander, S, Bouvier-Colle, MH, Macfarlane, A, MOMS-B Group. Incidence of severe pre-eclampsia, postpartum haemorrhage and sepsis as a surrogate marker for severe maternal morbidity in a European population-based study: the MOMS-B survey. BJOG. 2005; 112(1): 89-96.
13. Wen, SW, Huang, L, Liston, R, Heaman, M, Baskett, T, Rusen, ID, Joseph, KS, Kramer, MS for the Maternal Health Study Group, Canadian Perinatal Surveillance System. Severe maternal morbidity in Canada 1991-2001. CMAJ. 2005; 173(7): 759-766.
14. Zwart, JJ, Richters, JM, Ory, F, de Vries, JIP, Bloemenkamp, KWM, van Roosmalen, J. Severe maternal morbidity during pregnancy, delivery and puerperium in the Netherlands: a nationwide population-based study of 371,000 pregnancies. : BJOG. 2008;115(7):842-50.
15. Murphy, CM, Murad, K, Deane, R, Byrne, B, Geary, MP, McAuliffe, FM. Severe maternal morbidity for 2004-2005 in the three Dublin maternity hospitals. Eur J Obstet Gynecol. 2009; 143(1): 34-37.
16. Say L, Souza JP, Pattinson RC for the WHO working group on Maternal Mortality and Morbidity classifications. Maternal near miss – towards a standard tool for monitoring quality of maternal health care. Best Pract Res Clin Obstet Gynaecol. 2009; 23(3): 287-296.
17. Joseph, KS, Rouleau, J, Kramer, MS, Young, DC, Liston, RM, Baskett, TF; for the Maternal Health Study Group of the Canadian Perinatal Surveillance System. Investigation of an increase in postpartum haemorrhage in Canada. BJOG. 2007;114(6):751-759.
18. Scottish Obstetric Guidelines and Audit Project. The management of postpartum haemorrhage [online]. 1998 [cited 2011 May 05]; Available from: <http://www.healthcareimprovementscotland.org/his/idoc.ashx?docid=84ee51e6-d441-4dba-8ebf-4fa6a2857e0d&version=-1>
19. ISD. NHS Scotland workforce statistics. 2014 [cited 2014 April 3]; Available from: <https://isdscotland.scot.nhs.uk/Health-Topics/Workforce/Publications/2014-02-25/2014-02-25-Workforce-Report.pdf?88827151061>
20. The Scottish Government. Scottish index of multiple deprivations [online]. 2009 [cited 2011 May 05]; Available from: <http://scotland.gov.uk/topics/statistics/simd/simdpostcodelookup>
21. Medical Audit, Rationale and Practicalities. Frostick, S; Radford, P; Wallace, W (eds). Cambridge University Press 1993 pp 40-41

Appendix 1: Criteria and definitions for categories of Scottish Confidential Audit of Severe Maternal Morbidity (2003-2012)

Code	Category	Definition
1	Major obstetric haemorrhage	Estimated blood loss $\geq 2500\text{ml}$, or transfused 5 or more units of blood or received treatment for coagulopathy (fresh frozen plasma, cryoprecipitate, platelets). (Includes ectopic pregnancy meeting these criteria).
2	Eclampsia	Seizure associated with antepartum, intrapartum or postpartum symptoms and signs of pre-eclampsia.
3	Renal or liver dysfunction	Acute onset of biochemical disturbance, urea $>15\text{mmol/l}$, creatinine $>400\text{mmol/l}$, AST/ALT $>200\text{u/l}$.
4	Cardiac arrest	No detectable major pulse.
5	Pulmonary oedema	Clinically diagnosed pulmonary oedema associated with acute breathlessness and O_2 saturation $<95\%$, requiring O_2 , diuretics or ventilation.
6	Acute respiratory dysfunction	Requiring intubation or ventilation for >60 minutes (not including duration of general anaesthetic).
7	Coma	Including diabetic coma. Unconscious for > 12 hours.
8	Cerebro-vascular event	Stroke, cerebral/cerebellar haemorrhage or infarction, subarachnoid haemorrhage, dural venous sinus thrombosis.
9	Status epilepticus	Unremitting seizures in patient with known epilepsy.
10	Anaphylactic shock	An allergic reaction resulting in collapse with severe hypotension, difficulty breathing and swelling/rash.
11	Septicaemic shock	Shock (systolic blood pressure <80) in association with infection. No other cause for decreased blood pressure. Pulse of 120bpm or more.
12	Anaesthetic problem	Aspiration, failed intubation, high spinal or epidural anaesthetic.
13	Massive pulmonary embolism	Increased respiratory rate ($>20/\text{min}$), tachycardia, hypotension. Diagnosed as 'high' probability on V/Q scan or positive spiral chest CT scan. Treated by heparin, thrombolysis or embolectomy.
14	Intensive care admission Coronary care admission	Unit equipped to ventilate adults. Admission for one of the above problems or for any other reason. Include CCU admissions.

15 (was added in 2010): Patient received planned interventional radiology

Appendix 2: Additional data for 2012

All morbidities 2012

A2.1 Rates of women experiencing severe maternal morbidity by individual maternity unit, 2012

Location of Maternity Unit	Number of women with events reported	Number of all births within the maternity unit	Rate per 1000 births [95% CI]
Aberdeen	42	5173	8.1 [5.9 – 11.0]
Ayrshire	34	3619	9.4 [6.5 – 13.1]
Borders	6	1159	5.2 [1.9 – 11.3]
Dumfries	6	1290	4.7 [1.7 – 10.1]
Dundee	33	3918	8.4 [5.8 – 11.8]
Edinburgh	47	7064	6.7 [4.9 – 8.8]
Elgin	1	1065	0.9 [0.0 – 5.2]
Fife	27	3566	7.6 [5.0 – 11.0]
Glasgow Royal	56	6237	9.0 [6.8 – 11.7]
Inverness	15	2161	6.9 [3.9 – 11.4]
Livingston	19	2737	6.9 [4.2 – 10.8]
Paisley	21	3628	5.8 [3.6 – 8.8]
Southern General, Glasgow	54	5838	9.2 [6.9 – 12.1]
Stirling	24	3308	7.3 [4.6 – 10.8]
Stornoway	1	195	5.1 [0.1 – 28.6]
Wick	0	188	-
Wishaw	37	4843	7.6 [5.4 – 10.5]
Scottish Total	423	58301¹	7.3 [6.6 – 8.0]

¹This total includes 2312 births outside consultant maternity units

A2.2 Number of morbidities per woman, 2012

Number of morbidities	Number of women
1	359
2	60
3	3
4	1

In total 492 morbidities were experienced by the 423 women.

A2.3 Numbers and rates of individual categories of severe maternal morbidity, 2012

Category of severe maternal morbidity	Number of events 2012	Rate per 1000 live births [95% C.I.] 2012
Major obstetric haemorrhage	339	5.81 [5.21-6.47]
Eclampsia	8	0.14 [0.06-0.27]
Renal or liver dysfunction	17	0.29 [0.17-0.47]
Cardiac arrest	3	0.05 [0.01-0.15]
Pulmonary oedema	7	0.12 [0.05-0.25]
Acute respiratory dysfunction	3	0.05 [0.01-0.15]
Coma	0	-
Cerebrovascular event	1	0.02 [0.00-0.10]
Status epilepticus	1	0.02 [0.00-0.10]
Anaphylactic shock	3	0.05 [0.01-0.15]
Septicaemic shock	10	0.17 [0.08-0.32]
Anaesthetic problem	10	0.17 [0.08-0.32]
Massive pulmonary embolism	3	0.05 [0.01-0.15]
Intensive care or coronary care admission	87	1.49 [1.20-1.84]

A2.4 Women admitted to intensive care unit, nature of morbidity, 2012

Nature of morbidity	Number of women ¹
Major obstetric haemorrhage (MOH)	36
Not categorised ¹	29
Acute respiratory dysfunction	2
Septicaemic shock	4
Cardiac arrest	2
Eclampsia	1
Renal/liver dysfunction	7
Anaphylactic shock	1
Massive pulmonary embolism	1
MOH + pulmonary oedema	2
MOH + anaphylactic shock	1
MOH + cardiac arrest + acute respiratory dysfunction	1
All	87

¹ See Table 3.4 for details

A2.5 Smoking history

Of the 402 women where smoking behaviour was recorded:

86 (21.4%) were smokers at booking.

19 (22.1%) of the 86 smokers stated that they gave up during pregnancy.

316 (78.6%) stated that they were non-smokers.

A2.6 Age

Mean: 30.2 years (standard deviation 5.8 years)

Range: 16–45 years

Median: 30 years

A2.7 Gestation

Mean: 37.7 weeks (standard deviation 4.8 weeks)

Range: 10–44 weeks

Gestation at event (weeks)	Number of women ¹
< 12	1
12 – 23	10
24 – 31	22
32 – 36	60
37 or more	320

¹ Gestation not recorded for 10 women

Major obstetric haemorrhage 2012

A2.8 Major obstetric haemorrhage by individual unit, 2012

Maternity Unit	MOH	Reported rate per 1000 births [95% C.I.]
Aberdeen	38	7.3 [5.2 – 10.1]
Ayrshire	33	9.1 [6.3 – 12.8]
Borders	2	1.7 [0.2 – 6.2]
Dumfries	4	3.1 [0.8 – 7.9]
Dundee	22	5.6 [3.5 – 8.5]
Edinburgh Royal	32	4.5 [3.1 – 6.4]
Elgin	1	0.9 [0.0 – 5.2]
Fife	22	6.2 [3.9 – 9.3]
Glasgow Royal	51	8.2 [6.1 – 10.8]
Inverness	8	3.7 [1.6 – 7.3]
Livingston	12	4.4 [2.3 – 7.7]
Paisley	21	5.8 [3.6 – 8.8]
Southern General, Glasgow	42	7.2 [5.2 – 9.7]
Stirling	22	6.7 [4.2 – 10.1]
Stornoway	1	5.1 [0.1 – 28.6]
Wick	0	-
Wishaw	28	5.8 [3.8 – 8.4]
Scotland	339	5.8 [5.2 – 6.5]*

*This rate is based on all births registered in Scotland including those delivered outwith consultant-led maternity units

A2.9 Causes of major obstetric haemorrhage among 339 women in 2012

Cause	2012	
	Number	Percentage
Uterine atony	194	57.2
Retained placenta/membranes	81	23.9
Vaginal laceration/haematoma	53	15.6
Bleeding from uterine incision	62	18.3
Abruption	27	8.0
Placenta praevia	24	7.1
Cervical laceration	10	2.9
Morbidity adherent placenta	16	4.7
Broad ligament haematoma	8	2.4
Uterine rupture	9	2.7
Uterine inversion	1	0.3
Other ¹	16	4.7

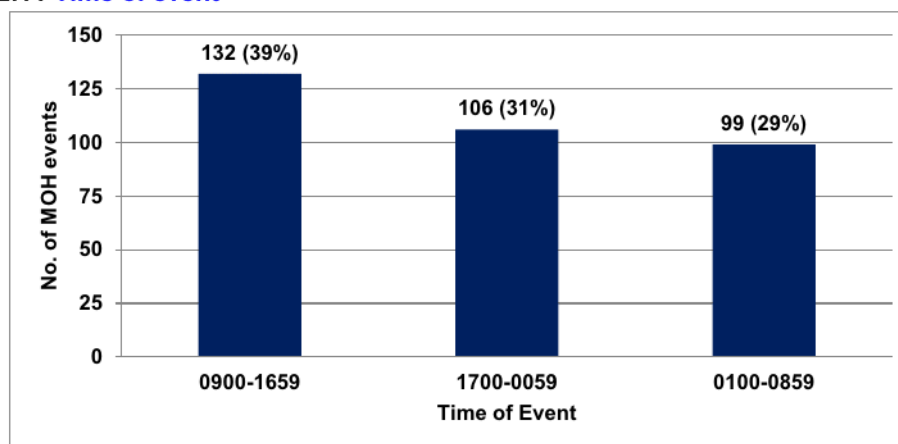
¹Other causes (16 women): 5 miscarriage/terminations, 4 with uterine fibroids, 3 ectopic pregnancies, 1 molar pregnancy, 1 disseminated intravascular coagulation, 1 wound haematoma, 1 intra-abdominal bleed of unknown cause.

A2.10 Timing and location of commencement of haemorrhage, 2012

Haemorrhage commenced	Location					Total ¹
	Obstetric Consultant-led Unit	Midwife-led community maternity unit	In transport	At home/outwith hospital	Midwife-led unit: same site as consultant-led unit	
Antepartum	18	0	0	9	1	28
Intrapartum	54	0	0	1	1	56
Postpartum	240	3	0	3	8	254
Total	312	3	0	13	10	338

¹ Data missing for 1 woman

A2.11 Time of event¹



¹No event time was recorded for 2 women

A2.12 Mode of delivery for women with major obstetric haemorrhage 2012 and for all women giving birth in Scotland April 2011- March 2012¹

Mode of delivery	MOH 2012		Scotland 2011-12 (where known) ²	
	Number	%	Number	%
Spontaneous vertex	107	32.1	33524	58.6
Breech	2	0.6	177	0.3
Ventouse	10	3.0	1753	3.1
Forceps	42	12.6	5577	9.7
Elective caesarean section	43	12.9	7011	12.3
Emergency caesarean section	129	38.7	9163	16.0
Total number of women	333		57205	

¹ SMR02 data for calendar year 2012 not available; fiscal year 2011-2012 is the nearest equivalent.

² Personal communication from K Monteath, Information Analyst, Information Services Division, 28 November 2012. Data from SMR02 returns; not available for all women.

A2.13 Resuscitation

Resuscitation parameter	Number of Women	Percentage of all women with MOH ³
Venous access achieved	339	100
Two large bore cannulae sited	308 ¹	91
Oxygen given	301 ²	89
Received blood transfusion	274	81

¹ Data missing for 16 women

² Data missing for 14 women

³ Percentage is of all women including those with missing data

Specialist equipment (blood warmer) was used in 210 cases.

A2.14 Fluid given

Type of fluid	Mean (mls)	Range (mls)	% at or below guideline ¹	% above guideline
Crystalloid	1722	250 – 12,000	77.4	22.6
Colloid	1057	300 – 3,600	91.2	8.8
Total volume	2581	500 – 6,000	88.0	12.0

¹ 2000mls for Crystalloid; 1,500mls for Colloid; 3,500mls for Total volume

Mean total volume does not equal the added means due to different cases with missing values.

A2.15 Blood cross-matching and transfusion

a) Cross-matching

Number of units cross-matched	Number of Women ¹
0	6
1	1
2	42
3	4
4	155
5	3
6	79
8	7
10	7
16	1
Total	305

¹ Data missing for 34 women.

Mean [n = 305]: 4.4 units (standard deviation 1.9 units). Mode: 4 units (range 0–16 units)

b) Transfusion

Type of transfusion	Number of women transfused ¹ [% of all transfused]	Mean units transfused [standard deviation]	Range transfused [units]
O negative blood	40 [15]	1.88 [0.88]	1 – 5
Group specific uncross-matched blood	32 [12]	2.44 [1.24]	1 – 6
Cross-matched blood	247 [90]	4.00 [4.37]	1 – 35
All of the above types of blood	274 [100]	4.22 [4.31]	1 – 37
Fresh frozen plasma	116 [42]	4.25 [3.23]	1 – 22
Cryoprecipitate	25 [9]	2.60 [1.63]	1 – 8
Platelets	56 [20]	1.57 [1.16]	1 – 6

¹ 274 women were transfused

A2.16 Investigations and monitoring

Investigation or monitoring parameter	Number of women ¹	Percentage of all women with MOH ²
Obstetric early warning chart used	273	81
Full blood count taken	312	92
Clotting screen taken	293	86
BP taken at least every 15 minutes	335	99
Pulse monitored at least every 15 minutes	335	99
Pulse oximeter used	333	98
Foley catheter placed	339	100
Urine output measured regularly	335	99
Central venous pressure line inserted	44	13
Arterial line inserted	105	31

¹ Data missing for 1 – 5 women depending on data question

² Percentage is of all women including those with missing data

A2.17 High dependency or intensive care

Type of care	Number of women	Percentage of all women with MOH ²
Admitted to ICU	40	12
HD room on labour ward	251	74
Admitted to General HDU	9	3

¹ Percentage is of all women including those with missing data

A2.18 Assessment of care by opinion former among the 336 cases of MOH for whom the information was available, 2012

Category of care*	Overall assessment of care	Risk management committee ¹	Clinical consensus ²	Informal discussion ³	Opinion of reporter ⁴
Appropriate	236 [70%]	174	7	39	16
Incidental sub-optimal	74 [22%]	59	0	12	3
Minor sub-optimal	20 [6%]	18	1	1	0
Major sub-optimal	6 [2%]	6	0	0	0
Total [%] ⁵	336 [100%]	257 [76.5%]	8 [2.4%]	52 [15.5%]	19 [5.7%]

* See Table A3.22 for further description of care and for data for all women (from 2007) with MOH for comparison

¹ Opinion formed by risk management team

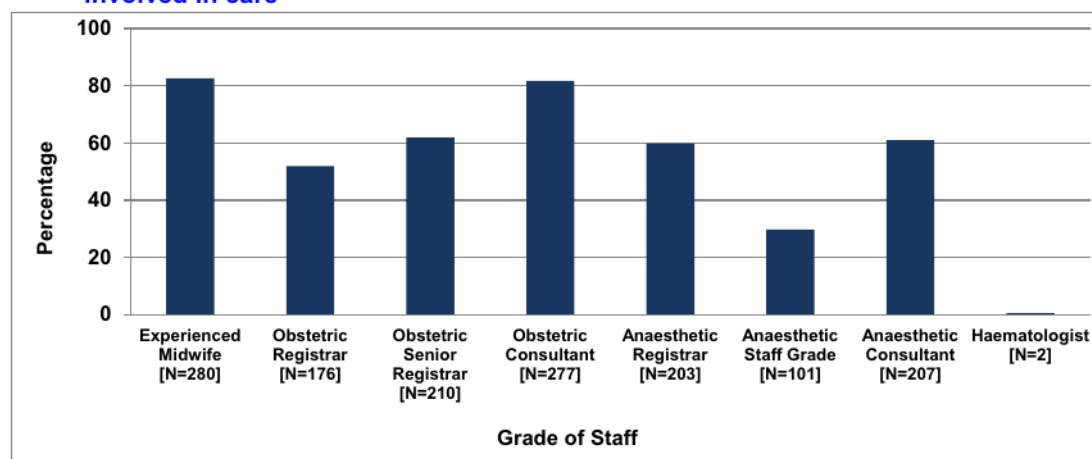
² Opinion formed during formal clinical meeting but not risk management team

³ Opinion formed as a result of informal discussion

⁴ Opinion of the unit coordinator reporting to SCASMM

⁵ Percentage in this row gives the distribution of opinion former among the 336 women

A2.19 Staff involvement: Percentage of cases with different staff directly involved in care¹



¹ Percentage based on 339 women

A2.20 Use of haemostatic surgical procedures among 277 women with the direct involvement of a consultant obstetrician and 62 women with no direct involvement reported, 2012

Procedure	Number of cases with direct involvement of a consultant obstetrician	Number of cases with no direct involvement of a consultant obstetrician
Intra-uterine balloon tamponade	78	4
Interventional radiology	10	1
Ligation of uterine or internal iliac arteries	5	0
Uterine brace suture	21	0
Hysterectomy	20	0

A2.21 Clinical records and documentation

Clinical records overall

Description	Number of women [%]
Excellent: filed in clear sequence, easy to extract data	162 [48]
Good: mainly clear, but some features absent	157 [46]
Fair: significant deficiencies in filing	16 [5]
Poor: chaotic notes, difficult to find much information	4 [1]

Documentation of episode of MOH

Description	Number ¹ of women [%]
Excellent: easy to follow, entries signed and timed	169 [50]
Good: clear, though some gaps	150 [44]
Fair: significant gaps, not all entries signed and timed	15 [4]
Poor: major omissions, many unsigned, untimed entries	2 [0.6]
Non-existent	1 [0.3]

¹ No information for 3 women

A2.22 Age

Mean: 31 years (Standard deviation 6 years)

Median: 30 years

Range: 16-45

A2.23 Parity

Para 0: 165

Para 1-4: 172

Para ≥ 5: 2

A2.24 Previous caesarean sections (excluding nulliparous women)

Number of previous caesarean sections	Number of women ¹
None	119
One	41
Two	8
Three	4
Four +	1

¹ Data missing for 1 woman

A2.25 Blood loss and haemoglobin levels

Mean: 3485 ml (standard deviation 2245 ml)

Range: 1900 – 30000 ml

Data missing for 3 women

Haemoglobin levels

Time	Mean	Standard deviation	Range
Before	11.6	1.3	6.6 – 15.2
After	8.9	1.6	3.4 – 13.6
Difference [Before-After]	2.7	2.0	-2.5 – 7.8

Difference data missing for 14 women

A2.26 Interventional radiology (IR): occlusive technique used in 11 cases of MOH utilising IR in 2012

Technique employed	Number of women ¹
Temporary balloon occlusion	8
Gelfoam/PVA	1
Coils	0
Embosphere/embozone	1
Temporary balloon occlusion + Gelfoam	0
Temporary balloon occlusion + Coils	0
Gelfoam + Amplatzer	0

¹Data missing for one woman

Eclampsia 2012

A2.27 Age

Mean: 25.5 years (standard deviation 7.0 years)

Range: 17–39 years

A2.28 Parity

Para 0: 6 women

Para 1 – 3: 2 women

A2.29 Deprivation code

SIMD deciles	No. of women	Percentage ¹
1 (Most deprived)	0	-
2	2	25
3	2	25
4	0	-
5	0	-
6	1	12.5
7	1	12.5
8	0	-
9	1	12.5
10 (Least deprived)	0	-

¹Scottish Index of Multiple Deprivation²⁰

¹Data not reported for 1 woman

A2.30 Body mass index

Mean 27.9 (Standard deviation 5.7)

Range: 23–37

A2.31 Smoking history

None of the 8 women indicated at booking that they were a current smoker.

A2.32 Gestation at eclamptic fit or of delivery if postpartum eclampsia

Mean: 35.5 weeks (standard deviation 5.0 weeks)

Range: 26– 41 weeks

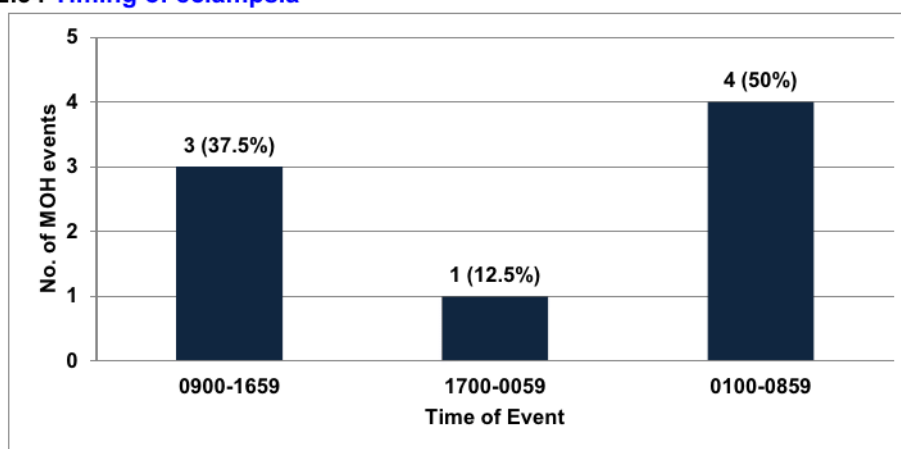
< 37 weeks: 3

≥ 37 weeks: 5

A2.33 Timing and location of eclampsia

Eclamptic episode occurred	Location ¹				Total
	Consultant-led Unit	Community maternity unit	In transport	At home/ outwith hospital	
Antepartum	2	-	1	1	4
Intrapartum	4	-	-	-	4
Postpartum	-	-	-	-	0
Total	6	-	-1	1	8

A2.34 Timing of eclampsia



A2.35 Staff involved in management

Staff directly involved	Number of women
Senior Midwife	7
Obstetric Registrar	4
Obstetric Senior Registrar	5
Obstetric Consultant	5
Anaesthetic Registrar	3
Anaesthetic Staff Grade	6
Anaesthetic Consultant	3

A2.36 Clinical records and documentation

Description	Number of women [%]
Excellent: filed in clear sequence, easy to extract data	5 [62]
Good: mainly clear, but some features absent	3 [38]
Fair: significant deficiencies in filing	-
Poor: chaotic notes, difficult to find much information	-

Description	Number of women [%]
Excellent: easy to follow, entries signed and timed	3 [38]
Good: clear, though some gaps	4 [50]
Fair: significant gaps, not all entries signed and timed	1 [12]
Poor: major omissions, many unsigned, untimed entries	-

Appendix 3: Additional data for 2003-2012

All morbidities 2003-2012

A3.1 Number of women reported from each obstetric consultant-led maternity unit with severe morbidity and rates per 1000 births, 2003 – 2012

Location of Maternity Unit ¹	Number of :		Rate per 1000 births [95% CI 2003-12]
	Women with events reported 2003-12	Births 2003-12	
Aberdeen	415	46525	8.9 [8.1 – 9.8]
Ayrshire	258	36801	7.0 [6.2 – 7.9]
Borders	77	11110	6.9 [5.5 – 8.7]
Dumfries	54	13115	4.1 [3.1 – 5.4]
Dundee ²	239	38964	6.1 [5.4 – 7.0]
Edinburgh	403	65158	6.2 [5.6 – 6.8]
Elgin	29	10358	2.8 [1.9 – 4.0]
Fife	263	35517	7.4 [6.5 – 8.4]
Glasgow Royal	424	57865	7.3 [6.6 – 8.1]
Inverness	90	20265	4.4 [3.6 – 5.5]
Livingston	165	28277	5.8 [5.0 – 6.8]
Paisley ³	185	33751	5.5 [4.7 – 6.3]
Queen Mother's, Glasgow ⁴	179	24279	7.4 [6.3 – 8.5]
Southern General, Glasgow	199	39740	5.0 [4.3 – 5.8]
Stirling ⁵	173	32119	5.4 [4.6 – 6.3]
Stornoway	8	2008	4.0 [1.7 – 7.9]
Wick	5	2060	2.4 [0.8 – 5.7]
Wishaw	309	49691	6.2 [5.5 – 7.0]
Scottish Total	3475	571083⁶	6.1 [5.9 – 6.3]

¹Obstetric Consultant-led maternity units only.

Births at Vale of Leven Hospital (open 2003 to 2004) are not included among women with morbidities as women subsequently gave birth at a number of different units.

²Includes Perth Royal Infirmary from 2003 to 2004.

³Includes Inverclyde Hospital from 2003 to 2004.

⁴Queen Mother's open 2003 to 2011. Thereafter, women gave birth at Southern General Hospital.

⁵Includes Falkirk Infirmary (from 2003 to 2004); now Forth Valley Hospital, Larbet.

⁶Includes births outwith consultant-led units and births at Vale of Leven Hospital.

A3.2 Numbers and rates per 1000 births of severe maternal morbidities reported to SCASMM, 2003-2012

Category of severe maternal morbidity	Number of events 2003-12	Rate per 1000 births [95% C.I.] 2003-12
Major obstetric haemorrhage	2691	4.78 [4.60-4.96]
Eclampsia	145	0.26 [0.22-0.30]
Renal or liver dysfunction	162	0.29 [0.24-0.34]
Cardiac arrest	23	0.04 [0.03-0.06]
Pulmonary oedema	95	0.17 [0.14-0.21]
Acute respiratory dysfunction	89	0.18 [0.13-0.19]
Coma	2	0.00 [0.00-0.01]
Cerebrovascular event	32	0.06 [0.04-0.08]
Status epilepticus	3	0.01 [0.00-0.02]
Anaphylactic shock	18	0.03 [0.02-0.05]
Septicaemic shock	67	0.12 [0.09-0.15]
Anaesthetic problem	64	0.11 [0.09-0.15]
Massive pulmonary embolism	36	0.06 [0.04-0.09]
Intensive care or coronary care admission	831	1.47 [1.38-1.58]

A3.3 Categories of severe maternal morbidity among 549 women admitted to ICU, 2007-2012

Nature of morbidity	Number of Morbidities 2007-2012
Major obstetric haemorrhage (MOH)	305
Not categorised ¹	148
Acute respiratory dysfunction	21
Septicaemic shock	19
Cardiac arrest	10
Eclampsia	10
Pulmonary oedema	19
Renal/liver dysfunction	30
Anaphylactic shock	4
Anaesthetic problem	5
Coma	1
Cerebro-vascular embolism	3
Massive pulmonary embolism	6
All	581²

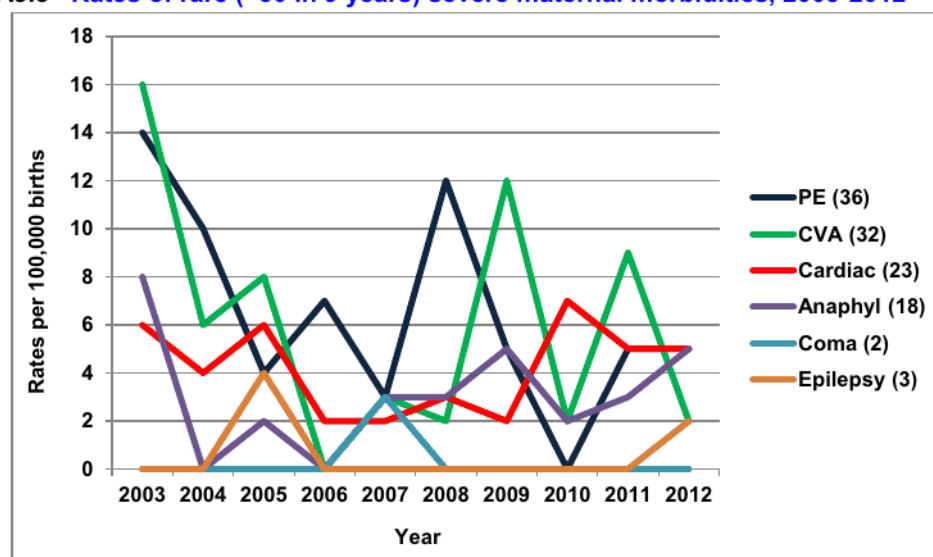
¹"Not categorised"= admitted to ICU for reasons other than the defined causes of severe maternal morbidity (see following table for details).

²Total number of morbidities exceeds the number of women admitted to ICU as some women had more than one morbidity.

A3.4 “Uncategorised” reasons for ICU admissions, 2008-12

Reason for ICU admission	2008	2009	2010	2011	2012	2008-2012 Total
Number of women						
Cardiac	11	6	4	2	7	30
Surgical	6	5	2	0	1	14
Sepsis	2	2	5	5	6	20
Chest infection	2	2	4	7	3	18
Renal	5	1	1	0	0	7
H1N1	0	3	1	6	0	10
MOH <threshold	1	2	1	1	5	10
Diabetes	0	0	2	0	2	4
Not recorded	1	0	1	0	1	3
Encephalopathy	1	0	0	0	1	2
Thrombosis	0	1	0	0	0	1
Trauma	0	0	1	0	0	1
Anaesthesia	0	0	1	1	0	2
Sickle cell crisis	0	0	0	1	0	1
Pancreatitis	0	0	0	1	0	1
Unexplained seizure	0	0	0	1	0	1
Interventional radiology	0	0	0	1	1	2
Amniotic fluid embolism	0	0	0	0	1	1
Meningitis	0	0	0	0	1	1
Total	29	22	23	26	29	129

A3.5 Rates of rare (<50 in 9 years) severe maternal morbidities, 2003-2012



PE = pulmonary embolism; CVA=cerebro-vascular event; Cardiac=cardiac arrest; Anaphyl=anaphylactic shock; coma=coma; epilepsy=status epilepticus. The number in brackets after each is the total number of cases reported in 9 years.

A3.6 Perinatal outcome among women with severe maternal morbidity and a viable pregnancy, 2005-2012

Outcome	Women with information available							
	2005	2006	2007	2008	2009	2010	2011	2012
All morbidities	213	257	220	275	291	345	401	403
Major haemorrhage	153	204	178	199	236	300	333	328
Non-haemorrhage	60	53	42	76	55	45	68	75
	Perinatal deaths (number)							
	2005	2006	2007	2008	2009	2010	2011	2012
All morbidities	15	17	10	16	15	22	9	7
Major haemorrhage	12	10	9	11	13	20	7	4
Non-haemorrhage	3	7	1	5	2	2	2	3
	Perinatal deaths (rate per 1000 with severe morbidity)							
	2005	2006	2007	2008	2009	2010	2011	2012
All morbidities	70.4	66.1	45.5	58.2	51.5	63.8	22.4	17.4
Major haemorrhage	78.4	49.0	50.6	55.3	55.1	66.7	21.0	12.2
Non-haemorrhage	50.0	132.1	23.8	65.8	36.4	44.4	29.4	40.0
Perinatal mortality rate among all births in Scotland	7.7	7.4	7.8	7.4	7.4	6.9	6.9	6.5

A3.7 Deprivation decile of women with severe maternal morbidity, 2009 – 2012

SIMD* deciles	2009	2010	2011	2012	2009-2012
	Number of Women ¹ (%)	Number of Women ² (%)	Number of Women ³ (%)	Number of Women ⁴ (%)	Percentage
1 (most deprived)	37 (14.2)	52 (15.0)	58 (13.8)	65 (15.8)	14.7
2	38 (14.6)	45 (13.0)	48 (11.4)	49 (11.9)	12.5
3	24 (9.2)	27 (7.8)	49 (11.7)	45 (10.9)	10.1
4	22 (8.5)	45 (13.0)	31 (7.4)	44 (10.7)	9.9
5	27 (10.4)	37 (10.7)	45 (10.7)	37 (9.0)	10.1
6	15 (5.8)	25 (7.2)	33 (7.9)	33 (8.0)	7.4
7	16 (6.2)	26 (6.2)	41 (9.8)	32 (7.8)	8.0
8	19 (7.3)	37 (10.7)	32 (7.6)	36 (8.8)	8.6
9	18 (6.9)	30 (8.6)	44 (10.5)	44 (10.7)	9.5
10 (least deprived)	44 (16.9)	23 (6.6)	39 (9.3)	26 (6.3)	9.2

Scottish Index of Multiple Deprivation²⁰

¹ Data were available for 260 women out of the 381 [68.2%] who experienced severe morbidity.

² Data were available for 347 women out of the 385 [90.1%] who experienced severe morbidity

³ Data were available for 420 women out of the 432 [97.2%] who experienced severe morbidity

⁴ Data were available for 411 women out of the 423 [97.2%] who experienced severe morbidity

A3.8 Body mass index of women with severe morbidity, 2009-2012

Body mass index	2009	2010	2011	2012	2009-12
	Number of women ¹ [%]	Number of women ² [%]	Number of women ³ [%]	Number of women ⁴ [%]	Percentage
< 30	232 [74.1]	248 [71.9]	293 [72.2]	293 [70.9]	72.2
30-34	43 [13.7]	68 [19.7]	60 [14.8]	63 [15.3]	15.8
35-39	19 [6.1]	21 [6.1]	37 [9.1]	39 [9.4]	7.9
≥ 40	19 [6.1]	8 [2.3]	16 [3.9]	18 [4.4]	4.1
Total no.	313	345	406	413	

¹ Data was available for 313 women out of the 381 [82.2%] who experienced severe morbidity.

² Data was available for 345 women out of the 385 [89.6%] who experienced severe morbidity.

³ Data was available for 406 women out of the 432 [94.0%] who experienced severe morbidity

⁴ Data was available for 413 women out of the 423 [97.6%] who experienced severe morbidity

Major obstetric haemorrhage 2003-2012

A3.9 Causes of major obstetric haemorrhage (MOH) among 2042 women, 2006-2012

Cause	2006-2012	
	Number	Percentage
Uterine atony	1077	52.7
Retained placenta/membranes	400	19.6
Vaginal laceration/haematoma	336	16.5
Bleeding from uterine incision	342	16.7
Abruption	180	8.8
Placenta praevia	163	8.0
Cervical laceration	63	3.1
Morbidity adherent placenta	104	5.1
Broad ligament haematoma	38	1.9
Uterine rupture	37	1.8
Uterine inversion	10	0.5
Other	124	6.1

A3.10 Mode of delivery for women with MOH, 2003- 2012

Mode of delivery	2003-2012	
	Number	Percentage
Spontaneous vertex	682	27.0
Breech	26	1.0
Ventouse	70	2.8
Forceps	349	13.8
Elective caesarean section	343	13.6
Emergency caesarean section	1054	41.8
Total number of women	2524	

A3.11 Emergency caesarean section performed at full dilatation among women experiencing MOH, 2004-2012

Year	Caesarean sections performed at full cervical dilatation	
	Number	Percentage of all emergency caesarean sections
2004	8	14
2005	19	24
2006	25	24
2007	22	19
2008	23	22
2009	30	25
2010	33	22
2011	21	18
2012	23	18

A3.12 Association of morbidly adherent placenta with previous caesarean section, 2006-2012

Association	2006	2007	2008	2009	2010	2011	2012
Number of parous women with morbidly adherent placenta	9	16	11	10	10	23	16
Without previous caesareans number of women [%]	4 [44]	6 [38]	5 [45]	5 [50]	8 [80]	3 [13]	2 [12]
With previous caesareans number of women [%]	5 [56]	10 [62]	6 [55]	5 [50]	2 [20]	20 [87]	14 [88]
χ^2 p-value	0.05	0.01	0.03	0.01	0.81	<0.001	<0.001

A3.13 MOH and deprivation 2009-2012

SIMD ²⁰ deciles	2009	2010	2011	2012
	Number of women ¹ [%]	Number of women ² [%]	Number of women ³ [%]	Number of Women ⁴ [%]
1 (Most deprived)	34 [15.4]	46 [15.1]	52 [15.4]	53 [15.8]
2	30 [13.6]	39 [12.8]	39 [11.5]	41 [12.2]
3	20 [9.0]	21 [6.9]	35 [10.4]	33 [9.8]
4	20 [9.0]	42 [13.8]	23 [6.8]	38 [11.3]
5	25 [11.3]	29 [9.5]	34 [10.1]	32 [9.5]
6	14 [6.3]	22 [7.2]	24 [7.1]	29 [8.6]
7	17 [7.7]	23 [7.5]	34 [10.1]	27 [8.0]
8	15 [6.8]	34 [11.1]	26 [7.7]	30 [8.9]
9	19 [8.6]	27 [8.9]	36 [10.7]	33 [9.8]
10 (least deprived)	27 [12.2]	22 [7.2]	35 [10.4]	20 [6.0]
All	221	305	338	336

Scottish Index of Multiple Deprivation²⁰

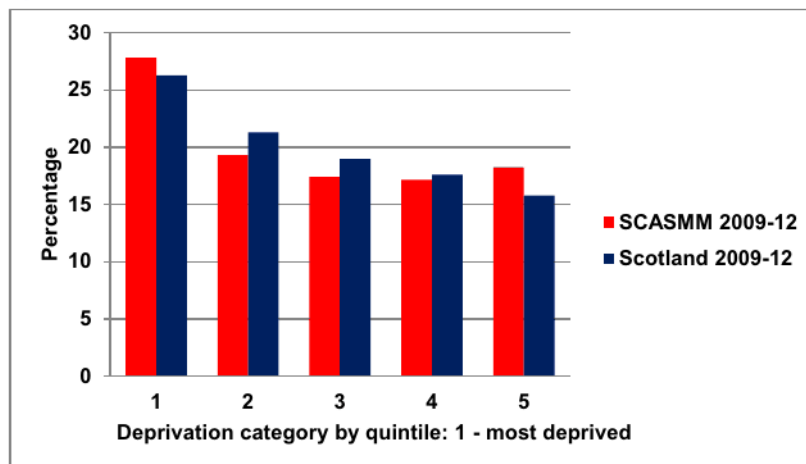
¹Data missing for 85 women

²Data missing for 23 women

³Data missing for 11 women

⁴Data missing for 3 women

A3.14 Deprivation quintile of women with major obstetric haemorrhage, 2009-2012



A3.15 MOH and body mass index (BMI) 2009-2012

BMI	2009	2010	2011	2012
	Number of women [%]*	Number of women [%]*	Number of women [%]*	Number of women [%]*
< 30	206 [74.4]	221 [73.4]	242 [72.5]	234 [69.6]
30 - 34	36 [13.0]	57 [18.9]	52 [15.6]	54 [16.1]
35 - 39	18 [6.5]	17 [5.6]	29 [8.7]	33 [9.8]
> 39	17 [6.1]	6 [2.0]	11 [3.3]	15 [4.5]
Total	277	301	334	336

*Percentage of women where information on BMI was completed

MOH and BMI	2009	2010	2011	2012
Mean BMI	27.1	26.9	26.8	27.3
Standard deviation	6.6	5.4	6	6.1
Range	16-73	16-52.5	16-56	15-53
Data missing: number of women	29	22	15	3

A3.16 MOH and smoking history 2009-2012

Smoking history*

Smoking history	2009	2010	2011	2012
	Number of women [%]	Number of women [%]	Number of women [%]	Number of women [%]
Current smokers at booking	50 [18]	55 [18]	67 [20]	65 [19]
Non-smokers	225 [82]	255 [82]	276 [80]	265 [78]
Smoked during pregnancy	14 [5]	23 [7]	53 [16]	51 [16]
No information available	31 [11]	13 [4]	6 [2]	9 [3]

*No information was available for 9 of the women in who were current smokers in 2009, for 9 of the women in 2010, for 11 of the women in 2011 and for 13 of the women in 2012.

For current smokers*

Number of cigarettes. per day	2009	2010	2011	2012
	Number of Women [%]	Number of Women [%]	Number of Women [%]	Number of Women [%]
< 5	8[20]	12[26]	22[39]	21[40]
6 – 10	19[46]	23[50]	15[27]	15[29]
11 – 20	12[29]	11[24]	17[30]	12[23]
≥ 21	2[5]	0[0]	2[4]	4[8]

*No information was available for 9 of the women in who were current smokers in 2009, for 9 of the women in 2010, for 11 of the women in 2011 and for 13 of the women in 2012.

A3.17 Prophylactic uterotonic agents administered during third stage among women delivering vaginally who experienced MOH, 2009, 2010, 2011 and 2012

Prophylactic agent	Number of women (%)			
	2009 ¹	2010 ²	2011 ³	2012 ⁴
Syntocinon	76 (59)	100 (72)	120 (82)	129 (80)
Syntometrine	52 (41)	43 (31)	37 (25)	38 (24)
Other ⁵	0	18 (13)	19 (13)	1 (0.6)

¹Prophylactic agent recorded for 128 of the 145 women who delivered vaginally

²Prophylactic agent recorded for all 139 women who delivered vaginally; 22 received more than one agent

³Prophylactic agent recorded for 149 women of the 155 women who delivered vaginally; 21 received more than one agent

⁴Prophylactic agent recorded for 158 women of the 161 women who delivered vaginally, 11 received more than one agent.

⁵Ergometrine, misoprostol, gemeprost or carboprost

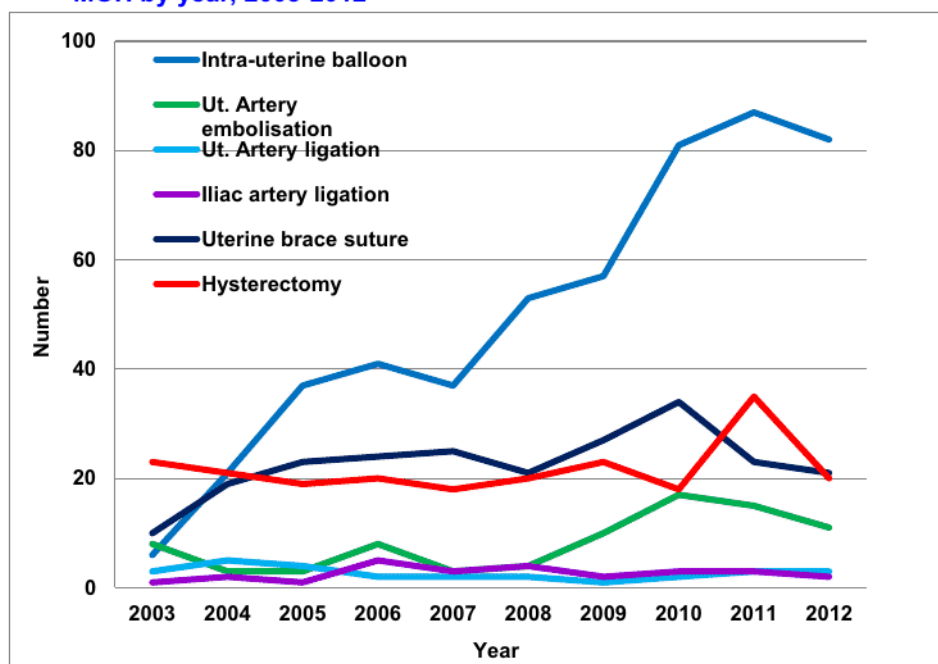
A3.18 Blood crossmatching and transfusion and administration of blood products for women with MOH, 2008-12

Parameter	Year				
	2008	2009	2010	2011	2012
No. of women transfused ¹	207	244	283	290	274
Mean no. of blood units X-matched	N/A	4.8	4.8	4.5	4.4
Number of women transfused:					
X-matched blood	184 (89%)	226 (93%)	243 (86%)	255 (88%)	248 (91%)
Group specific blood ²	19 (9%)	13 (5%)	23 (8%)	20 (7%)	32 (12%)
O negative blood ²	36 (17%)	41 (17%)	41 (15%)	47 (16%)	40 (15%)
Mean number of blood units transfused:					
In total	N/A	N/A	4.6	4.2	4.2
X-matched blood	4.3	4.8	4.2	4.0	4.0
Group specific blood	4.0	2.9	3.0	2.8	2.4
O negative blood	2.0	1.9	2.1	1.7	1.9
Number of women receiving blood products:					
Fresh frozen plasma ²	84 (41%)	98 (40%)	127 (45%)	127 (44%)	119 (43%)
Cryoprecipitate ²	25 (12%)	33 (14%)	32 (11%)	28 (10%)	25 (9%)
Platelets ²	46 (22%)	68 (28%)	69 (24%)	77 (27%)	58 (21%)
Mean number of units of blood products transfused:					
Fresh frozen plasma	4.4	4.6	4.2	4.2	4.3
Cryoprecipitate	2.3	2.7	2.5	2.3	2.6
Platelets	1.7	2.0	1.6	1.6	1.6

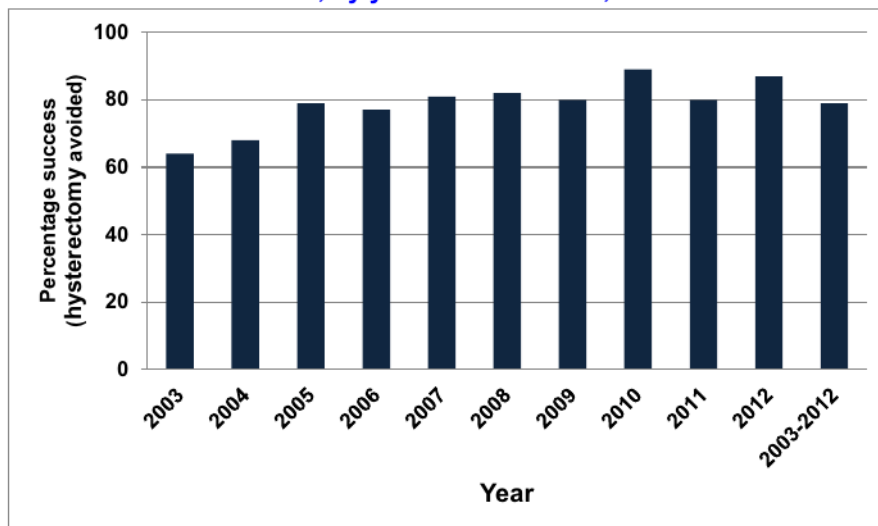
¹This is the number of women for whom detailed information is available; where detail was not reported, women are not included.

²Percentage is of women transfused blood.

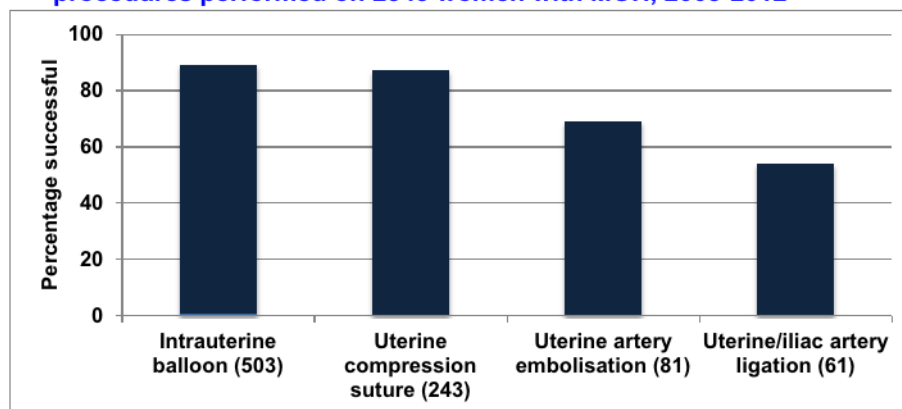
A3.19 Number of each different surgical procedures used to treat women with MOH by year, 2003-2012



A3.20 Percentage success rate for all surgical haemostatic procedures combined (ie hysterectomy avoided) for 909 procedures performed on 2543 women with MOH, by year and combined, 2003-2012



A3.21 Percentage success rate (ie hysterectomy avoided) for 909 surgical procedures performed on 2543 women with MOH, 2003-2012



Note: number in brackets at each procedure is the number of each performed

A3.22 Overall assessments of care in the 1798 cases of major obstetric haemorrhage for which the information was available, 2007-2012

Category	2007	2008	2009	2010	2011	2012 ¹
	Number [%]	Number [%]	Number [%]	Number [%]	Number [%]	Number [%]
Appropriate care. Well managed	150 [65]	161 [69]	201 [71]	232 [78]	269 [80]	236 [70]
Incidental sub-optimal care. Lessons can be learned although it did not affect the final outcome	58 [25]	53 [23]	53 [19]	52 [18]	54 [16]	74 [22]
Minor sub-optimal care. Different management may have resulted in a different outcome	16 [7]	15 [6]	23 [8]	9 [3]	11 [3]	20 [6]
Major sub-optimal care. Different management might have been expected to result in a more favourable outcome. The management of this case contributed significantly to the morbidity of this patient.	6 [3]	4 [2]	5 [2]	4 [1]	3 [1]	6 [2]

¹ No information for 3 women

Eclampsia 2003-2012

A3.23 Prodromal symptoms and signs of eclampsia, 2008-2012

Recorded signs and symptoms	2008 ^a	2009 ^b	2010 ^c	2011 ^d	2012 ^e
	Number of women	Number of women	Number of women	Number of women	Number of women
None	7	4	3	3	1
Headache	7	4	2	2	3
Visual disturbance	3	3	1	1	3
Nausea/vomiting	4	2	1	1	3
Upper abdominal pain	4	1	1	1	3
Oedema	9	7	1	1	3
Clonus	2	4	2	2	1
Right abdomen tenderness	1	0	0	0	1
Diagnosed with pre-eclampsia	6	4	3	3	3
Brisk reflexes	-	0	1	1	0
Face puffy, protein creatinine ratio 206:8	-	0	1	1	0

a 18 cases reported but with detailed case assessments for 17

b 15 cases reported but with detailed case assessments for 13 women

c 12 cases reported with detailed case assessments for all 12

d 7 cases reported with detailed case assessments for all 7

e 8 cases reported with detailed case assessments for all 8

A3.24 Resuscitation in eclampsia, 2008-2012

Resuscitation measure employed	2008	2009	2010	2011	2012
	Number of women	Number of women	Number of women	Number of women	Number of women
Airway secured	11	10	8	6	6
Oxygen given	13	12	11	6	7
Venous access obtained	14	11	11	6	8
Tilted to left lateral position	14	9	10	6	8

A3.25 Treatment, investigation and monitoring features of care of 40 women with eclampsia and sufficient information available, 2009-2012

Feature of management	2009	2010	2011	2012
	Number of women [%] ¹	Number of women [%] ¹	Number of women [%] ¹	Number of women [%] ¹
Treatment				
Magnesium sulphate intravenous infusion	13 [100]	12 [100]	7 [100]	8 [100]
Magnesium sulphate given for at least 24 hours	9 [69]	8 [67]	7 [100]	8 [100]
Investigation				
Blood taken for:				
Full blood count	12 [92]	12 [100]	7 [100]	8 [100]
Urate	11 [85]	12 [100]	6 [86]	8 [100]
Urea, electrolytes, creatinine	12 [92]	9 [75]	6 [86]	8 [100]
Liver function	12 [92]	11 [92]	6 [86]	7 [88]
Coagulation screen	12 [92]	11 [92]	6 [86]	7 [88]
Blood tests repeated within 6 hours	7 [54]	10 [83]	2 [29]	3 [38]
Monitoring				
Intensive care chart used	12 [92]	10 [83]	6 [86]	7 [88]
Blood pressure taken ≤ every 15 minutes	8 [62]	11 [92]	5 [71]	8 [100]
Pulse oximeter used	12 [92]	12 [100]	7 [100]	8 [100]
Oxygen saturation monitored continuously	12 [92]	11 [92]	7 [100]	8 [100]
Respiratory rate taken ≤ every 15 minutes	8 [62]	8 [67]	6 [86]	7 [88]
Deep tendon reflexes tested every 15 minutes	3 [23]	5 [42]	2 [29]	2 [25]
Foley's catheter placed	12 [92]	12 [100]	7 [100]	8 [100]
Urine output measured frequently	12 [92]	10 [83]	7 [100]	8 [100]
Fluid input and output strictly documented	12 [92]	11 [92]	6 [86]	8 [100]
Calcium gluconate available at bedside	8 [62]	9 [75]	4 [57]	3 [38]

¹Number of women with sufficient information available. Total reported cases of eclampsia were 13 in 2009, 12 in 2010, 7 in 2011 and 8 in 2012. Even among cases for which sufficient information was reported, data were incomplete for some questions.

Appendix 4: SCASMM contributors

NHS Board	Hospital Name	Co-ordinator(s)/contributor(s)
NHS Grampian	Aberdeen Maternity Hospital	B Brampton, L Crawford, T Fairley, B Pande
NHS Ayrshire & Arran	Ayrshire Maternity Unit	M Campbell, M Donald, M Dunlop, H Fleming, M Gallacher, S Johnstone, V Kemp, J McIlvery, E Melrose, L Muir, , I Paterson, L Rimmer, E Roy, H Ryrie, A Wheeler
NHS Borders	Borders General Hospital	K Smail
NHS Highland	Caithness General Hospital	P Boabang, M Hart
NHS Dumfries & Galloway	Cresswell Maternity Unit	K Hepburn
NHS Grampian	Dr Gray's Hospital, Elgin	Y Walters
NHS Fife	Forth Park Hospital	D Brown, A Lobo
NHS Tayside	Ninewells Hospital	S Chisholm, F Dye, C Hastings, D Locherty
NHS Greater Glasgow and Clyde	Princes Royal Maternity Hospital	V Brace, F McComb, S McNaught, M Young
NHS Highland	Raigmore Hospital	F Cargill, C Cruickshank, K Freeman, A Giwa-Osagie, E MacDonald
NHS Greater Glasgow and Clyde	Royal Alexandra Hospital	G Burdge
NHS Lothian	Simpson Centre for Reproductive Health	C Blair, A Campbell, S Cowan, J Craig, C Dunlop, A Fisher, I Ismail-Pratt, H Kyle, C Love, N Mary, C Thyne, P Wade
NHS Greater Glasgow and Clyde	Southern General Hospital	L Allan, B Cowan, J Gillies
NHS Lothian	St John's Hospital, Livingston	S Court, K Nattan
NHS Forth Valley	Stirling Royal Infirmary / Forth Valley Royal Hospital	G Bell
NHS Western Isles	Westen Isles Hospital	R Al-Kamil, K Kearney, C MacDonald
NHS Lanarkshire	Wishaw General Hospital	W Duffy, G Morgan

Appendix 5: Links to previous SCASMM reports and to 2012 data collection forms

Data Collection Case Ascertainment Form 2012

<http://www.healthcareimprovementscotland.org/his/idoc.ashx?docid=a863b4df-7db2-415f-a98c-da4140f87d42&version=-1>

9th Annual SCASMM Report (2011)

<http://www.healthcareimprovementscotland.org/his/idoc.ashx?docid=8b6a97f7-ae6e-4dac-9f45-16d5737ba0e9&version=-1>

8th Annual SCASMM Report (2010)

<http://www.healthcareimprovementscotland.org/his/idoc.ashx?docid=7c92abc7-6f7f-432b-80f4-02cb67ea7a03&version=-1>

7th Annual SCASMM Report (2009)

<http://www.healthcareimprovementscotland.org/his/idoc.ashx?docid=7c8fc48a-dd38-45d7-be00-05a0ec1be61a&version=-1>

6th Annual SCASMM Report (2008)

<http://www.healthcareimprovementscotland.org/his/idoc.ashx?docid=c27f7f72-63c7-4619-a6e7-a2c90e6e85f6&version=-1>

5th Annual SCASMM Report (2007)

<http://www.healthcareimprovementscotland.org/his/idoc.ashx?docid=a2e81bfd-4f3d-469d-a568-2c64350ae57a&version=-1>

4th Annual SCASMM Report (2006)

<http://www.healthcareimprovementscotland.org/his/idoc.ashx?docid=f181adcb-971d-4c26-b5c1-b4da20eb94c2&version=-1>

3rd Annual SCASMM Report (2005)

<http://www.healthcareimprovementscotland.org/his/idoc.ashx?docid=ffb0aae2-9747-40cd-940d-58ab30beff91&version=-1>

2nd Annual SCASMM Report (2004)

<http://www.healthcareimprovementscotland.org/his/idoc.ashx?docid=db96ac4b-e7fb-4937-978e-6f24bf9b538b&version=-1>

1st Annual SCASMM Report (2003)

<http://www.healthcareimprovementscotland.org/his/idoc.ashx?docid=32a7adc4-bbaa-447a-9064-978ea6e93098&version=-1>

Appendix 6: Form A 2012

FORM A – Notification of an event

SCOTTISH CONFIDENTIAL AUDIT OF SEVERE MATERNAL MORBIDITY (SCASMM) 2012

Hospital name: Completed by:

Patient information

Initials: Age: BMI:
 Deprivation decile: Gestation at pregnancy end: Parity: +
(see rear for instructions) (completed weeks)
 Did she smoke at booking? Yes ☐ No ☐ Unknown ☐
 Did she give up smoking during pregnancy? Yes ☐ No ☐ Unknown ☐ N/A ☐
 How many did she smoke per day? N/A ☐ <5 ☐ 6-10 ☐ 11-20 ☐ >21 ☐

Event information

Date of event: 2012 Day Month Year			Category (definitions on rear) Please tick all that apply	
Time of onset of event: (24 hour clock)			1	Major obstetric haemorrhage*
Date of delivery: 2012 (or end of pregnancy if early pregnancy loss)			2	Eclampsia†
Was this a multiple pregnancy? Yes ☐ No ☐			3	Renal or liver dysfunction
Baby status: Alive at end of first week ☐ Stillbirth ☐ First week death ☐ Miscarriage ☐ (including ectopic)			4	Cardiac arrest
For any other details please use the "additional information" box on the rear of this form			5	Pulmonary oedema
			6	Acute respiratory dysfunction
			7	Coma
			8	Cerebro-vascular event
			9	Status epilepticus
			10	Anaphylactic shock
			11	Septicaemic shock
			12	Anaesthetic problem
			13	Massive pulmonary embolism
			14	ICU/CCU admission
			15	Interventional radiology*

* category 1 and 15: a completed Form B must be enclosed
 † category 2: a completed Form C must be enclosed

Appendix 7: Maternity and Children Care Quality Improvement Collaborative

Overview

Healthcare Improvement Scotland co-ordinates the Scottish Patient Safety Programme (SPSP) with the stated aim of reducing mortality in Scotland's hospitals by 20% by December 2015. The Healthcare Quality Strategy launched by the Scottish Government in May 2010 (Scottish Government, 2010(2))¹⁶ has the stated aim of “no avoidable injury or harm to people from healthcare they receive” (p7) in Scotland.

The SPSP Maternity and Children Quality Improvement Collaborative (MCQIC) is an exciting programme of work which aims to improve outcomes for women and babies across NHS Scotland. The programme is innovative and complex and focuses on developing, testing and spreading a range of approaches to drive safe, effective and person-centred improvements in maternity services. Strengthening the role of maternity care services in promoting and supporting improvements in maternal and infant wellbeing is one of the aims of the programme, along with improvement activity in both neonatal and paediatric care.

This collaborative sits within the SPSP family and as such it is delivered in conjunction with other improvement programmes.

The Maternity Care Strand sets the pace for continuous improvements in maternity care with a focus on:

- Culture and leadership
- Teamwork, communication and collaboration
- Person centred care
- Safe effective reliable care (eg PPH prevention and management bundles)

The term maternity care is intended to refer to any NHS service providing maternity care to women and their babies including care provided by midwives, obstetricians, general practitioners, anaesthetists, paediatricians, neonatologists, public health nurses, health visitors, pharmacists, optometrists, dentists and allied health professionals. Effective collaboration and communication between all of these disciplines and services, and particularly between primary care, public health nursing/health visitors and maternity services, is essential for person centred, safe and effective maternity care.

Bernadette McCulloch, Improvement Advisor, SPSP Maternity Care Quality Improvement Collaborative: email: bernadette.mcculloch@nhs.net or David Maxwell, Associate Improvement Advisor: davidmaxwell@nhs.net