Summary

This thesis combines hospital based studies from Namibia with hospital based and population based studies from the Netherlands, with a common theme: audit. The term audit is generally used to refer to a wide range of methods for monitoring and reporting on the quality of health care. One of the basic principles of this thesis is that maternity care will benefit more from optimizing the use of existing knowledge and technology (through audit) than from the development of new technologies.

In chapter 1, the term audit is introduced and linked to three Safe Motherhood issues: maternal mortality, maternal morbidity and obstetric interventions. In addition, background information from the author (justification for the thesis) and from both countries where the studies were performed (Namibia and the Netherlands) are presented placing the studies in their geographical, social, medical and economical context. The key questions presented are:

- What are the determinants, substandard care factors and areas for improvement with regard to maternal mortality in Onandjokwe district, Namibia?
- What lessons can we learn from maternal mortality audits in different settings worldwide?
- What are the determinants of caesarean section in selected hospitals in Namibia and the Netherlands?
- What is the influence of caesarean section on severe acute maternal morbidity in the Netherlands?
- Can obstetric audit of topics like maternal morbidity, caesarean section and perineal injury after delivery, be introduced in the existing structure of daily practice in Namibia and the Netherlands?

In Chapter 2 we present results from a facility based maternal mortality audit in Onandjokwe district Namibia. Onandjokwe Lutheran Hospital is introduced as a district and referral hospital in Northern Namibia with a catchments population of 200-300,000 inhabitants living in a semi rural/ peri-urban area. All in-hospital maternal deaths occurring between January 2001 - December 2003 were audited for classification and cause. Recommendations for improvement were formulated.

The maternal mortality ratio (MMR) was found to be 508/100,000 with 45% of deaths due to AIDS. Of 56 maternal deaths, only 17 were direct maternal deaths (30%) and 39 were indirect deaths (70%). AIDS is the most important factor influencing maternal mortality with 25 deaths. Substandard care was identified in four areas and recommendations are presented. We concluded that a facility based maternal mortality audit is an important tool in understanding maternal deaths as well as in identifying substandard care factors which require immediate action. A direct maternal mortality percentage of only 30% is one of the lowest reported and this refers to HIV/AIDS as an important factor influencing maternal mortality in this part of the world.

Chapter 3 illustrates how maternal mortality audit identifies different causes and factors which contribute to maternal deaths in different settings. Results from facility based maternal mortality audits from Namibia, The Gambia and Zambia are presented and compared with
data from the latest confidential enquiry in the Netherlands. In addition, review of data concerning the history of reducing maternal mortality in high income countries is discussed. MMR ranged from 10/100,000 (the Netherlands) to 1540/100,000 (The Gambia). Differences in causes of deaths were characterised by HIV/AIDS for Namibia, sepsis and HIV/AIDS in Zambia, (pre-) eclampsia in the Netherlands and obstructed labour in The Gambia. Differences in maternal mortality are more than just differences between the rich and the poor. Acknowledgement of the magnitude of maternal mortality and a strong political will to tackle the issues are important factors. There is no single, general solution to reduce maternal mortality and identification of problems needs to be promoted through audit, both national as well as local.

In a nationwide prospective cohort study called LEMMoN, severe acute maternal morbidity (SAMM) was identified to occur in at least 7.1 per 1,000 births in the Netherlands. In chapter 4, cases from the LEMMoN study are used for the introduction of audit in the Netherlands. Several audit meetings have been organized to assess the severity of SAMM and to identify substandard care. Before each panel meeting, SAMM details of selected cases were send for individual assessment to selected panel members. During the panel meeting, substandard care factors as judged by the majority of assessors were scored.

Substandard care was identified in 53 of 67 cases (79%). Specific recommendations were formulated concerning local as well as national management guidelines. Data from the LEMMoN study reflect SAMM in the Netherlands and substandard care is often present. Ongoing audit of cases is promoted both at national and at local level.

In chapter 5 we evaluated the risk of SAMM related to mode of delivery using data from the LEMMoN study. Incidence of SAMM in caesarean section (CS) was compared with incidence of SAMM in vaginal delivery (VD). One of the main problems when comparing these two is bias by indication: morbidity related to CS may be a result from preexisting disease leading to the decision to perform the operation rather than from the procedure itself. Therefore, for analyzing the incidence of SAMM related to mode of delivery, three subgroups were used: total SAMM inclusions, selected SAMM inclusions possibly related to mode of delivery and SAMM inclusions in low risk pregnancies using single term breech as surrogate. For those SAMM inclusions possibly related to CS, we excluded all cases where SAMM was not clearly related to the mode of delivery. Additionally, risk of SAMM after previous CS was assessed. The incidence of SAMM possibly related to elective CS was 6.4 per 1,000 compared to 3.9 per 1,000 attempted VD (OR 1.7: 95% CI 1.4-2.0). Women with a previous CS are at increased risk for SAMM in the present pregnancy (OR 3.0: 95% CI 2.7-3.3). In conclusion, CS in previous as well as present pregnancy increases the risk of SAMM, also after excluding those cases where SAMM is not clearly related to mode of delivery.

Knowing the immediate risks, the impact on future pregnancy and the international ‘paradox of CS’ (chapter 10), critical analysis of the procedure, as mentioned in the justification, is needed. Both chapter 6 & 7 describe the introduction of CS audit in the Netherlands and Namibia respectively. In chapter 6, CS audit was introduced in a regional teaching hospital in the Netherlands. This was done during the existing daily report meetings from August 1st 2005 to June 1st 2006 in The Haga hospital, a large teaching hospital in The Hague, the
Netherlands. During the study period, 74% of CS were discussed with regard to indication, classification and audited for 'lack of necessity'. Of 1,221 deliveries, 228 were CS (18.7%) while prior to the audit period there were 1,216 deliveries with 284 were CS (23.4%).

The CSR was found to be significantly lower during the audit period. Assisted vaginal deliveries, neonatal outcome, and induction of labor rates were comparable. Concerning the audit question ‘could CS have been prevented’, there was discussion in 24.4% of cases. In 6.7% of CS, consensus about lack of necessity was achieved. We concluded that introducing CS audit during the existing structure of daily report meetings in a regional teaching hospital is both feasible and practical. It creates awareness and encourages discussion among staff members concerning indications for CS and lack of necessity. Furthermore, there was a significant decrease in CSR during the audit period.

**Chapter 7** describes a retrospective observational study concerning CS in Onandjokwe Lutheran Hospital, Namibia. Indications of 576 CS performed between January 2001 – December 2002, were analyzed using intra-operative internal pelvimetry and a CS record keeping system. Most CS were done for dystocia (34%) followed by repeat CS (31%). The true conjugate (distance between the promontorium to mid pubic bone) was significantly smaller in these recurrent indication groups when compared to non recurrent indications. In this rural hospital the introduction of Delee Pelvimetry and a CS record keeping system was found to be a simple and cheap way to introduce obstetric audit. This creates awareness, which may help in reducing unnecessary CS.

Although CS is performed frequently, no consensus exists concerning classification of the procedure. In **chapter 8** we evaluated the agreement between different classification systems (the traditional binary - emergency versus elective - and a new four grade classification system advocated by the RCOG) among obstetricians in the Netherlands and Belgium: 212 obstetricians were requested to grade a list of 18 obstetrical scenarios according to three classification systems (traditional binary classification, new classification using four grades of urgency without and with additional interpretation). Agreement was assessed by the weighted kappa: 77 obstetricians responded (Netherlands 62.2%, Belgian 9.9%) with substantial agreement for all three classification systems ($\kappa=0.71; \kappa=0.70; \kappa=0.67$). The traditional binary and new classification based on four grades of urgency, were found to have similar but relatively low inter-observer agreement. We suggest to use the classification based on four grades of urgencies, but future studies are necessary to evaluate the effect of this implementation.

Another common intervention in obstetrics is the episiotomy. In **chapter 9** we evaluate the dimensions of mediolateral episiotomy and the diagnosis of obstetric anal sphincter injuries (OASIS) during routine clinical practice in two teaching and one university hospital in the Netherlands. In all women delivering between February - September 2008, the dimensions of episiotomy were measured directly post delivery with the women in lithotomy position. Furthermore, in all women with ≥ 2nd degree tear, a second labour room employee re-evaluated the extent of injury according to RCOG classification. Incidence of OASIS during the audit period was compared with the incidence one year preceding the audit. Of 1,979 deliveries, 420 women had episiotomy (21.2%) and 58 women sustained OASIS (2.9%). The mean angle of episiotomy was $40^\circ$ away from the midline. There was no difference in the length or the angle of episiotomy between gynaecologist or midwife and most episiotomies
were sufficiently away from the midline. There was a significant increase in OASIS as compared with the preceding year. Introducing perineal audit in daily practice is illustrated to be feasible, practical and might result in improved diagnosis of OASIS. To improve recognition and classification of OASIS, perineal audit including an international agreed classification should be introduced as routine practice.

In **chapter 10** the findings from the previous studied are discussed and audit is linked to research, ectoscopy and lifelong learning. In conclusion, the introduction of audit concerning obstetric issues is possible in routine daily practice. It creates awareness, stimulates professionalism, identifies areas for improvement, stimulated discussion concerning indications for obstetric procedures and, making use of the ‘Hawthorne effect’, influences outcome. Teaching hospitals should be encouraged to create a supportive environment for the implementation of audit.