

## **Transfers to hospital in planned home birth in four Nordic countries – A prospective cohort study**

Running headline: Transfers in planned home births

Ellen Blix<sup>1</sup>, Merethe H. Kumle<sup>2</sup>, Karen Ingversen<sup>3</sup>, Anette S. Huitfeldt<sup>4</sup>, Hanne K. Hegaard<sup>5</sup>, Ólöf Á. Ólafsdóttir<sup>6</sup>, Pål Øian<sup>7,8</sup>, Helena Lindgren<sup>9</sup>

<sup>1</sup>Faculty of Health, Oslo and Akershus University College of Applied Science, Oslo, Norway

<sup>2</sup>Department of Radiology, University Hospital of North Norway, Tromsø, Norway

<sup>3</sup>Homebirth Association, Region Zealand, Sorø, Denmark

<sup>4</sup>Unit for Clinical Genetics, Oslo University Hospital, Oslo, Norway

<sup>5</sup>The Research Unit, Women's and Children's Health, The Juliane Marie Centre for Women, Children and Reproduction, Copenhagen University Hospital Rigshospitalet, Copenhagen, Denmark

<sup>6</sup>Department of Midwifery, Faculty of Nursing, University of Iceland, Reykjavík, Iceland

<sup>7</sup>Department of Obstetrics and Gynecology, University Hospital of North Norway, Tromsø, Norway

<sup>8</sup>Women's Health and Perinatology Research Group, Department of Clinical Medicine, Faculty of Health Sciences, University of Tromsø, Tromsø, Norway

<sup>9</sup>Department of Women's and Children's Health, Karolinska Institutet, Stockholm, Sweden

### **Corresponding author:**

Ellen Blix

Faculty of Health Sciences, Oslo and Akershus University College of Applied Sciences, P.O. box 4 St Olavs plass, NO-0130 Oslo, Norway.

E-mail: ellen.blix@hioa.no

### **Conflict of interest**

The authors declare that there are no conflicts of interest in connection with this article.

This article has been accepted for publication and undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as doi: 10.1111/aogs.12858

This article is protected by copyright. All rights reserved.

## Abstract

*Introduction.* Women planning for home birth are transferred to hospital in case of complications or elevated risk for adverse outcomes. The aim of the present study was to describe the indications for transfer to hospital in planned home births, and the proportion of cases in which this occurs. *Material and methods.* Women in Norway, Sweden, Denmark and Iceland who had opted for, and were accepted for, home birth at the onset of labor, were included in the study. Data from 3068 women, 572 nulliparas and 2446 multiparas, were analyzed for proportion of transfers during labor and within 72 hours after birth, indications for transfer, how long before or after birth the transfer started, time from birth to start of transfer, duration and mode of transfer, and whether the transfer was classified as potentially urgent. Analyses were stratified for nulli- and multiparity. *Results.* One third (186/572) of the nulliparas were transferred to hospital, 137 (24.0%) during labor and 49 (8.6%) after the birth. Of the multiparas, 195/2446 (8.0%) were transferred, 118 (4.8%) during labor and 77 (3.2%) after birth. The most common indication for transfers during labor was slow progress. In transfers after birth, postpartum hemorrhage, tears and neonatal respiratory problems were the most common indications. A total of 116 of the 3068 women had transfers classified as potentially urgent. *Conclusions.* One third of all nulliparous and 8.0% of multiparous women were transferred during labor or within 72 hours of the birth. The proportion of potentially urgent transfers was 3.8%.

## Keywords

Planned home birth; Transfer to hospital; Indications for transfers; Potentially urgent transfer; Midwifery

## Key message

Transfers to hospital during labor or within 72 hours after birth occurred in one third of nulliparous women and 8.0% of multiparous women. Most transfers were non-urgent; the overall proportion of potentially urgent transfers was 3.8%.

## Abbreviation

CI confidence interval

## Introduction

In Western countries, up to one third of women planning to give birth at home are transferred to hospital during labor or after the birth (1). Compared with low-risk women planning to give birth in a hospital, there is evidence that low-risk women planning to give birth at home have fewer interventions in labor, including cesarean sections, assisted vaginal deliveries, oxytocin augmentation and epidural analgesia (2-6).

The total population of Norway, Sweden, Denmark and Iceland is 20.5 million, with a combined annual birth rate of 220,000 births. Women receive free care and treatment during pregnancy.

The majority of births are in obstetric units, with a smaller proportion in midwife-led units and at home. Between one and two percent of all births are planned at home in Denmark (7), 2.2 % in Iceland (8), 0.7/1000 in Sweden (9) and 1.5/1000 in Norway (6). In Norway, Sweden and Iceland, women have to find a midwife willing to assist the birth and only low-risk women are accepted for home birth. In Denmark, women have the right to be attended by a midwife at home, even when they have been advised to give birth in an obstetric unit. In Norway, Sweden, Iceland and some Danish regions, the woman will usually be attended by a midwife she has met during pregnancy, and who provided antenatal care. In other Danish regions, she may be attended by a midwife from the nearest hospital, without any particular experience or interest in home births, and the woman and midwife have never met before onset of labor. Denmark, Norway and Iceland, but not Sweden, have national guidelines on how to manage planned home births (7).

Maternal and neonatal outcomes are registered in national birth registries in all Nordic countries. However, planned home births are not systematically registered according to the principle of intention-to-treat, and hospital transfers in such cases and the reasons for them are not described.

Many previous studies on transfers to hospital in planned home births have not reported on indications for transfers, proportion of potentially urgent transfers or used stratified analyses by nulli- and multiparity (1). Thus, the findings in this study will be useful for midwives, obstetricians and others providing antenatal care, and for women considering home births. Caregivers should be able to give evidence-based information about the probability of transfers during and after a planned home birth, and why they might be necessary.

This study aims to describe 1) how often women and neonates were transferred from home to hospital during labor or after birth; 2) indications for transfer; 3) how long before or after birth the transfer started; 4) mode and duration of transfer and 5) the proportion of transfers classified as potentially urgent.

## **Material and methods**

This was an almost fully prospective cohort study using data collected from planned home births in Norway, Denmark, Sweden and Iceland between 2008 and 2013. All midwives attending home births were asked to recruit their clients to the study. The women were given information about the study during pregnancy or labor, and signed a consent form agreeing to participate. All women who had opted for, and were accepted to, home birth at the onset of labor were eligible for inclusion.

Data were collected from January 1<sup>st</sup> 2008 to December 31<sup>st</sup> 2012 in Norway, January 1<sup>st</sup> 2009 to December 31<sup>st</sup> 2013 in Sweden, March 1<sup>st</sup> 2010 to May 15<sup>th</sup> 2013 in Denmark, and January 1<sup>st</sup> 2010 to December 31<sup>st</sup> 2013 in Iceland. For all births in Sweden and Iceland and some in Denmark, the data were entered into a web-based form and transferred into a data file. In Norway and for 70% of the Danish births, data were entered into a form and sent by post or e-mailed to the national study coordinator, who entered the data into a data file. The midwife who attended the birth filled in the form and submitted it one week after birth. In some cases, the midwives forgot to fill the forms and did so when they remembered or perhaps were reminded. Therefore, parts of the data were collected retrospectively and, especially in Denmark, planned home births were not reported.

The following variables were registered: Maternal age, civil status (married/cohabitant or single), country of residence, body mass index, smoking habits, parity, previous cesarean section, gestational age, estimated amount of blood loss, fetal presentation, mode of birth, birthweight, Apgar scores, any treatment given to the mother or baby, maternal death, stillbirths, neonatal deaths within the first 7 days of life, whether the woman and/or baby were transferred to hospital, time between the start of transfer and the birth or between the birth and the start of transfer, mode of transfer, duration of transfer and whether the transfer was classified as potentially urgent or non-urgent. Transfers were defined as potentially urgent if the indication for transfer was recorded as suspected or manifest fetal distress,

antepartum hemorrhage, slow progress or detection of breech position in the second stage of labor, postpartum hemorrhage, low Apgar score, respiratory problems or other potentially urgent situations, at the discretion of the assisting midwife.

To ensure that women who met the inclusion criteria were recruited to the study, the coordinators contacted home birth midwives regularly by e-mail and telephone. Members of the study group were also invited to meetings arranged by home birth midwives, and informed about the study.

The databases were merged, and obviously erroneous values were deleted and registered as missing. We performed the following analyses: numbers, proportions, means, medians, standard deviations, ranges, differences in proportions and 95% confidence intervals.

Analyses were stratified for parity (nulliparity, multiparity and unknown). The IBM SPSS Statistics for Windows version 21.0. data program (IBM Corp., Armonk, NY, USA) was used for the analyses.

The study was approved separately in each of the participating countries, by the Regional Committee for Medical and Health Research Ethics (REC North) (200704605-5) in Norway, by the Regional Committee at Karolinska Institutet (2009/147-31) in Sweden, by The Capital Region Committee on Health Research Ethics (H-3-2014-FSP71) in Denmark, and by The National Bioethics Committee (No. 11-031) in Iceland.

## **Results**

We collected data from 3068 planned home births, 482 from Norway, 445 from Sweden, 1843 from Denmark and 298 from Iceland (Supplementary file S1). During the same period, the Medical Birth Registry of Norway registered 488 planned home births. The Medical Birth Registry of Sweden does not register planned home births, but according to the Association for Home Births, an association for midwives and parents, there were about 460 planned home births between 2009 and 2013 (Cina Madison, personal communication, January 2015). In Denmark, it is estimated that there were between 2000–2400 planned home births during the study period. The actual number is uncertain as the number of home births in 2011 was assessed to be 841 according to a publication from The Danish Health and Medicines Authority (10) and 550 according to The State Serum Institute (11). Furthermore, it was

noted that due to poor data quality, too few homebirths have been registered (11). In Iceland, it is estimated that there were approximately 360 planned home births during the data collection period (12). These estimates suggest that we have data from more than 90% of the planned home births in Norway and Sweden and 80% in Iceland. The proportion from Denmark is 90% at best, but probably less.

A total of 2446 women (81.4%) were multiparous, 2922 (97.5%) married or cohabitants, 204 (6.6%) smokers and 138 (4.5%) had a previous cesarean section. Table 1 shows the characteristics of the study population.

#### *Total transfers*

Table 2 contains detailed numbers of transfers, together with their indications, mode and duration. Of the 3068 women, 402 (13.1%) were transferred to hospital during labor or within 72 hours of giving birth, including 32.7% of all nulliparous and 8.0% of all multiparous women (difference 24.7%; 95% confidence interval (CI): 20.7–28.9). Data about parity were missing for 50 women, of whom 21 (42.0%) were transferred.

The transfer rates differed across the countries, and were 9.4, 12.1, 13.1 and 24.8% in Sweden, Denmark, Norway and Iceland, respectively. Transfer rates for nulliparous women were 25.7 (Sweden), 28.5 (Denmark), 34.4 (Norway) and 57.4% (Iceland). In multiparous women, transfer rates were 6.2% (Sweden), 7.2% (Denmark), 8.2% (Norway) and 15.2% (Iceland). Supplementary file S2 gives information about transfer rates in each country.

#### *Transfers during labor*

Most transfers occurred during labor, before the birth of the baby. A total of 271 women (8.8%) were transferred to hospital before birth. In nulliparas and multiparas, transfer rates during labor were 24.0% and 4.8%, respectively (difference 19.2%; 95% CI 15.7–22.9). The rate was 42.0% for women whose parity was not recorded.

The median time interval from the start of the transport to the birth of the baby was 3 hours and 34 minutes (range 20 minutes-24 hours). In nulliparas, the median time interval was 4 hours and 30 minutes and in multiparas, 2 hours and 45 minutes. The most common reason for transfer was slow progress, both in nulli- and multiparous women. (Table 2).

### *Transfers after the birth*

In total, 131 (4.3%) women and/or neonates were transferred after the birth. The transfer rates in nulliparas and multiparas were 8.6% and 3.2% (difference 5.4%; 95% CI 3.1–8.1). The most common maternal indications for transfer were postpartum hemorrhage and tearing that needed to be repaired by an obstetrician. The most common neonatal indication was respiratory problems/low Apgar score. Median time interval from the birth to the start of the transfer was 1 hour and 45 minutes (range 8 minutes–48 hours). In 36 cases (27.5%), the transfer started within 1 hour after the birth, and in 52 cases (39.7%), between 1 and 6 hours after the birth (Table 2).

### *Potentially urgent transfers*

In total, 116 transfers (28.9% of all transfers and 3.8% of all deliveries) were classified as potentially urgent, of which 55 occurred before and 61 after the birth of the baby. Forty-eight (8.7%) nulliparous and 61 (2.5%) multiparous women had a potentially urgent transfer (difference 6.2%; 95% CI 3.9–8.9). The most common indications for potentially urgent transfers were suspected fetal distress, postpartum hemorrhage and respiratory problems/low Apgar score (Table 2).

In 83 of the 116 transfers (71.6%) for potentially urgent reasons, no medical treatment was needed on arrival at the hospital. Of the 55 women transferred before birth, nine had an instrumental delivery and eight a cesarean section. In five cases, the operative delivery was performed within an hour of the transfer. Among the 61 women transferred after giving birth, three received a blood transfusion, three had a manual removal of the placenta and eight had both. One neonate needed a respirator and another nasal continuous positive airway pressure (CPAP) treatment. Indications for the potentially urgent transfers are in Supplementary file S3.

### *Mode and duration of transfers*

In the 332 transfers for non-urgent reasons, a private car was the most commonly used vehicle (49.2%), followed by an ambulance car (38.7%). In 14 cases (5.5%), a taxi was used for the transfer. In 68.4% of cases, the transfer was completed within 30 minutes. In two women (0.6%), it took more than 1 hour. Information on duration of the transfer was missing in 22.9% of the cases. The median duration of the non-urgent transfers was 20 minutes (range 3–95 minutes) (Table 2).

Of the 116 women or infants transferred for potentially urgent reasons, an ambulance car was used in 91 cases (78.4%), ambulance helicopter in one, and private car or taxi in 21 (15.5%). The median duration of potentially urgent transfers was 15 minutes (range 5–45 minutes) (Table 2).

## **Discussion**

In this study, 32.7% of nulliparous and 8.0% of multiparous women were transferred to hospital during labor or after the birth. The most common reasons for transfer were slow labor progress, need for medical pain relief and suspected fetal distress. In total, 28.9% of transfers, 3.8% of all deliveries, were classified as potentially urgent.

A strength of this study is that it included the majority of planned home births in all four countries during the study period. One limitation is that our only data source was the attending midwives. Diagnoses and other information were not verified through patient files or other sources. Another limitation is that planned home births are not systematically registered, and thus impossible to assess exact number in the four countries. In Norway, Sweden and Iceland, there are few homebirths and few midwives attending them. We are quite sure that we know all midwives attending homebirths, and that we have collected data from practically all planned home births in these countries. Collecting data in Denmark was challenging as there are many homebirths and all midwives may attend home births. We did attempt to give all midwives information about the study several times during the data collection period. It is impossible to estimate the proportion missed, but missed home births occurred probably more often among planned home births organized from hospitals than in settings with more experienced and dedicated midwives. The missed home births probably had a higher rate of transfers as previous research have shown that a known midwife reduces the rate of transfers (9) and some large Danish hospital units organizing home births had transfer rates up to 60% in nulliparous women (Ole Olsen, personal communication, October 2015).

Our findings are in line with previous studies from Norway and Sweden. In a Swedish study of homebirths between 1992 and 2005, 23.4% of nulliparous and 9.1% of multiparous women were transferred to hospital during labor or after the birth (9). In a Norwegian study with data from 1990 to 2007, 31.7% of the nulliparous and 6.3% multiparous women were transferred (6). An Icelandic study including homebirths from 2005 to 2009 found that 39.1% of nulliparous and 12.3% of multiparous women were transferred (8).



A study reporting outcomes from all planned home births in England with National Health Service midwives in 2008–2010 reported higher proportions of transfer, 45.4% and 12.0% for nulliparous and multiparous women, respectively (2). A Dutch study (13) reported transfers from home to hospital in 49.3% of nulliparous and 12.1% of multiparous women in 2000–2008.

We found a higher rate of transfers in Iceland than in the other Nordic countries. There were slightly more nulliparous women in the Icelandic cohort, but this does not explain the difference. Iceland's low population density, harsh terrain, unpredictable weather and risk of difficult transportation could be a part of the reason, although this is also true for other parts of the region, especially Norway. Transfer rates in Iceland are, however, comparable to those in England and the Netherlands (2, 13). There are probably also variations within different areas and practices within each country. A recent study from the Netherlands (14) found that the transfer rate varied from 10 to 63% between different midwifery practices, and that the variation could not be explained by medical factors or client characteristics alone. The authors state that factors related to the midwifery practice are strong contributors to the variation in transfer rates.

Transfers should not be regarded as an adverse outcome, and are not necessarily indicators of quality of care. High rates of transfer may be for non-medical reasons such as traffic or weather conditions. It is difficult to assess what transfer rate provides the best outcomes of care. A very high transfer rate, however, may lead to unnecessary interventions and also lower patient satisfaction. A Dutch study investigating maternal sense of control found that women transferred from midwife-led care at home to obstetric-led care in hospital reported lower feelings of control during labor than those who were not transferred (15).

In this study, the most common reason for transfers was slow labor progress (52.8% of all transfers and 4.7% of the study population). Slow progress and failure to progress are not clearly defined and may vary between individual midwives and regions. This is slightly lower than the figure reported in a recent systematic review. (1).

We found that the proportion of potentially urgent transfers was 3.8% (116/3068). Previous studies have reported figures from 0% to 5.4% (1, 9, 14, 16). The definitions of an urgent transfer varied across these studies, making them difficult to compare.

Median transport time was 20 minutes for non-urgent and 15 minutes for potentially urgent transfers. We do not have data for how long it took to arrange the transfer, therefore we do not know the overall time from decision to arrival at the hospital. In transfers for non-urgent reasons, the time from decision to transfer likely does not influence the outcomes of care, but a long overall transfer time could lead to poorer outcomes in potentially urgent transfers. It is reasonable to estimate about 20 minutes to arrange the transfer (T. Wisborg, Director, Norwegian National Advisory Unit on Trauma, personal communication, March 2015). An English study assessing duration and urgency of transfers in 13,175 home births found median overall transport time for potentially urgent transfers to be 42 minutes (16). The overall transport time is dependent on the distance between the woman's home and the hospital. We did not collect data on distances from home to hospital. According to the home birth midwives, the majority of planned home births in the Nordic countries are in or around the bigger cities, with short distances to the nearest hospital. Our findings support this assumption.

### **Conclusion**

One third of nulliparous and 8.0% of multiparous women were transferred to hospital during labor or within 72 hours of giving birth. Transport from home to hospital commonly took approximately 15–20 minutes. Most transfers (63.7%) were for non-urgent reasons. Women planning a home birth should receive information about the possibility of transfer and about its potential mode and duration.

As the official registration of planned home births is poor, we recommend that public authorities do that systematically. There should be a concise definition of planned home births – the woman had planned, and was accepted for, home birth at the onset of labor. Transfers during labor and after the birth should be registered together with indication for transfer.

### **Acknowledgements**

The authors are grateful to the home birth midwives in Norway, Sweden, Denmark and Iceland who provided the data for the study. Hanne Kjærgaard who passed away in December 2013, participated in initiating the study and in the study design.

## Funding

The study was funded by the Northern Norway Regional Health Authority, the Swedish Council for Working Life and Social Research, the Danish Association of Midwives' Research Fund, Aase and Ejnar Danielsen's Fund, Denmark, and the Icelandic Association of Midwives' Research Fund.

## References

1. Blix E, Kumle M, Kjærgaard H, Øian P, Lindgren HE. Transfer to hospital in planned home births: a systematic review. *BMC Pregnancy Childbirth*. 2014;14:179.
2. Birthplace in England Collaborative G, Brocklehurst P, Hardy P, Hollowell J, Linsell L, Macfarlane A, et al. Perinatal and maternal outcomes by planned place of birth for healthy women with low risk pregnancies: the Birthplace in England national prospective cohort study. *BMJ* 2011;343:d7400.
3. Janssen PA, Saxell L, Page LA, Klein MC, Liston RM, Lee SK. Outcomes of planned home birth with registered midwife versus planned hospital birth with midwife or physician. *CMAJ* 2009;181:377-83.
4. Lindgren HE, Radestad IJ, Christensson K, Hildingsson IM. Outcome of planned home births compared to hospital births in Sweden between 1992 and 2004. A population-based register study. *Acta Obstet Gynecol Scand*. 2008;87:751-9.
5. Johnson KC, Daviss BA. Outcomes of planned home births with certified professional midwives: large prospective study in North America. *BMJ* 2005;330:1416.
6. Blix E, Huitfeldt AS, Øian P, Straume B, Kumle M. Outcomes of planned home births and planned hospital births in low-risk women in Norway between 1990 and 2007: a retrospective cohort study. *Sex Reprod Healthc* 2012;3:147-53.
7. Lindgren H, Kjaergaard H, Olafsdottir OA, Blix E. Praxis and guidelines for planned homebirths in the Nordic countries - an overview. *Sex Reprod Healthc* 2014;5:3-8.
8. Halfdansson B, Smarason AK, Olafsdottir OA, Hildingsson I, Sveinsdottir H. Outcome of Planned Home and Hospital Births among Low-Risk Women in Iceland in 2005-2009: A Retrospective Cohort Study. *Birth*. 2015;42:16-26.
9. Lindgren HE, Hildingsson IM, Christensson K, Rådestad IJ. Transfers in planned home births related to midwife availability and continuity: a nationwide population-based study. *Birth* 2008;35:9-15.
10. Danish Health and Medicines Authority. Fødselsstatistiken 2011 (Birth statistics 2011). Copenhagen: Danish Health and Medicines Authority, 2012.

11. The State Serum Institute. Fødselsstatistik 2012 [Birth statistics 2012]. In Danish. Copenhagen: The State Serum Institute, 2013.
12. Bjarnadóttir RI. Yfirlit yfir fæðingar árið 2013 [Overview of births 2013]. In Icelandic. In: RI Bjarnadóttir, G Garðarsdóttir, AK Smáráson, GI Pálsson (Eds). Skýrsla frá Fæðingaskráningunni fyrir árið 2013 [Report from the birth registry for 2013]. Reykjavík: Landspítali, Kvenna- og barnasvið, 2014.
13. Offerhaus PM, Hukkelhoven CW, de Jonge A, van der Pal-de Bruin KM, Scheepers PL, Lagro-Janssen AL. Persisting rise in referrals during labor in primary midwife-led care in the Netherlands. *Birth* 2013;40:192-201.
14. Offerhaus PM, Geertz C, de Jonge A, Hukkelhoven CWPM, Twisk JWR, Lagro-Janssen ALM. Variation in referrals to secondary obstetrician-led care among primary midwifery care practices in the Netherlands: A nationwide cohort study. *BMC Pregnancy and Childbirth* 2015; 15:42.
15. Geerts CC, Klomp T, Lagro-Janssen AL, Twisk JW, van Dillen J, de Jonge A. Birth setting, transfer and maternal sense of control: results from the DELIVER study. *BMC Pregnancy Childbirth* 2014;14:27.
16. Rowe RE, Townend J, Brocklehurst P, Knight M, Macfarlane A, McCourt C, et al. Duration and urgency of transfer in births planned at home and in freestanding midwifery units in England: secondary analysis of the birthplace national prospective cohort study. *BMC Pregnancy Childbirth* 2013;13:224.

### **Supporting Information legends**

Table S1. Parity of the study population in each country.

Table S2. Transfer to hospital rates for each country.

Table S3. Indications for hospital transfer in 116 cases of potentially urgent transfers.

Table 1. Characteristics of the 3068 women who planned and were approved for home birth.

	Total study population (n=3068)		Nulliparas (n=572)		Multiparas (n=2446)		Parity missing (n=50)	
<i>Country, No. (%)</i>								
Norway	482	(15.7)	90	(15.7)	391	(16.0)	1	(2.0)
Sweden	445	(14.5)	74	(12.9)	370	(15.1)	1	(2.0)
Denmark	1843	(60.1)	340	(59.4)	1455	(59.5)	48	(96.0)
Iceland	298	(9.7)	68	(11.9)	230	(9.4)	0	-
Missing	0	-	0	-	0	-	0	-
<i>Age, No. (%)</i>								
<20	10	(0.3)	6	(1.0)	4	(0.2)	0	-
20-24	201	(6.6)	87	(15.2)	110	(4.5)	4	(8.0)
25-29	767	(25.0)	230	(40.2)	520	(21.2)	17	(34.0)
30-34	1199	(39.1)	185	(32.3)	995	(40.7)	19	(38.0)
35-39	736	(24.0)	53	(9.3)	677	(27.7)	6	(12.0)
>40	138	(4.4)	10	(1.7)	127	(5.2)	1	(2.0)
Missing	17	(0.6)	1	(0.2)	13	(0.5)	3	(6.0)
<i>BMI*, No. (%)</i>								

<18.5	103	(3.4)	25	(4.4)	75	(3.0)	3	(6.0)
18.5-24.9	1994	(65.0)	371	(64.9)	1589	(65.0)	34	(68.0)
25-29.9	535	(17.4)	91	(15.9)	438	(17.9)	6	(12.0)
>30	199	(6.5)	24	(4.1)	173	(7.1)	2	(4.0)
Missing	237	(7.7)	61	(10.7)	171	(7.0)	5	(10.0)
Mean BMI, SD	23.4	3.8	22.9	3.4	23.6	3.9	22.3	3.8
(range)		(15.2-43.4)		(16.2-38.1)		(15.2-43.4)		(17.1-37.3)
Missing								
<i>Civil status, No. (%)</i>								
Married/cohabitant	2992	(97.5)	556	(97.2)	2388	(97.6)	48	(96.0)
Single	48	(1.6)	12	(2.1)	36	(1.5)	0	-
Missing	28	(0.9)	4	(0.7)	22	(0.9)	2	(4.0)
<i>Smokers, No. (%)</i>								
No	2805	(91.4)	518	(90.6)	2244	(91.7)	43	(86.0)
Yes	204	(6.7)	38	(6.6)	163	(6.7)	3	(6.0)
Missing	59	(1.9)	16	(2.8)	39	(1.6)	4	(8.0)
<i>Previous CS, No. (%)</i>								
No	2923	(95.3)	-	-	2301	(94.1)	50	(100)
Yes	144	(4.7)	-	-	144	(5.9)	0	-
Missing	1	(0.0)	-	-	1	(0.0)	0	-

*Gestational age*

<37 weeks	8	(0.3)	3	(0.5)	5	(0.2)	0	-
>37-42 weeks	2956	(96.3)	541	(94.6)	2371	(96.9)	44	(88.0)
>42 weeks	22	(0.7)	8	(1.4)	14	(0.6)	0	-
Missing	82	(2.7)	20	(3.5)	56	(2.3)	6	(12.0)

*Fetal presentation, No. (%)*

Occipito-anterior	2887	(94.1)	516	(90.2)	2330	(95.3)	41	(82.0)
Abnormal cephalic**	126	(4.1)	38	(6.6)	81	(3.3)	7	(14.0)
Breech	7	(0.2)	2	(0.3)	5	(0.2)	0	-
Missing	48	(1.6)	16	(1.9)	30	(1.2)	2	(4.0)
<i>Birth weight, grams, mean (SD)</i>	3687	(459)	3552	438	3718	457	3672	505
<i>(range)</i>		(2070-6380)		(2210-5520)		(2070-6380)		(2940-5200)
Missing, No. (%)	85	(2.8)	23	(4.0)	78	(3.2)	4	(8.0)

\* Pre-pregnancy weight or weight measured at first consultation < 12 week gestational age.

\*\*Includes occipito-posterior presentations, face and brow presentations and unspecified abnormal cephalic presentations.

BMI, body mass index; CS, cesarean section.

Table 2. Transfers to hospital during labor and within 72 hours after the birth.

	Total study population (n=3068)		Nulliparas (n=572)		Multiparas (n=2446)		Parity missing (n=50)	
<i>All transfers (during labor and after birth), No. (%)</i>	402/3068	(13.1)	186/572	(32.5)	195/2446	(8.0)	21/50	(42.0)
<i>Transfers during labor, No. (%)</i>	271/3068	(8.8)	137/572	(24.0)	118/2446	(4.8)	16/50	(32.0)
Indications:								
Slow progress of labor	143/271	(52.8)	83/137	(60.6)	50/118	(42.4)	10/16	(62.4)
Need for medical pain relief	33/271	(12.2)	10/137	(7.3)	19/118	(16.1)	4/16	(25.0)
Suspected/manifest fetal distress	33/271	(12.2)	16/137	(11.7)	16/118	(13.6)	1/16	(6.3)
Midwife not available/not able to reach the woman's home in time	5/271	(1.8)	3/137	(2.2)	2/118	(1.7)	0/16	
Woman changed her mind (during labor)	3/271	(1.1)	1/137	(0.7)	2/118	(1.7)	0/16	
Abnormal cephalic/breech presentation	6/271	(2.2)	3/137	(2.2)	3/118	(2.5)	0/16	
Other reasons <sup>1</sup>	28/271	(10.3)	12/137	(8.7)	16/118	(13.6)	0/16	
Indication missing	20/271	(7.4)	9/137	(6.6)	10/118	(8.4)	1/16	(6.3)
<i>Time from transport started to birth, in women transferred during labor</i>								
<1 hour	24/271	(8.9)	9/137	(6.6)	11/118	(9.3)	4/16	(25.0)
>1-3 hours	77/271	(28.4)	35/137	(25.5)	40/118	(33.9)	2/16	(12.5)



>3-6 hours	58/271	(21.4)	30/137	(21.9)	26/118	(22.0)	2/16	(12.5)
>6 hours	63/271	(23.2)	42/137	(30.7)	16/118	(13.6)	5/16	(31.3)
Missing	49/271	(18.1)	21/137	(15.3)	25/118	(21.2)	3/16	(18.7)
Median time in minutes (range)	212	(20-1440)	270	(20-1440)	165	(20-1080)	190	(43-720)
<i>Transfers after the birth, No. (%)</i>	131/3068	(4.3)	49/572	(8.6)	77/2446	(3.2)	5/50	(10.0)
Maternal indications	(n=96*)		(n=37*)		(n=55*)		(n=4)	
PPH	36/96	(37.5)	13/37	(35.2)	23/55	(41.8)	0/4	
Retained placenta	17/96	(17.7)	5/37	(13.5)	12/55	(21.8)	0/4	
Tear to be sutured/assessed by consultant	34/96	(35.4)	16/37	(43.2)	15/55	(27.3)	3/4	(75.0)
Other indications <sup>2</sup>	5/96	(5.2)	2/37	(5.4)	2/55	(3.6)	1/4	(25.0)
Indication missing	4/96	(4.2)	1/37	(2.7)	3/55	(5.5)	0/4	
Neonatal indications, No. (%)	(n=38*)		(n=14*)		(n=23*)		(n=1)	
Respiratory problems/low Apgar score	23/38	(60.5)	9/14	(64.3)	12/23	(52.2)	1/1	(100)
Malformation	2/38	(5.3)	0/14		2/23	(8.7)	0/1	
Suspected infection	1/38	(2.6)	0/14		1/23	(4.3)	0/1	
Jaundice	3/38	(7.9)	1/14	(7.1)	2/23	(13.0)	0/1	
Other indications <sup>3</sup>	8/38	(21.0)	4/14	(28.6)	4/23	(17.4)	0/1	
Indication missing	1/38	(2.6)	0/14		1/23	(4.3)	0/1	
<i>Time from birth to start of transfer to hospital in women and infants transferred after the birth, No. (%)</i>								
<1 hour	36/131	(27.5)	12/49	(24.5)	24/77	(31.2)	0/5	

>1-6 hours	52/131	(39.7)	20/49	(40.8)	28/77	(36.4)	4/5	(80.0)
>6-24 hours	2/131	(1.5)	1/49	(2.0)	1/77	(1.3)	0/5	
>24-72 hours	4/131	(3.1)	1/49	(2.0)	3/77	(3.9)	0/5	
Missing	37/131	(28.2)	15/49	(30.6)	21/77	(27.2)	1/5	(20.0)
Median time in minutes (range)	105	(8-2880)	115	(8-2880)	80	(10-2880)	162	(120-240)
<i>Urgency of transfer</i>								
Non-urgent transfer	256/402	(63.7)	127/186	(68.3)	116/195	(59.5)	13/21	(61.9)
Potentially urgent transfer*	116/402	(28.9)	48/186	(25.8)	61/195	(31.3)	7/21	(33.3)
Missing	30/402	(7.5)	11/186	(5.9)	18/195	(9.2)	1/21	(4.8)
<i>Vehicle used for transport, in non-urgent transfers No. (%)</i>								
Private car	126/256	(49.2)	70/127	(55.1)	52/116	(44.8)	4/13	(30.8)
Taxi	14/256	(5.5)	4/127	(3.2)	9/116	(7.8)	1/13	(7.7)
Ambulance car	99/256	(38.6)	52/127	(40.9)	39/116	(33.6)	8/13	(61.5)
Ambulance helicopter	1/256	(0.4)	0/127	-	1/116	(0.9)	0/13	-
Other	1/256	(0.4)	1/127	(0.8)	0/116	-	0/13	-
Missing	15/256	(5.9)	0/127	-	15/116	(12.9)	0/13	-
<i>Duration transport, in non-urgent transfers, No. (%)</i>								
< 30 minutes	175/256	(68.4)	93/127	(73.2)	72/116	(62.1)	10/13	(76.9)
31-60 minutes	29/256	(11.3)	14/127	(11.0)	15/116	(12.9)	0/13	-
>60 minutes	2/256	(0.8)	2/127	(1.6)	0/116	-	0/13	-

Missing	50/256	(19.5)	18/127	(14.2)	29/116	(25.0)	3/13	(23.1)
Median time in minutes (range)	20	(3-95)	15	(3-95)	20	(3-60)	20	(10-30)
<i>Vehicle used for transport, in potentially urgent transfers No. (%)</i>								
Private car	18/116	(15.5)	10/48	(20.8)	8/61	(13.1)	7/7	(100)
Taxi	3/116	(2.6)	2/48	(4.2)	1/61	(1.6)	0/7	-
Ambulance car	91/116	(78.4)	35/48	(79.2)	49/61	(80.3)	0/7	-
Ambulance helicopter	1/116	(0.9)	0/48	-	1/61	(1.6)	0/7	-
Missing	3/116	(2.6)	1/48	(2.1)	2/61	(3.3)	0/7	-
<i>Duration transport, in potentially urgent transfers, No. (%)</i>								
< 30 minutes	99/116	(85.3)	41/48	(85.4)	51/61	(83.6)	7/7	(100)
31-60 minutes	4/116	(3.4)	1/48	(10.5)	3/61	(4.9)	0/7	-
>60 minutes	0/116	-	0/19	-	0/61	-	0/7	-
Missing	13/116	(11.2)	6/48	(12.5)	7/61	(11.5)	0/7	-
Median time in minutes (range)	15	(5-45)	15	(5-45)	15	(5-45)	15	(10-30)

<sup>1</sup>Other indications: 5 not described; 4 elevated blood pressure; 2 fever; 1 irregular fetal heart rate ; 8 prelabor rupture of membranes; 1 low blood sugar; 1 mother unconscious; 1 exhausted mother; 1 suspected risk for uterine rupture; 1 suspected placental abruption; 3 vaginal bleedings

<sup>2</sup>Other indications: 2 infections/maternal fever; 1 low blood pressure; 1 mother dizzy/unwell; 1 breast feeding problems.

<sup>3</sup>Other indications: 1 umbilical cord rupture and bleeding, 1 for observation after clavicle fracture following shoulder dystocia, 2 low birthweight, 1 to be assessed by a pediatrician after vacuum extraction for fetal distress at home, 1 bleeding because of vasa previa, 1 meconium aspiration, 1 transferred 4 hours after the birth because the parents felt unsafe.

\*In 3 cases, both mother and infant were transferred, resulting in 3 more indications than transfers as the denominator is number of deliveries.

PPH, post-partum hemorrhage.