Maternal morbidity and mortality in the Netherlands and their association with obstetric interventions

Kallianidis, A.F.

Summary
Samenvatting

SUMMARY

Maternal morbidity and mortality are severe, unforeseen and sorrowful outcomes of pregnancy. They serve as quality indicators of obstetric care and studies on this subject are essential for improving obstetric care. The two main topics of this thesis are maternal mortality in the Netherlands and peripartum hysterectomy. Peripartum hysterectomy is a last-resort intervention in case of severe pregnancy- or birth-related complications and therefore used as a morbidity indicator. **Part 1** of this thesis focused on maternal mortality in the Netherlands. We presented the incidence, causes of death and lessons learned from the audit of every maternal death by the Dutch Auditcommittee Maternal Mortality and Severe Morbidity (*Auditcommissie Maternale Sterfte en Morbiditeit*, AMSM). In **part 2** we studied the incidence, outcomes and management of peripartum hysterectomy on national, European and global level thanks to the International Network of Obstetric Survey Systems (INOSS).

PART 1: MATERNAL MORTALITY IN THE NETHERLANDS

In **chapter 2** we presented the results of maternal mortality registration and auditing, in the Netherlands, between 2006-2018. We calculated the national maternal mortality ratio (MMR), described main causes of death and presented the *lessons learned* from auditing of maternal deaths by the AMSM. The ultimate goal of confidential enquiries into maternal deaths is to improve obstetric outcomes and prevent avoidable maternal deaths. Main results were the decline of the national MMR, being the lowest ever calculated. Most common underlying cause of death were cardiovascular diseases followed by hypertensive disorders and thromboembolism. We identified risk-factors such as teenage pregnancies, advanced maternal age and severe underlying health disorders. Also, we saw that women with a non-Western ethnic background, especially those from Surinam or the Dutch Antilles had a significantly higher risk of dying during pregnancy compared to white native women. In nearly half of all maternal deaths we observed *improvable factors* in the healthcare process. Our results depict the high standards of maternal and obstetric care in the Netherlands. However, we need to remain vigilant, the decrease in MMR should not be taken for granted for the future.

In **chapter 3** we explore the association between caesarean section and maternal mortality. We included all maternal deaths reported to the AMSM between 1999 and 2013 and compared the risk of death for women after vaginal birth and caesarean section. After in-depth assessment of all maternal deaths, we were able to exclude cases where the caesarean section was not associated with the death of the woman. Also we discriminated between cases in which the death was associated with the caesarean section, and those in which the surgery directly led to death. Our

results showed that women after caesarean section had a three times higher risk of death compared to vaginal birth. In one out of ten deaths the caesarean in fact initiated the train of events that led to death. These results underline that the short term risks and complications of caesarean section should not be underestimated, especially in light of the rapidly increasing caesarean section rates worldwide.

PART 2: MATERNAL MORBIDITY

Chapter 4 is a secondary analysis of data from the LEMMoN-study *(Landelijke studie naar Ethnische determinanten van Maternale Morbiditeit in Nederland)*. This was a prospective, population-based cohort study between 2004-2006, which included women with severe acute maternal morbidity. We analysed women who underwent a (re-)laparotomy after vaginal birth or caesarean section. We found a 16-times higher risk for laparotomy following caesarean section compared to vaginal birth. This risk was highest for women following emergency caesarean section and women with a previous caesarean scar. During the re-intervention, peripartum hysterectomy was the most commonly performed procedure. This finding formed the basis for the following chapters where peripartum hysterectomy was used as a proxy for severe maternal morbidity.

Chapter 5 is an update of a previous systematic review and meta-analysis on the incidence, indications and outcomes of emergency peripartum hysterectomy worldwide. We included studies reporting on the emergency peripartum hysterectomy and compared these outcomes between different income settings. The results showed that countries from low- and middle-income settings had the highest incidence of peripartum hysterectomy, which was most commonly performed due to uterine rupture. Globally, the commonest indication was *placenta accreta spectrum disorder* and we saw that compression techniques were the most commonly applied type of management to prevent peripartum hysterectomy. This update was improved by the inclusion of several population-based studies, which present the most accurate national estimates. We recommend using a broader definition of emergency peripartum hysterectomy, including hysterectomies up to six weeks postpartum, in order to include indications such as severe postpartum infections. Finally, the results point out the considerable differences that persist between different income settings.

Chapters 6 and 7 are paired publications made possible by the collaboration of national obstetric surveillance systems within the INOSS. We compared data on peripartum hysterectomy between nine nationwide studies from Belgium, Denmark, England, France, Italy, the Netherlands, Norway, Slovakia and Sweden. In **chapter 6** we focused on the differences in definitions and indications. After overcoming the differences in applied definitions, we found marked variation in the incidence between countries. Countries with higher caesarean section rates and

larger proportions of women with a previous caesarean section had higher national rates of peripartum hysterectomy. Most common indications were uterine atony and *placenta accreta spectrum* disorder. In continuation of these results, in **chapter 7**, we compared the management of severe postpartum haemorrhage that eventually led to peripartum hysterectomy between countries. We separated women who underwent hysterectomy due to *placenta accreta spectrum* as a separate category and described all surgical and non-surgical management options, again pointing out marked variation in management. These two publications underline the importance of collaboration between nationwide studies of (rare) obstetric interventions. This will enable pooling sufficient numbers, more powerful conclusions and identification of best clinical practice.