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Research article

Discharge time after birth is associated with parity – A retrospective cohort study

Victoria Lindblad [a], Kristian Hay Kragholm [b], Anya Eidhammer [a], Dorte Melgaard [c,d,*]

[a] Department of Gynecology and Obstetrics, North Denmark Regional Hospital, Bispensgade 37, 9800, Hjoerring, Denmark
[b] Unit of Clinical Biostatistics and Epidemiology, Department of Cardiology, Aalborg University Hospital, Hobrovej 18-22, 9000, Aalborg, Denmark
[c] Centre for Clinical Research, North Denmark Regional Hospital, Bispensgade 37, 9800, Hjoerring, Denmark
[d] Department of Clinical Medicine, Aalborg University, Søndre Skovvej 15, 9000, Aalborg, Denmark

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ABSTRACT

Background: All healthy mothers with uncomplicated births are recommended to be discharged directly from the labour ward a few hours after birth as a change in practice in three hospitals in Denmark. However, despite this practice, there is limited knowledge about when mothers leave the hospital after birth in clinical practice.
Objective: The aim of this study is to examine 1) when mothers are discharged from hospital after birth, 2) if discharge time from the hospital after birth is associated with parity, and 3) which factors are associated with discharge time.
Methods: This retrospective study is based on data from the North Denmark Regional Hospital and included mothers giving vaginal birth from March 25, 2019 to April 10, 2021.
Results: A total of 1990 mothers were included. Nearly 50% of the new mothers stayed at the hospital less than 6 h after birth (26% of primiparous women vs 64% of multiparous women). Primiparous women had an adjusted RR 0.44 (95% CI 0.39–0.49) for discharge ≤6 h, RR 1.71 (95% CI 1.15–2.54) for discharge >6–12 h, and RR 3.76 (95% CI 3.03–4.67) for discharge >48 h after birth compared to multiparous women. Multiparous women's adjusted RR for discharge >6–12 h was 0.15 (95% CI 0.12–0.20) and for discharge >48 h 0.16 (95% CI 0.14–0.20) compared to discharge less than 6 h after birth. Furthermore, smoking, low education level, and younger age were associated with early discharge.
Conclusion: There is a significant association with parity and discharge time after birth and factors related to discharge time which healthcare professionals should be aware of when planning inpatient and outpatient care. In addition, healthcare professionals should be aware of mothers discharged early who are smoking, of younger age, lower education level or multiparity.

1. Introduction

The tendency is that the hospital stay after a birth shortens, and discharge 6 h after birth was reported already in 1987 in the United States of America [1,2]. Arguments for reducing the length of hospital stay after birth are health care costs [1,3–5] and reducing the

* Corresponding author. Centre for Clinical Research, North Denmark Regional Hospital, Bispensgade 37, 9800, Hjoerring, Denmark.
E-mail addresses: vpln76@outlook.dk (V. Lindblad), kdks@rn.dk (K.H. Kragholm), a.eidhammer@rn.dk (A. Eidhammer), dmk@rn.dk (D. Melgaard).

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risk of nosocomial infections [6,7]. In 2017 and 2021, two systematic reviews could not conclude the impact of early discharge on the outcome for mothers and newborns because of low evidence [4,5]. National guidelines have common denominators of postpartum discharge criteria, among others, that the mother has normal blood pressure, controlled vaginal bleeding, and spontaneous urination after birth [8–10]. Furthermore, the mother and newborn must not have any signs or risk factors for infection before discharge [8–10]. Lastly, healthcare professionals should evaluate if the baby is suckling correctly before discharge to ensure adequate feeding [8,10]. Some national guidelines recommend that healthcare professionals consider the parent's readiness for discharge after birth [8,10,11]. The mother's readiness for discharge depends on the mother's feelings of physical capability, knowledge about and confidence in their ability to care for themselves and their newborn, the number of children at home, and the available support from families and healthcare professionals [12,13]. Despite some similarities in the recommended criteria for discharge after birth, a study showed that discharge time after vaginal delivery in 71 countries varied from 0.5 days to 6.2 days from 2005 to 2012 [14]. To our knowledge, no literature reports on the optimal time for discharge or whether discharge time should be differentiated according to parity. Since 2018, three maternity wards in Denmark have recommended the discharge of primiparous women directly from the labour ward a few hours after birth, as multiparous women had been for years. The change from inpatient to outpatient postpartum care in clinical practice in Denmark led to a need to know when mothers are deemed ready for discharge after birth to be able to allocate sufficient resources and develop postpartum care policies. A Danish study examining the characteristics of mothers discharged early found that 9% of primiparous women and 52% of multiparous women were discharged within 12 h in 2013 and 2014 and that the primiparous women had an odds ratio 0.22 (CI 0.17–0.29) for early discharge compared to multiparous women [15]. In the study, the maternity wards differ in the recommendation for discharge time after birth, making it difficult to generalize the results to maternity wards that recommend discharge a few hours after birth. The study from Denmark found that predictors for early discharge among all new mothers were no epidural anaesthesia during labour, no induction of labour, vaginal bleeding below 500 ml, higher gestational age, early expected discharge and a positive breastfeeding experience [15]. However, the predictors were not stratified according to primiparous and multiparous women, thus leaving us with a lack of knowledge of whether the predictors differ between primiparous and multiparous, which might affect the planning of inpatient and outpatient postpartum care. The two systematic reviews examining the outcome of early discharge after birth from 2017 to 2021 did not include any studies that recommended early discharge from the hospital a few hours after birth. Furthermore, a scoping review of early discharge of first-time parents, included one study where the mothers were discharged six to 8 h after birth as a short-stay program [16]. The study examined the mothers' information priorities and did not report how many mothers were discharged early after birth [17]. Thus, to the authors' knowledge, the present study is unique because it was conducted in a setting where the recommendation was to discharge all healthy mothers with uncomplicated birth and a healthy newborn directly from the labour ward a few hours after birth.

The hypothesis in this study is that primiparous women are discharged later than multiparous women, and there is an association between parity and time for discharge. Thus, this study aimed to examine 1) when mothers were discharged after birth, 2) if discharge

Table 1
The labour ward's criteria and contraindications for discharge directly from the labour ward.

Criteria - mother	Criteria - newborn
P.p. bleeding ≤500 ml and unaffected mother	APGAR[a] ≥ 9 in 5 min p.p.
Spontaneous urination	Gestation age ≥37 + 0 (weeks + days)
No language difficulties	Birth weight >2500 g
If epidural anaesthesia during birth - observation 4 h p.p.	Observation of the newborn suckling and swallowing correctly
Contraindications - mother	**Contraindications - newborn**
Caesarean section	Risk of hypoglycaemia[b]
Pre-eclampsia[c]	Mother in anti-depressive medical treatment
Hypertension, blood pressure >140/90	Risk of infection, including PROM and maternal fever, >38.0 C∘ (>38.2 C∘ if the mother had epidural anaesthesia during birth)
4th-degree perineal tear	
Medical conditions assessed by a physician during pregnancy	
Thyrotoxicosis	
Gemelli	
Multipara with previous breastfeeding complications	
Breast operated mothers with a desire to breastfeed	
Vulnerable families	
Risk of neglect of the newborn	
Circumstances that require individual assessment by a physician before discharge	
Instrumental-assisted birth	
3rd-degree perineal tear	
Prophylactic anticoagulation treatment	

Abbreviations: p.p. = postpartum; g = grams; ml = millilitres; PROM = prelabour rupture of membranes (≥18 h from rupture of membranes to birth).

[a] APGAR = score to evaluate the neonatal. Assessed in one-, five-, and 10-min p.p. Ten points are top score. Up to two-point are given according to Appearance (colour), Pulse, Grimace (irritability), Activity, and Respiration.

[b] Risk factors for neonatal hypoglycaemia: Large for gestational age (=birth weight > +22%), small for gestation age (= birth weight < −15%), dysmaturity, sepsis, asphyxia, maternal insulin-dependent diabetes, apnoea, cramps.

[c] Pre-eclampsia: Blood pressure >140/90 and proteinuria >0,3 g/24 h albumin/creatinine. Alternatively, blood pressure >140/90 and one or more of the following: thrombocytopenia, renal insufficiency, ALAT< 70 U/L, cerebral/visual symptoms.

time is associated with parity, and 3) which factors were associated with discharge time after birth and how the factors affect the discharge time after birth.

2. Methods

This paper follows the "Strengthening The Reporting of Observational Studies in Epidemiology" (STROBE) statement [18].

2.1. Design and settings

The present study was a retrospective cohort study among mothers giving birth in The North Denmark Regional Hospital, Hjoerring, Denmark, with approximately 1400 births annually from gestation 32 + 0 weeks. All mothers have free and equal access to health care in Denmark during pregnancy, birth, and after birth. The maternity ward recommended discharge directly from the labour ward a few hours after birth for all healthy mothers with an uncomplicated vaginal birth and a healthy newborn. The recommended criteria and contraindications for discharge directly from the labour ward a few hours after birth are described in Table 1.

All mothers received verbal and written information before discharge about being aware of vaginal bleeding, fever, signs of neonatal jaundice, amount of neonatal urination and departure of faeces, and breastfeeding within the first week after birth. After early discharge, the follow-up strategy for primiparous women was an offer of a home visit by a midwife around 24 h after birth. The home visit included an evaluation of the mother's vaginal bleeding and overall well-being. Furthermore, the home visit also included an evaluation of neonatal jaundice, feeding pattern, neonatal urination, and departure of faeces. After early discharge, the follow-up strategy for multiparous women was an offer of a phone call by a midwife around 24 h after birth that included an evaluation of all the subjects mentioned above. All mothers had an appointment for neonatal biochemical screening, with a 30-min consultation by a midwife 48–72 h after birth. In addition, primiparous women also received a 30-min consultation with a nurse on the day of the appointment for neonatal biochemical screening. All mothers were offered a home visit by a nurse specialised in caring for the newborn on the fourth- or fifth day after birth. The healthcare professionals at the hospital were available by phone within the first seven days after discharge.

2.2. Participants

The study population included all mothers with planned vaginal birth of a live foetus from the new recommendation on March 25, 2019 to April 10, 2021. Exclusion criteria were caesarean sectio, severe pre-eclampsia, insulin-dependent diabetes, homebirth, Gemelli, gestation age less than 37 weeks, and birthweight under 2500 g. In addition, mothers with missing neonatal birth weight and gestational age data were excluded.

2.3. Variables

Data on the following variables were collected:

- parity
- socio-demographic factors (age, living alone, education)
- maternal health factors (Body Mass Index (BMI), smoking, gestational diabetes, minor pre-eclampsia)
- birth-related factors (induction of birth, oxytocin augmentation, meconium-stained amniotic fluid, epidural anaesthesia, fever, breech presentation, shoulder dystocia, instrumental-assisted birth, amount of bleeding postpartum, perineal tear third- and fourth-degree, length of birth)
- neonatal factors (gestational age, birth weight, neonatal suction, pH-value of umbilical artery blood, neonatal transfer to Neonatal Intensive Care Unit (NICU))
- postpartum factors (length of hospital stay after birth and expected discharge within 6 h but discharged later).

The number and percentages of socio-demographic-, maternal health-, birth-related-, and neonatal factors of mothers discharged ≤6, >6–12, >12–24, >24–48, >48 after birth, calculated separately for primiparous and multiparous women are presented in the supplementary material (see Table s1 online).

Induction of birth included birth induced by prostaglandin, oxytocin, rupture of membranes, and balloon catheter. Furthermore, epidural anaesthesia included spinal anaesthesia, and instrumental-assisted births included vacuum or forceps-assisted births. We chose to examine mothers discharged within ≤6, >6–12, >12–24, >24–48, and >48 h after birth to compare the results in our study with the results in other studies.

2.4. Data sources

Data were retrieved from the local Department of Data Management. The data were coded in the software IBM® computer system Application System/400, 1988, as routine by midwives and secretaries during labour and immediately after birth. Birth length was calculated from regular contractions and the beginning of cervical dilatation to birth. A unique identification number was applied to the individual birth to exclude mothers that gave birth more than once in the study period. We did not retrieve data on mothers

diagnosed with severe pre-eclampsia or eclampsia.

2.5. Statistical methods

Categorical data were presented as counts and percentages. Accordingly, Pearson's χ^2 was performed to report crude differences between parity groups. There was no competing risk to discharge (e.g., no mothers died during pregnancy, at birth or before discharge from the hospital after birth); therefore, Kaplan-Meier estimates were calculated using crude data to visualise the difference between discharge time in parity groups. In addition, we performed a log-rank test of the equality of the two parity curves. We estimated the crude and adjusted relative risk (RR) and the 95% confidence interval (95% CI) with a binomial logistic regression to examine the association between discharge time after birth and parity. Finally, in table four, we used binomial logistic regression to calculate the relative risk of being discharged later than 6 h after birth according to the mothers' characteristics and factors related to the mother and newborn. The outcome was discharging time in categories of >6–12, >12–24, >24–48, and <48 h after birth, with reference to discharge within 6 h after birth. The exposure was socio-demographic-, maternal health-, birth-related-, and neonatal factors that were not contraindications for discharge within 6 h after birth. The relative risk was calculated according to the risk of being discharged later than 6 h in each discharge time category if the mothers were exposed to one of the factors compared to either not exposed or a control reference. The group with the most participants was chosen as a control reference. This study is a register-based study that included all mothers that met the inclusion criteria in the study period. The calculated confidence level (power) with a confidence interval (CI) of 95% and a sample size of 1990 participants in this study was 99%. Missing data were reported in the tables and coded as zero. Sensitivity analyses of the worst-case scenario were performed regarding the newborn's pH value (see Supplementary material Table s2 online). Data were analyzed using STATA/MP® version 16.1 [19]. P-values <0.05 were considered statistically significant in all analyses.

3. Ethical approval

According to Danish legislation, the registration and publication of data from clinical registries do not require patient consent or approval by ethics committees. The study was registered by the Danish Data Protection Authority (2020–113).

4. Results

We retrieved data from 2543 births, and 1990 mothers were included in this study (Fig. 1). The number of mothers discharged within 6 h after birth slightly increased throughout the study period. The tendency was similar for primiparous and multiparous women (Supplementary online material Figure s1).

The parity groups in this study differed significantly regarding age, the number of mothers smoking, and minor pre-eclampsia (see Table 2). Significantly more primiparous women experienced birth-related complications, and neonates needed assistance after birth. The average birth length was nearly 6 h longer for primiparous women than for multiparous women. Of the women deemed healthy enough in pregnancy to be discharged within 6 h after birth, over double as many primiparous women were discharged after 6 h compared to multiparous women. 26% of primiparous women and 65% of multiparous women were discharged within 6 h after birth. Most primiparous women were discharged later than 24 h after birth (54.0%).

Primiparous women were consistently discharged later than multiparous women when not adjusting for factors that might influence the time for discharge (see Fig. 2). There was a significant association between discharge time and parity (see Table 3). The estimated relative risk showed that primiparous women were 56% less likely to be discharged within 6 h after birth than multiparous women after adjusting for all factors that may require a more extended hospital stay after birth. In addition, primiparous women were 71% more likely to be discharged between six to 12 h after birth than multiparous women. The only timespan where the mothers' parity did not make a difference was discharging between 12 and 24 h after birth. Finally, primiparous women were 276% more likely to stay at the hospital 48 h after birth than multiparous women in the adjusted analysis. In the stratified analysis, primiparity was associated with discharge later than 6 h after birth. Multiparity was associated with discharge 6 h after birth regardless of adjustment

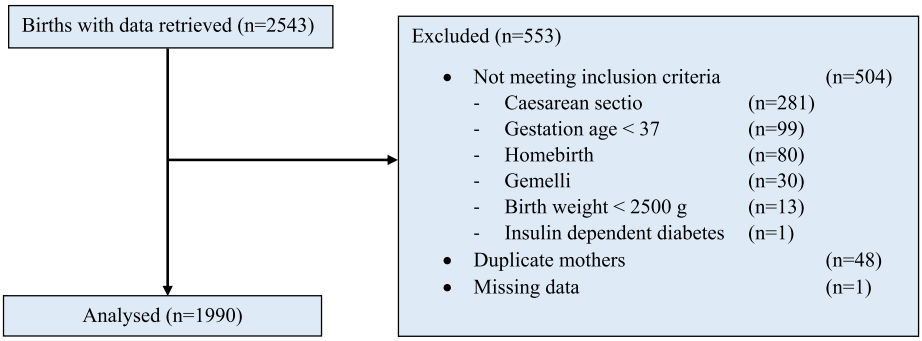

Fig. 1. Flow diagram participants.

Table 2
Baseline characteristics of mothers and newborns according to primiparous and multiparous women.

	Total n (%)[b]	Primiparas n (%)[b]	Multiparas n (%)[b]	*p*-value[a]
Total[c]	1990 (100.0)	850 (42.7)	1140 (57.3)	
Parity				
2			777 (39.1)	
3			281 (14.1)	
4			56 (2.8)	
5			19 (0.9)	
6			6 (0.3)	
7			1 (0.1)	
Socio-demographic factors				
Age (years)				
17 - 25	272 (13.4)	206 (24.2)	64 (5.6)	<0.001
25 -35	1497 (73.4)	589(69.3)	873 (76.6)	<0.001
35 - 44	269 (13.2)	55 (6.5)	203 (17.8)	<0.001
Living alone	91 (4.6)	46 (5.4)	45 (4.0)	≥0.05
Education[d]				≥0.05
None	439 (22.1)	193 (22.8)	246 (21.6)	
Skilled worker	384 (19.3)	162 (19.1)	222 (19.5)	
Short	270 (13.6)	107 (12.6)	163 (14.3)	
Medium	743 (37.4)	317 (37.4)	426 (37.4)	
Long	152 (7.7)	69 (8.1)	83 (7.3)	
Maternal health factors				
Body Mass Index (BMI)				
15.8–18.49	69 (3.5)	31 (3.7)	38 (3.3)	≥0.05
18.5–24.99	1007 (50.6)	443 (52.1)	564 (49.5)	≥0.05
25.0–29.99	516 (25.9)	208 (24.5)	308 (27.0)	≥0.05
30.0–34.99	247 (12.4)	103 (12.1)	144 (12.6)	≥0.05
35.0–54.99	151 (7.6)	65 (7.7)	86 (7.5)	≥0.05
Smoking in pregnancy	228 (11.5)	118 (13.9)	110 (9.7)	<0.05
Gestational diabetes	73 (3.7)	30 (3.5)	43 (3.8)	≥0.05
Minor pre-eclampsia[a]	42 (2.1)	35 (4.1)	7 (0.6)	<0.001
Birth-related factors				
Induction of birth	526 (26.4)	224 (26.4)	302 (26.5)	≥0.05
Oxytocin augmentation	343 (17.2)	242 (28.5)	101 (8.9)	<0.001
Meconium-stained amniotic fluid	60 (3.0)	24 (2.8)	36 (3.2)	≥0.05
Epidural anaesthesia	378 (19.0)	254 (29.9)	124 (10.9)	<0.001
Fever[c]	69 (3.5)	54 (6.4)	15 (1.3)	<0.001
Breech presentation	10 (0.5)	4 (0.5)	6 (0.5)	≥0.05
Shoulder dystocia	29 (1.5)	4 (0.5)	25 (2.2)	<0.05
Instrumental assisted birth	149 (7.3)	116 (13.6)	33 (2.8)	<0.001
Amount of bleeding (millilitre)[c,f]	1968 (100.0)	840 (42.7)	1128 (57.3)	
≤ 500	1685 (85.6)	690 (82.1)	995 (88.2)	<0.05
501 - ≤ 1000	181 (9.2)	92 (11.0)	89 (7.9)	<0.05
>1000	102 (5.2)	58 (6.9)	44 (3.9)	<0.05
Perineal tear 3rd-degree	44 (2.2)	37 (4.4)	7 (0.6)	<0.001
Perineal tear 4th-degree	7 (0.4)	5 (0.6)	2 (0.2)	≥0.05
Length of birth (hours)				
0 - 12	1617 (81.3)	552 (64.9)	1065 (93.4)	<0.001
13 - 24	307 (15.4)	247 (29.1)	60 (5.3)	<0.001
25 - 53	66 (3.3)	51 (6.0)	15 (1.3)	<0.001
Neonatal factors				
Gestational age (weeks + days)				
≥ 37 + 0 - ≤ 39 + 6	644 (32.4)	294 (34.6)	350 (30.7)	<0.001
≥ 40 + 0 - ≤ 41 + 6	1289 (64.8)	516 (60.7)	773 (67.8)	<0.001
≥ 42 + 0 - ≤ 42 + 6	57 (2.9)	40 (4.7)	17 (1.5)	<0.001
Birthweight (grams)				
2500 - 3999	1558 (78.3)	708 (83.3)	850 (74.6)	<0.001
≥ 4000 - 4499	352 (17.7)	120 (14.1)	232 (20.4)	<0.001
≥ 4500	80 (4.0)	22 (2.6)	58 (5.1)	<0.001
Neonatal suction	145 (7.3)	90 (10.6)	55 (4.8)	<0.001
Umbilical artery blood pH-value[c,f]	1435 (100.0)	626 (43.6)	809 (56.4)	
≥7.00 - < 7.10	81 (5.6)	49 (7.8)	32 (4.0)	<0.05
<7.00	16 (1.1)	9 (1.4)	7 (0.9)	<0.05
Neonatal transfer to NICU	46 (2.3)	26 (3.1)	20 (1.8)	<0.05
Postpartum factors				
Length of hospital stay after birth (hours)				
≤ 6	963 (49.4)	224 (26.3)	739 (64.8)	<0.001
7 - 12	114 (5.7)	61 (7.2)	53 (4.7)	<0.001
13 - 24	240 (12.1)	106 (12.5)	134 (11.8)	<0.001

(*continued on next page*)

Table 2 (*continued*)

	Total n (%)[b]	Primiparas n (%)[b]	Multiparas n (%)[b]	*p*-value[a]
25 - 48	249 (12.5)	137 (16.1)	112 (9.8)	<0.001
>48	424 (21.3)	322 (37.9)	102 (8.9)	<0.001
Expected discharge ≤6 h, but discharged later	657 (32.2)	394 (64.6)	263 (26.0)	<0.001

Abbreviations: SD = standard deviation; NICU=Neonatal Intensive Care Unit.
[e] Fever >38.0 C∘ or > 38.2 C∘ if the mother had epidural anaesthesia or spinal anaesthesia.
[a] p-value <0.05 statistically significant. Pearson's chi-squared test.
[b] Column.
[c] Row.
[d] Education = academic qualification. Skilled worker = special skill, training, or knowledge, short = 1–2 years, medium = 3–4 years, long≥5 years[d] Minor pre-eclampsia: blood pressure ≥140/90 - <160/110, urine albumin/creatinine >0.3 g over 24 h.
[f] Missing values n (%): bleeding 22 (1.1); Umbilical artery blood pH-value 555 (27.9).

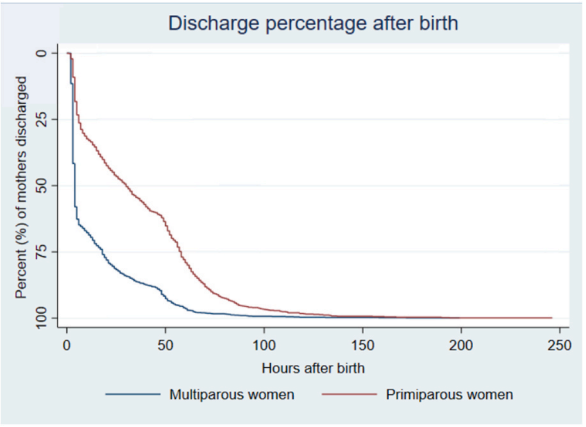

Fig. 2. The time-to-event curve illustrates the percentage of mothers discharged from the hospital in the hours after birth, estimated separately regarding parity (log-rank test <0.001).

for factors that might influence discharge time. The analysis estimated that multiparous women had 84% less likelihood to be discharged >48 h after birth. Adjusting for confounding factors did not change the relative risk much for multiparous women to be discharged >48 h after birth compared with the crude analysis.

Mothers with a body mass index between 25 and 35 were more likely to return home 6 h after birth than stay at the hospital more than 24 h after birth than mothers with a BMI in the normal range (BMI 18.5–25) (see Table 4). Mothers with a long education were more likely to leave the hospital within 6 h after birth than mothers with an education of medium length for primiparous women. However, the analysis also found that primiparous women with a low level of education were associated with early discharge compared to primiparous women with a medium-length education. For primiparous women, smoking was associated with returning home from the hospital less than 6 h after birth. The analysis showed that neonatal factors related to discharge time towards early discharge were mothers with neonatal birthweight between 4000 g and 4500 g compared to mothers with a newborn birthweight between 2500 g and 4000 g. Furthermore, primiparous women giving birth at a gestational age between 37 and 39 weeks compared to primiparous women giving birth at a gestational age between 40 and 42 weeks were discharged early. Primiparous women who experienced instrumental assisted birth or had a 3rd-degree perineal tear or gave birth at a gestation age over 42 weeks compared to those giving birth at a gestational age between 40 and 42 weeks were associated with a hospital stay after birth longer than 48 h. Furthermore, multiparous women who were younger than 25 years compared to between 25 and 35 years, had their labour induced, had a long education compared to a medium length of education, had a length of birth over 25 h compared to a length of birth shorter than 12 h, or a neonate with birthweight above 4000 g compared to a birthweight between 2500 g and 4000 g were associated with early discharge after birth than those staying at the hospital for 24–48 h after birth. Multiparous women with gestational diabetes were associated with discharge later than 6 h after birth. Finally, multiparous women over 35 years compared to between 25 and 35 years, a skilled worker, or experienced a breech presentation at birth was related to discharge later than 48 h after birth compared to discharge 6 h after birth.

5. Discussion

This study will inform healthcare professionals of when mothers are discharged after birth, if there is a difference between first-time mothers and multiple mothers, and what factors impact the discharge time when looking at first-time mothers and multiple mothers. This knowledge will support healthcare providers and decision-makers in allocating resources in the maternity ward and planning

Table 3
Relative risk (RR) and confidence interval (CI) of being discharged ≤6, >6–12, >12–24, >24–48, >48 h after birth when comparing primiparous with multiparous women (reference) and stratified by parity comparing to discharge within 6 h after birth (reference).

Hours after birth	Crude RR	(95% CI)	Adjusted RR[a]	(95% CI)	Adjusted RR[b]	(95% CI)	Adjusted RR[c]	(95% CI)	Adjusted RR[d]	(95% CI)
Primiparous women compared to multiparous women (1.00 reference)										
≤6	0.41	(0.36–0.46)	0.39	(0.34–0.44)	0.39	(0.35–0.45)	0.43	(0.39–0.49)	0.44	(0.39–0.49)
>6 - 12	1.54	(1.08–2.21)	1.63	(1.11–2.39)	1.64	(1.11–2.41)	1.61	(1.06–2.44)	1.71	(1.15–2.54)
>12 - 24	1.06	(0.84–1.35)	1.01	(0.78–1.30)	1.01	(0.78–1.31)	1.08	(0.82–1.44)	0.91	(0.70–1.18)
>24 - 48	2.40	(1.92–3.02)	2.52	(1.98–3.21)	2.49	(1.96–3.17)	2.17	(1.68–2.80)	1.72	–
>48	4.23	(3.45–5.19)	4.39	(3.55–5.43)	4.36	(3.52–5.39)	3.49	(2.80–4.36)	3.76	(3.03–4.67)
Primiparous women compared to discharge ≤ 6 h after birth (1.00 reference)										
>6 - 12	3.20	(2.27–4.50)	3.32	(2.31–4.78)	3.37	(2.34–4.85)	2.92	(2.19–4.30)	2.01	–
>12 - 24	2.09	(1.68–2.61)	2.05	(1.62–2.60)	2.06	(1.63–2.62)	1.97	(1.53–2.53)	1.52	–
>24 - 48	2.88	(2.32–3.58)	2.98	(2.37–3.75)	2.95	(2.35–3.72)	2.55	(2.00–3.25)	2.48	(1.94–3.15)
>48	4.86	(4.00–5.91)	4.96	(4.07–6.06)	5.05	(4.14–6.15)	2.68	–	2.87	–
Multiparous women compared to discharge ≤ 6 h after birth (1.00 reference)										
>6 - 12	0.31	(0.22–0.44)	0.30	(0.21–0.43)	0.30	(0.21–0.43)	0.34	(0.23–0.50)	0.15	(0.12–0.20)
>12 - 24	0.48	(0.38–0.60)	0.49	(0.38–0.62)	0.48	(0.38–0.61)	0.51	(0.40–0.65)	0.27	(0.23–0.31)
>24 - 48	0.35	(0.28–0.43)	0.34	(0.27–0.42)	0.20	(0.15–0.21)	0.20	(0.17–0.24)	0.21	(0.17–0.24)
>48	0.21	(0.17–0.25)	0.13	(0.11–0.16)	0.13	(0.11–0.16)	0.16	(0.13–0.19)	0.16	(0.14–0.20)

[a] Adjusted for socio-demographic factors (age, living alone, education).
[b] Adjusted for socio-demographic factors[a]and maternal health factors (Body Mass Index (BMI), smoking, gestational diabetes, minor pre-eclampsia).
[c] Adjusted for socio-demographic factors[a], maternal health factors[b],and birth-related factors (induction of birth, oxytocin augmentation, meconium-stained fluid, epidural anaesthesia, fever, breech presentation, shoulder dystocia, instrumental-assisted birth, bleeding>500 ml, perineal tear 3rd- and 4th-degree, length of birth).
[d] Adjusted for socio-demographic factors[a], maternal health factors[b],birth-related factors[c],and neonatal factors (gestational age, birth weight, neonatal suction, umbilical artery blood pH < 7.10, neonatal transferred to Neonatal Intensive Care Unit (NICU)).

Table 4
Relative risk (RR) and confidence interval (95% CI) for discharge >6–12, >12–24, >24–48, >48 h after birth compared to discharge within 6 h after birth (1.00 refence) according to socio-demographic-, maternal health-, birth-related-, and neonatal factors that are not contraindications for discharge within 6 h after birth (see Table 1). Estimated separately for primiparous and multiparous women.

Discharge time after birth (hours)	Primiparous women								Multiparous women							
	>6 - 12		>12 - 24		>24 - 48		>48		>6 - 12		>12 - 24		>24 - 48		>48	
	RR[a]	95% CI	RR[a]	95% CI	RR[a]	95% CI	RR[a]	95% CI	RR[a]	95% CI	RR[a]	95% CI	RR[a]	95% CI	RR[a]	95% CI
Socio-demographic factors																
Age (years)																
17 - 25	0.45	(0.28–0.73)	1.78	–	0.61	(0.47–0.80)	0.94	(0.80–1.10)	–	–	1.23	(0.69–2.21)	0.34	(0.16–0.73)	0.13	(0.03–0.50)
25 - 35	1	(reference)	1	(reference)	1	(reference)	1	(reference)	1	(reference)	1	(reference)	1	(reference)	1	(reference)
35 - 44	0.47	(0.20–1.11)	0.41	(0.19–0.85)	0.53	(0.31–0.92)	0.93	(0.71–1.22)	0.86	(0.41–1.79)	1.15	(0.77–1.72)	1.40	(0.94–2.10)	1.27	(1.27–1.27)
Living alone	0.26	(0.04–1.52)	1.14	(0.56–2.31)	1.14	–	0.92	(0.76–1.11)	1.22	(0.30–4.89)	1.74	(0.90–3.35)	0.65	(0.30–1.42)	2.31	–
Education[b]																
None	0.23	(0.11–0.48)	1.00	(0.63–1.57)	0.98	(0.69–1.39)	1.09	(0.90–1.31)	1.36	(0.70–2.63)	0.97	(0.64–1.47)	0.85	(0.51–1.40)	0.67	–
Skilled worker	1.14	–	0.41	(0.26–0.63)	0.49	(0.36–0.69)	0.96	(0.79–1.16)	0.51	(0.20–1.34)	1.00	(0.65–1.53)	1.23	–	1.62	(1.05–2.50)
Short	0.95	(0.47–1.91)	0.77	(0.42–1.38)	0.50	(0.32–0.78)	0.81	(0.69–1.00)	0.71	(0.28–1.80)	1.05	(0.65–1.69)	1.36	–	0.81	–
Medium	1	(reference)	1	(reference)	1	(reference)	1	(reference)	1	(reference)	1	(reference)	1	(reference)	1	(reference)
Long	0.19	(0.05–0.70)	0.53	(0.31–0.90)	0.54	(0.35–0.82)	0.63	(0.47–0.85)	2.10	(0.91–4.86)	0.88	(0.42–1.83)	0.62	(0.36–1.09)	0.53	(0.29–0.95)
Maternal health factors																
Body Mass Index (BMI)																
15.8–18.49	1.00	–	0.53	(0.21–1.31)	1.48	(0.80–2.73)	0.86	(0.66–1.13)	1.97	(0.63–6.19)	1.15	(0.46–2.92)	0.32	(0.11–0.94)	0.26	(0.07–0.97)
18.5–24.99	1	(reference)	1	(reference)	1	(reference)	1	(reference)	1	(reference)	1	(reference)	1	(reference)	1	(reference)
25–29.99	0.53	(0.35–0.80)	0.98	(0.65–1.46)	0.54	(0.40–0.72)	1.17	(0.98–1.39)	0.88	(0.45–1.70)	1.41	(0.99–2.01)	0.30	(0.21–0.44)	0.98	(0.98–0.98)
30–34.99	1.21	(0.60–2.43)	1.02	–	0.64	(0.45–0.91)	0.95	(0.78–1.15)	1.18	(0.55–2.55)	1.21	(0.77–1.90)	0.33	(0.20–0.56)	1.01	(1.01–1.01)
35–54.99	1.45	(0.65–3.24)	0.60	(0.35–1.02)	1.69	(1.09–2.61)	0.82	(0.67–1.01)	1.15	(0.41–3.25)	1.04	(0.56–1.93)	1.02	(0.57–1.81)	1.51	–
Smoking in pregnancy	0.48	(0.29–0.88)	0.51	(0.34–0.78)	0.59	(0.42–0.82)	0.99	(0.99–0.99)	0.45	(0.14–1.45)	0.42	(0.20–0.86)	0.82	(0.46–1.47)	0.92	–
Gestational diabetes	0.31	(0.50–1.93)	0.50	(0.19–1.28)	0.74	(0.38–1.42)	0.83	(0.62–1.10)	3.55	(1.32–9.52)	2.02	(1.05–3.87)	3.00	(1.58–5.69)	1.37	–
Birth-related factors																
Induction of birth	1.10	–	1.20	–	1.06	–	1.07	(0.95–1.22)	0.84	(0.37–1.89)	1.20	(0.81–1.79)	0.39	(0.25–0.61)	1.01	–
Oxytocin augmentation	0.34	(0.20–0.57)	1.22	(0.80–1.86)	1.13	–	1.01	(0.88–1.17)	0.29	(0.07–1.18)	0.96	(0.59–1.54)	1.03	–	1.05	–
Meconium-stained amniotic fluid	0.75	(0.26–2.15)	0.91	(0.49–1.69)	0.48	(0.17–1.42)	1.08	(0.79–1.48)	0.60	(0.09–4.08)	1.07	–	1.37	(0.70–2.69)	0.63	(0.33–1.22)
Epidural anaesthesia	1.14	–	0.59	(0.44–0.80)	1.05	–	1.04	(0.89–1.20)	0.26	(0.06–1.04)	1.02	(1.02–1.02)	1.12	–	1.24	–
Breech presentation	1.43	(0.36–5.70)	1.00	–	1.00	–	1.12	(0.50–2.51)	–	–	5.95	(2.07–17.11)	–	–	2.92	(1.12–7.60)
Shoulder dystocia	–	–	–	–	–	–	–	–	1.59	(0.43–5.94)	1.36	–	1.44	(1.44–1.44)	0.37	(0.11–1.27)
Instrumental-assisted birth	0.62	(0.20–1.94)	1.39	–	1.34	–	1.52	(1.32–1.75)	2.18	(0.74–6.44)	1.34	–	0.66	(0.33–1.32)	1.31	–
3rd-degree perineal tear	1.47	–	1.41	(1.41–1.41)	–	–	1.45	(1.33–1.87)	–	–	–	–	–	–	–	–
Length of birth (hours)																
0-12	1	(reference)	1	(reference)	1	(reference)	1	(reference)	1	(reference)	1	(reference)	1	(reference)	1	(reference)
13-24	1.06	–	0.95	(0.53–1.73)	0.87	–	0.89	(0.69–1.15)	0.22	(0.02–1.90)	1.59	(0.71–3.55)	1.43	(0.63–3.28)	0.72	–
25-53	0.42	(0.12–1.49)	0.24	(0.04–1.47)	0.33	(0.08–1.42)	0.94	–	0.09	(0.00–1.86)	0.56	(0.05–6.15)	0.60	(0.05–7.27)	0.15	(0.06–0.39)
Neonatal factors																
Gestational age (weeks + days)																
37 + 0–39 + 6	0.53	(0.35–0.78)	0.41	(0.31–0.56)	0.64	(0.52–0.79)	1.00	(0.89–1.13)	1.08	(0.62–2.89)	1.00	(0.71–1.41)	1.23	–	1.25	–
40 + 0–41 + 6	1	(reference)	1	(reference)	1	(reference)	1	(reference)	1	(reference)	1	(reference)	1	(reference)	1	(reference)
42 + 0	0.87	(0.41–1.82)	0.79	(0.45–1.38)	0.67	(0.35–1.28)	1.37	(1.09–1.72)	–	–	1.76	(0.84–3.70)	1.07	(0.30–3.81)	–	–
Birthweight (grams)																
2500 - 3999	1	(reference)	1	(reference)	1	(reference)	1	(reference)	1	(reference)	1	(reference)	1	(reference)	1	(reference)
4000 - 4499	1.10	–	0.40	(0.25–0.65)	0.68	(0.52–0.90)	0.63	(0.51–0.78)	1.41	(0.79–2.52)	1.04	(0.28–1.50)	0.38	(0.26–0.56)	0.60	(0.36–0.99)
≥ 4500	1.35	(0.52–3.45)	0.52	(0.11–2.53)	1.54	–	0.99	(0.81–1.22)	0.92	(0.23–3.71)	0.61	(0.37–1.00)	0.39	(0.19–0.81)	1.03	–
Neonatal suction	2.24	–	1.80	(0.75–4.33)	1.05	–	1.23	(0.96–1.58)	0.63	(0.16–2.52)	1.37	(0.55–3.38)	1.05	–	1.00	(0.43–2.31)

[a] Adjusted for socio-demographic factors (age, living alone, education), maternal health factors (Body Mass Index (BMI), smoking, gestational diabetes, minor pre-eclampsia), birth-related factors (induction of birth, oxytocin augmentation, meconium-stained amniotic fluid, epidural anaesthesia, fever, breech presentation, shoulder dystocia, instrumental-assisted birth, bleeding>500 ml, perineal tear 3rd- and 4th-degree, length of birth), and neonatal factors (gestational age, birth weight, neonatal suction, umbilical artery blood pH < 7.10, neonatal transferred to Neonatal Intensive Care Unit (NICU)).

[b] Education = academic qualification. Skilled worker = special skill, training, or knowledge, short = 1–2 years, medium = 3–4 years, long≥5 years.

postpartum care.

Our study confirmed that the discharge time after birth is significantly associated with parity. However, we were surprised by the magnitude of primiparous women's relative risk compared to multiparous women for staying more than 48 h in the hospital after birth after adjusting for factors that might influence the time for discharge.

Even after adjusting for factors that might impact the length of hospital stay after birth, primiparous women had a 56% more probability of staying at the hospital more than 6 h after birth than multiparous women. Another study that examined the length of stay after uncomplicated vaginal birth found that primiparous women stayed longer in the hospital than multiparous women, which is in line with this study [20]. One explanation for the prolonged stay might be that the labour ward in this study recommended that healthcare professionals evaluate if the newborn was suckling and swallowing correctly before discharge. A comparison of breastfeeding by parity found that 35% of primiparous women had problems initiating breastfeeding in the first 48 h after birth [21]. In contrast, only 20% of the multiparous women who breastfed their first child had problems initiating breastfeeding [21]. Thus, more primiparous women might be more challenged in initiating breastfeeding than multiparous women and therefore need additional time before the healthcare professionals can evaluate correct breastfeeding. A focus group study with pregnant women and mothers in the postpartum period up to 12 months after delivery found that first-time mothers had different needs than mothers who had already experienced motherhood [22]. The mothers were concerned about the safety of their new babies and lacked confidence in their ability to care for them [22]. The mothers expressed that the physical presence and availability of professional support helped alleviate the mothers' concerns [22]. Some studies have shown that online communication and mobile Apps might meet the families' need for support and timely information and provide the parents with a sense of security in caring for the newborn at home [23–26]. The fact that primiparous women were 71% more likely to be discharged between 6 and 12 h after birth than multiparous women in this study indicates that many primiparous women need more time than multiparous women before they are ready to return home after birth. One study found that only 4% of primiparous mothers chose to be discharged within 24 h after birth when they were offered a home visit from a midwife two to six days after birth [27]. Even though the primiparous women in this study were offered a home visit by the midwife around 24 h after birth and could call the maternity ward 24 h around the clock, primiparous women still had a significantly higher probability of staying at the hospital for 48 h than multiparous women. Another study indicates that mothers who remained in the maternity ward more than 40 h after birth valued rest and sleep, a quiet atmosphere, attention from others, and having knowledgeable healthcare professionals nearby [1]. Thus, the follow-up strategy offered by the maternity ward in this study might not meet all the primiparous women's needs after birth since more healthy primiparous women with uncomplicated births remained in the hospital for 48 h than healthy multiparous women with uncomplicated births.

A 3rd-degree perineal tear was one of the factors that required individual assessment by a physician before discharge. Only 4% of primiparous women and less than 1% of multiparous women experienced a 3rd-degree perineal tear in this study. Women with repairs of perineal tears might experience pain and incontinence after birth [28]. The other factor that required individual evaluation by a physician before discharge was instrumental assisted birth. For primiparous women, both third-degree perineal tear and instrumental assisted birth were associated with a 48-h stay at the maternity ward, showing that the mothers required additional time to recover after birth.

On the other hand, multiparity was associated with early discharge, and 65% of multiparous women were discharged within 6 h after birth. One study found that the mothers' reasons for wanting early discharge were to return to the other children at home and the mothers felt they had good knowledge and experiences with caring for a newborn [29]. Furthermore, most of the women felt safe with early discharge [29]. A qualitative study found that multiparous women prefer to return home shortly after birth to be with their older children rather than stay at the hospital longer, which might explain the findings in this study [30]. However, the early return to home may have consequences for multiparous women since the mothers find it difficult to relax at home because they need to take care of their older children [30]. In addition, a review of early discharge from 1997 describes that multiparous women might be more vulnerable because they must take care of their older children at home and the newborn immediately after birth [31]. Another factor to consider is that some multiparous women reported domestic tension and less involvement from the father than primiparous women when the mothers were discharged early [1].

A long education versus a medium length of education was associated with discharge within 6 h after birth compared to discharge later for primiparous women. Our findings contrast with a study from the United States of America in 2004 that found mothers staying in the hospital 43–54 h after birth had higher educational levels than mothers discharged earlier [20]. The mothers that stayed longer in the hospital after birth had a private payer source, whereas the mothers discharged early had a public payer source [20]. In Denmark, all mothers have free and equal access to health care during pregnancy, during and after birth. Furthermore, primiparous women with low education levels were related to early discharge after birth compared to primiparous women with a medium length of education in our study. Low education is associated with poor health literacy in European countries [32]. Health literacy is the mother's ability to access, understand, and apply health information to make judgements and take decisions about healthcare [33]. The mother's health literacy influences her and the newborn's health [33]. A Danish study from 2017 documented that smoking was associated with discharge within 12 h after birth compared to discharge 50 h after birth [15], which corresponds with the results of our study. The mothers, who are smoking, may prioritise leaving the hospital early at the expense of other maternal or neonatal considerations. Therefore, healthcare professionals should be aware of mothers with a low educational level and mothers smoking when planning postpartum care. Gestational diabetes was not a contraindication to early discharge at the hospital where the mothers in this study gave birth. However, the analysis showed that significantly more multiparous mothers with gestational diabetes were discharged after 6 h. Gestational diabetes is associated with pre-eclampsia, shoulder dystocia, and caesarean section [34,35]. Our interpretation of the results is that gestational diabetes might not be the decisive factor for the longer stay at the hospital as much as the other factors related to gestational diabetes. Nevertheless, we should not ignore that mothers with gestational diabetes might need additional

support from healthcare professionals.

Studies have indicated that some parents feel better in their own homes after birth, and the mother's recovery is improved [1,6]. In addition, early discharge may enhance the father's involvement in nursing and care for the newborn [1]. The home may facilitate increased interaction and bonding between the parents and the newborn and increase the possibility of involving the family in caring for the mother and newborn [1,2,6,36]. Some studies have pointed out that shorter hospital stay after birth may decrease the risk of nosocomial infections [4–6]. The risk of infection during a hospital stay is important, not least in light of the Covid-19 pandemic. However, any increased risk of Covid-19 infection for the mother and newborn during a hospital stay remains to be investigated.

Nearly three-thirds of the primiparous women in this study were not assessed as ready to leave the hospital within 6 h after birth. In contrast, over 60% of multiparous women left for home within 6 h after birth. Therefore, maternity wards should expect to allocate resources that support inpatient care more than 6 h after birth to half of the new mothers, approximately.

5.1. Limitations

Due to national restrictions during the covid-19 pandemic, the mothers in this study did not receive public prenatal education from March 2020 to May 2020. Afterwards, the public prenatal education converted to online video, which might have influenced the parents' readiness for discharge and the primiparous women's breastfeeding knowledge. The data on length of birth should be interpreted with caution since the coded value for the beginning of regular contractions is subjectively evaluated by the midwives. There were 27.9% missing data regarding the estimated pH-value from the blood sample from the umbilical cord drawn immediately after birth. The missing values in the dataset were coded with a zero, which indicates a positive outcome. We estimated that the data were missing at random [37]. We performed a sensitivity analysis of the worst-case scenario where 100% of the missing data were coded as pH value $<$ 7,10. The analysis did not change the significance of the adjusted relative risk.

5.2. Strengths

This study is based on a large cohort which strengthens the estimation of relative risk. Furthermore, this study was a retrospective study based on data from the register; therefore, there is a minimal risk of information bias. Finally, this study was not dependent on the consent of participation, minimising the risk of selection bias.

6. Conclusion

This study found that nearly 50% of all new mothers left the hospital within 6 h after birth. Furthermore, we found that discharge time was significantly associated with parity and that healthy primiparous women with uncomplicated birth and a healthy newborn were 56% less likely to be discharged within 6 h after birth than multiparous. Moreover, despite a recommendation to discharge all healthy mothers with uncomplicated births, this study showed primiparity was associated with a discharge 48 h after birth compared to multiparity. On the other hand, multiparity was associated with discharge within 6 h after birth. Therefore, more primiparous women were assessed as requiring a longer hospital stay after birth than multiparous women. The tendency of earlier discharge from the hospital after birth was nearly the same for all mothers regarding factors such as young mothers, mothers with a high BMI, those with a long academic education, and those smoking. However, there were some factors where the mothers differed regarding parity. Primiparous women who experienced instrumental assisted birth, had a 3rd-degree perineal tear or gave birth after 42 weeks gestation was associated with a hospital stay over 48 h. In comparison, multiparous women with gestational diabetes were associated with discharge after 6 h after birth. Furthermore, multiparous women older than 35 years, skilled workers, or experiencing a breech presentation were associated with discharge later than 48 h after birth. Based on our results, we recommend that inpatient and outpatient care planning should consider the differences in parity. Healthcare professionals should be aware of mothers discharged early after birth who are smoking, of younger age, lower education level or with older children at home.

Author contribution statement

Victoria Lindblad: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper. Kristian Hay Kragholm: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Wrote the paper. Anya Eidhammer, Dorte Melgaard: Conceived and designed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

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Data availability statement

Data included in article/supplementary material/referenced in article.

Declaration of competing interest

The authors declare no conflict of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2023.e14004.

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