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The impact of increased number of low-risk deliveries on maternal and neonatal outcomes: A retrospective cohort study in Finland in 2011–2015

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ABSTRACT

Objectives: Our aim was to demonstrate the influence of increased number of low-risk deliveries on obstetric and neonatal outcome.
Study design: The study hospital was Kätilöopisto Maternity Hospital in Helsinki. Simultaneously, we studied all three delivery units in the Helsinki region in the population-based analysis. The study population was singleton hospital deliveries occurring between 2011 and 2012, and 2014–2015. The study hospital included 11 237 and 15 637 births and the population-based group included 28 950 and 27 979 births. We compared outcome measures in different periods by calculating adjusted odds ratios (AOR). Main outcome measures were induced delivery, mode of delivery, third or fourth degree perineal tear, Apgar score at five minutes <7, umbilical artery pH <7.00, transfer to higher level of neonatal care, neonatal antibiotic treatment, respiratory support of the neonate, hospitalization of the neonate >7 days, and perinatal death.
Results: In the study hospital, induction rate increased from 22.4% to 24.8% (AOR 1.06, 95% CI; 1.00–1.12) while in the population-based analysis the rate decreased from 22.2% to 21.5% (AOR 0.96, 95% CI; 0.92–1.00). Percentage of neonatal transfers, low Apgar scores, and severe perineal tears increased both in study hospital and in population-based group. Changes in operative delivery rate and other adverse perinatal outcomes were statistically insignificant.
Conclusions: Increasing the volume of a delivery unit does not compromise maternal or neonatal outcome. Specific characteristics of a delivery unit affect the volume outcome association.

Introduction

Many studies demonstrate that when an experienced surgeon operates on a difficult condition the patient outcome is better [1,2]. A study on abdominal hysterectomy for endometrial cancer shows that complications during and after surgery are lower in patients treated by high-volume surgeons [3]. Moreover, many studies report that the higher the hospital volume the lower the mortality [4,5].

In obstetrics, many studies demonstrate that centralization of very low-birth-weight and very premature deliveries in tertiary clinics with more experience of similar cases results in better outcomes [6,7]. A consensus on the management of low-risk deliveries does not exist. Some studies detect worse outcomes, for both mother and child, in very small and very large hospitals [8]. Some studies suggest it is not the volume that predicts the outcome but the academic status of the delivery unit [9]. Other studies comparing different levels of delivery units reveal no difference in patient outcome [10,11].

The Helsinki region has three maternity hospitals in 20 kilometers radius, Kätilöopisto Maternity Hospital, Women's Hospital, and Jorvi Hospital. They are publicly financed teaching hospitals operated by the University of Helsinki, and are under the same administration. There are neither privately-owned delivery

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units nor midwife-led units in Finland. The Women's Hospital is the only tertiary delivery unit in Helsinki area. Jorvi Hospital, like Kätilöopisto Maternity Hospital, predominately take care of low-risk deliveries.

The opportunity to evaluate the effect of an increased number of low-risk deliveries on obstetric outcome emerged due to construction project of Women's Hospital, beginning in May 2013. Some deliveries which normally would have been directed to Women's Hospital were instead directed to Kätilöopisto or Jorvi Hospital. The annual volume of deliveries at Kätilöopisto Hospital increased from 5600 to 7500. At the same time the number of deliveries in Women's Hospital decreased, and Kätilöopisto Hospital received supplementary staff and resources to perform the additional deliveries while staff to patient ratio remained the same.

The aim of this study is to evaluate the effect of increased number of low-risk deliveries on obstetric outcomes.

Material and methods

The study population was singleton hospital deliveries in Helsinki region. During the study time, the number of annual deliveries increased by 1900 in the study hospital (Kätilöopisto Maternity Hospital). To detect the changes significant only for the study hospital, we performed a simultaneous population-based analysis including all three maternity hospitals in Helsinki region.

Two periods were compared in the study: before the construction project (the beginning of 2011 to the end of 2012) and after the beginning of the construction project (the beginning of 2014 to the end of 2015). The earlier period was used as a reference. Women's hospital, manages high-risk pregnancies and deliveries, such as insulin treated diabetes before pregnancy, multiple pregnancies, and very premature deliveries before the 32nd week of pregnancy. After the construction began, these criteria remained the same. Low-risk deliveries were centralized in the study hospital, but elective cesarean sections were relocated to Women's hospital. The study hospital has a special care nursery (SCN) but newborns requiring demanding neonatological care are transferred to the Helsinki Children's Hospital neonatal intensive care unit (NICU).

Primary outcome measures were: induced deliveries, emergency cesarean section, operative vaginal deliveries (vacuum and forceps), third or fourth degree perineal tear, perinatal death (separately stillbirths and early neonatal deaths), low Apgar score at five minutes (0–6), very low Apgar score at five minutes 0–3, low umbilical artery pH (less than 7.00), transfer to SCN or NICU, hospitalization of a newborn for more than seven days, intubation of newborn, neonatal ventilator support, and antibiotic treatment.

We chose the following secondary outcome measures in order to detected possible confounding factors: birthweight, gestational age, any congenital anomaly detected in the perinatal period and elective cesarean section. We used SAS v9.3 (SAS Institute Inc., Cary, NC, USA) to analyze the data and calculated adjusted odds ratios (AOR) and 95% confidence intervals (95% CI), adjusted for maternal age, parity, and pre-pregnancy BMI in logistic regressions. Register-based studies require neither statement from a

Table 1
Singleton hospital deliveries in study hospital (Kätilöopisto Maternity Hospital) and in all Helsinki University Maternity Hospitals (population-based analysis) in 2011–2012 and 2014–2015.

	Kätilöopisto Maternity Hospital			All Helsinki University Hospitals		
	2011–2012	2014–2015		2011–2012	2014–2015	
	n (%[a])	n (%[a])	Change n(%)	n (%[a])	n (%[a])	Change n (%)
Total number of babies born	11,267	15,704	4437 (39.4)	29,019	28,074	−945 (−3.3)
Number of babies borns at the hospital	11,237	15,637	4400 (39.2)	28,950	27,979	−971 (−3.4)
Small for gestational age	380 (3.4)	583 (3.7)	203 (53.4)	1111 (3.8)	1127 (4.0)	16 (1.4)
Large for gestational age	219 (1.9)	197 (1.3)	−22 (−10.0)	692 (2.4)	564 (2.0)	−128 (−18.5)
Weight <2500g	259 (2.3)	338 (2.2)	79 (30.5)	1161 (4.0)	1050 (3.8)	−111 (−9.6)
Weight ≥4500g	269 (2.4)	303 (1.9)	34 (12.6)	687 (2.4)	591 (2.1)	−96 (−14.0)
Gestational age <37 + 0 weeks	383 (3.4)	493 (3.2)	110 (28.7)	1573 (5.4)	1424 (5.1)	−149 (−9.5)
Congenital anomalies	879 (7.8)	1133 (7.2)	254 (28.9)	2762 (9.5)	2803 (10.0)	41 (1.5)
Planned cesarean section	563 (5.0)	45 (0.3)	−518 (−92.0)	1808 (6.2)	1732 (6.2)	−76 (−4.2)
Induction of labour (planned cesarean sections exluded)	2516 (22.4)	3874 (24.8)	1358 (54.0)	6414 (22.2)	6004 (21.5)	−410 (−6.4)
Operative vaginal delivery	1186 (10.6)	1785 (11.4)	599 (50.5)	2970 (10.3)	2746 (9.8)	−224 (−7.5)
3rd or 4th degree perineal tear	130 (1.4)	284 (2.0)	154 (118.5)	399 (1.7)	447 (1.9)	48 (12.0)
Emergency cesarean section	1143 (10.2)	1613 (10.3)	470 (41.1)	3343 (11.5)	3108 (11.1)	−235 (−7.0)
Apgar score at five minutes 0–6	138 (1.2)	322 (2.1)	184 (133.3)	592 (2.0)	729 (2.6)	137 (23.1)
Apgar score at five minutes 0–3	27 (0.2)	48 (0.3)	21 (77.8)	113 (0.4)	124 (0.4)	11 (9.7)
Umbilical artery pH <7.00	45 (0.4)	63 (0.4)	18 (40.0)	118 (0.4)	131 (0.5)	13 (11.0)
Transfer to SCN or NICU	818 (7.3)	1278 (8.1)	460 (56.2)	2986 (10.3)	3023 (10.8)	37 (1.2)
Neonatal ventilator support	132 (1.2)	211 (1.3)	79 (59.8)	455 (1.6)	464 (1.7)	9 (2.0)
Intubation of a newborn	149 (1.3)	233 (1.5)	84 (56.4)	483 (1.7)	420 (1.5)	−63 (13.0)
Neonatal antibiotic treatment	322 (2.9)	449 (2.9)	127 (39.4)	1678 (5.8)	1517 (5.4)	−161 (9.6)
Hospitalization of a newborn >7 days	58 (0.5)	90 (0.6)	32 (55.2)	341 (1.2)	284 (1.0)	−57 (−16.7)
Stillbirth	32 (0.3)	28 (0.2)	−4 (−12.5)	87 (0.3)	73 (0.3)	−14 (−16.1)
Early neonatal death	2 (0.0)	3 (0.0)	1 (50.0)	35 (0.1)	35 (0.1)	0 (0.0)
Perinatal death	34 (0.3)	31 (0.2)	−3 (−8.8)	122 (0.4)	108 (0.4)	−14 (−11.5)

[a] Percentage of the babies born at the hospital.