

ORIGINAL RESEARCH ARTICLE

Is the increasing prevalence of labor induction accompanied by changes in pregnancy outcomes? An observational study of all singleton births at gestational weeks 37–42 in Norway during 1999–2019

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Abstract

Introduction: Induction of labor is often performed to prevent adverse perinatal and maternal outcomes, and has become increasingly common. We studied whether changes in prevalence of labor induction in gestational weeks 37–42 weeks were accompanied by changes in adverse pregnancy outcomes or mode of delivery.

Material and methods: We used data from the Medical Birth Registry of Norway, and included all singleton births in gestational weeks 37–42 in Norway, 1999–2019 ($n = 1\,127\,945$). We calculated the prevalence of labor induction and outcome measures according to year of birth. We repeated these calculations for each gestational week at birth.

Results: The prevalence of labor induction increased from 9.7% to 25.9%, and the increase was particularly high in gestational week 41. A modest decline in fetal deaths was observed in all gestational weeks, except gestational week 41. The overall decline was from 0.18% in 1999–2004 to 0.13% during 2015–2019. There were no overall changes in other perinatal outcomes. The prevalence of postpartum hemorrhage ≥ 500 ml increased from 11.4% in 1999 to 30.1% in 2019, and operative deliveries increased slightly. The prevalence of acute cesarean section increased from 6.5% to 9.3%, whereas vacuum and/or forceps assisted deliveries increased from 7.8% to 10.4%.

Conclusions: A high increase in labor inductions was accompanied by a modest decline in fetal deaths, but no decline in other adverse perinatal outcomes. In settings where the prevalence of adverse perinatal outcomes is low, the beneficial effect of increased use of labor induction may not outweigh the side effects or the costs.

KEYWORDS

induction of labor, postpartum hemorrhage, pregnancy, stillbirth

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1 | INTRODUCTION

The rationale for induction of labor is to prevent adverse perinatal and maternal outcomes, and induction of labor in term and particularly in post term pregnancies has been increasingly common. However, it is uncertain whether an increase in labor inductions is accompanied by reduced prevalence of adverse outcomes, especially in settings where the perinatal mortality already is low.

The risk of perinatal death is most likely increased in post term pregnancies if antenatal surveillance is not provided.^{1,2} The effect of labor induction in all post term pregnancies, however, is being discussed. A review from the Cochrane Library suggested that the risk of perinatal death is lower when labor is induced in all pregnancies in gestational week 41, as compared to expectant management until gestational week 42.³ This review included studies performed decades ago, when the availability of fetal diagnostic technology was limited, and the prevalence of perinatal death was several times higher than in high income countries today. Randomized controlled trials have recently been performed in settings with low perinatal mortality, but with contradictory results. A Swedish study reported that induction of labor in all pregnancies in gestational week 41 reduced the risk of perinatal death as compared to expectant management,⁴ whereas a Dutch trial found no significant effect.⁵ Preventive effects that are estimated in randomized controlled trials may not be found when applied in clinical practice. In Denmark, the effect of changing the national guidelines for labor induction from 42⁺⁰ to 41⁺³⁻⁵ weeks of gestation has been evaluated in two studies.^{6,7} Although both studies included all births in Denmark, they reported opposite conclusions.

In previous studies, the effect of labor induction was studied in post term pregnancies only. To our knowledge, it is not known whether increased use of labor induction in post term pregnancies impacts the overall prevalence of adverse outcomes. If the

Key message

Increased use of labor induction may have limited impact in settings where the prevalence of adverse pregnancy outcomes is low.

prevalence of perinatal death in post term pregnancies is low, few cases can be prevented by increased use of labor induction. These few cases may have limited impact on the overall prevalence of perinatal death.

We performed an observational study among all singleton births in gestational weeks 37–42 in Norway during 1999–2019. We studied whether changes in labor inductions were accompanied by changes in adverse perinatal outcomes, maternal outcomes, or in mode of delivery. We studied the overall changes in such outcomes and made separate analyses by gestational week at birth.

2 | MATERIAL AND METHODS

2.1 | Design and study population

We performed a registry-based population study, and included all singleton births between gestational week 37⁺⁰ and 42⁺⁶ in Norway during 1999–2019, a total of 1 127 945 births (Figure 1).

We used data from the Medical Birth Registry of Norway.⁸ Reporting of births to this registry is compulsory by law, and the reporting is performed by the attending midwife or doctor shortly after the delivery.

Antenatal and maternity health care is free of charge in Norway, and almost all pregnant women attend the public antenatal care

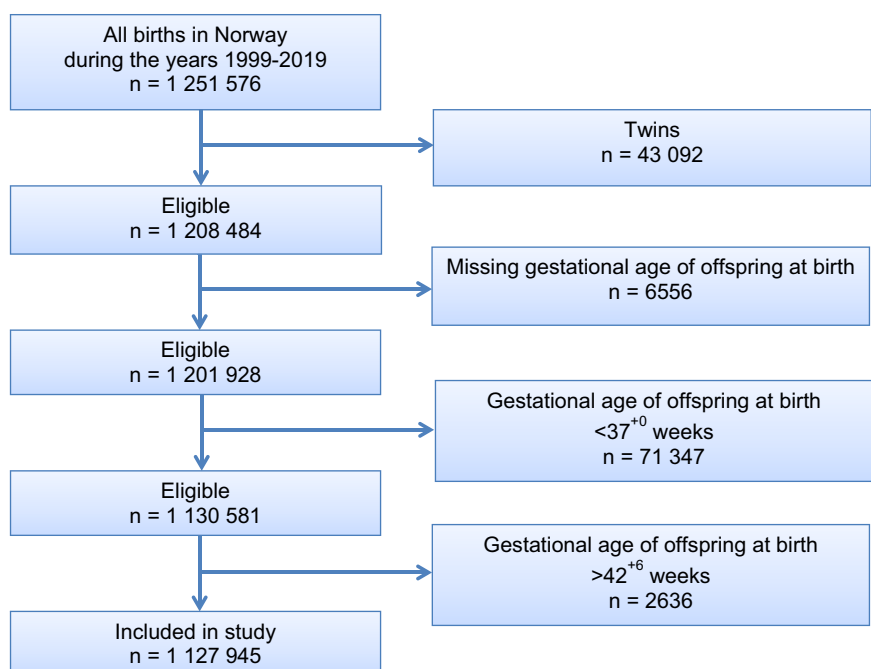


FIGURE 1 Flowchart of births included in the study.

program and deliver in public hospitals or maternity units (>99%).⁹ From the first trimester until the expected date of delivery, mothers receive at least seven antenatal clinical examinations by a midwife and/or a doctor in primary health care.¹⁰ High risk pregnancies are referred to specialist care at hospitals for follow-up.

2.2 | Induction of labor

The Norwegian induction of labor guidelines have changed gradually over time.¹¹ Particularly, the guidelines for labor induction in post term pregnancies have been subject to repeated discussions.¹² Until 2010, all women with an ongoing pregnancy were offered a clinical examination in gestational week 42⁺⁰–42⁺², including fetal biometry and cardiotocography at the hospital where the delivery was scheduled to take place. Induction of labor was recommended in high risk pregnancies, whereas in low risk pregnancies, expectant management was recommended until gestational week 43⁺⁰.

In 2010, the clinical examination at the hospital was recommended to be performed earlier in pregnancy, in gestational week 41⁺²–42⁺⁰. Induction of labor was recommended in pregnancies with a fetus small for gestational age (<2.5 percentile), if maternal age was above 38 years, in pregnancies with oligohydramnios (amniotic fluid index <5 cm), or if term predicted by ultrasound was more than 14 days later than term date predicted by the last menstrual period. In low risk pregnancies, induction of labor was recommended no later than in gestational week 42⁺⁰–42⁺². Since 2014, the clinical examination at the hospital has been performed no later than gestational week 41⁺²–41⁺⁴.

The threshold for labor induction for reasons such as diabetes, preeclampsia, prelabor rupture of membranes (PROM) or intrahepatic cholestasis has also been lowered during our study period. Additionally, the criteria for being diagnosed with gestational diabetes and preeclampsia have changed.^{13,14}

The following methods of induction of labor were used: prostaglandin, oxytocin infusion, amniotomy, or other and unspecified methods of induction (such as balloon catheter).¹⁵

2.3 | Other study factors

Gestational week at delivery was estimated on the basis of fetal size at a routine ultrasonographic examination performed 17–19 weeks after the last menstrual period (for 98% of all pregnancies). In the remaining 2% of the pregnancies, gestational week at delivery was based on the date of last menstrual period.

We studied changes in the following adverse perinatal outcomes: Apgar score ≤ 7 at 5 min after birth,¹⁶ admission to the neonatal intensive care unit, fetal death (ante partum 79.7%, intra partum 6.3% and unknown time of death prior to birth 14.0%), and neonatal death (death within 28 days after birth). We also studied changes in the prevalence of postpartum hemorrhage, defined by the Medical Birth Registry as ≥ 500 ml during labor or within 24 h after delivery. Additionally, we report changes in mode of delivery: acute cesarean section (decided < 8 h

before the procedure), elective cesarean section (decided ≥ 8 h before the procedure), and vacuum/forceps assisted delivery.

2.4 | Statistical analyses

We calculated the prevalence (in percent) of the outcomes described above by year of delivery during 1999–2019. Firstly, we included all births between gestational week 37⁺⁰ and 42⁺⁶, and thereafter we made separate analyses for each gestational week. All statistical analyses were conducted by using IBM SPSS Statistics for Windows, version 25.0 (Armonk, NY, USA).

2.5 | Ethics statement

The Medical Birth Registry of Norway is approved by the Norwegian Data Inspectorate. We used anonymous data, and the use of such anonymous data for research requires no additional approval from an ethical board according to Norwegian legislation.

3 | RESULTS

Characteristics of the study sample are shown in [Table 1](#). During our study period, there was an increase in women 30 years or older at delivery, pregnancies after assisted reproductive technology or with any diabetes. The proportion of multiparous women and smokers and women with preeclampsia decreased.¹⁷

The prevalence of labor induction increased from 9.7% (5195/53 702) of all deliveries in gestational weeks 37–42 in 1999 to 25.9% (13215/50968) in 2019 ([Figure 2](#), [Table 2](#)). The increase was observed in all gestational weeks, but was particularly high in gestational week 41, from 7.5% (817/10 935) in 1999 to 28.6% (3070/10 748) in 2019 ([Figure 3](#), [Table 3](#)). Consequently, the proportion of births that occurred in gestational week 42 declined from 8.9% of all births (4763/53 702) in 1999 to 4.7% (2386/50 968) in 2019 ([Figure 4](#)).

We observed no overall changes in the proportion of newborn with Apgar score ≤ 7 at 5 mins after birth, admission to the neonatal intensive care unit or in neonatal deaths ([Figure 2](#), [Table 2](#)).

The overall prevalence of fetal death decreased modestly ([Table 2](#)). The yearly number of fetal deaths was low and fluctuated. Therefore, we calculated the changes by five-year intervals. During the first 5 years (1999–2003), the mean prevalence of fetal death was 0.18% (480/260 432), and it was 0.13% (343/265 447) during the last 5 years (2015–2019) (chi-square test, $p < 0.01$). Thus, there were on average 27 fewer fetal deaths per year in the last five-year interval compared to the first.

In gestational week 42, the number of fetal deaths decreased from 42/21 518 (0.20%) during 1999–2003 to 4/11 954 (0.03%) during 2015–2019 (chi-square test, $p < 0.01$) ([Table 3](#)). The decrease in number of fetal deaths in gestational week 42 represented approximately one third of the overall decline in fetal deaths during our

TABLE 1 Characteristics of the study sample, 1 127 945 singleton births during 1999–2019 in Norway. All births, and births in the first and in the last year of our study period are presented

	Total births (percent)	1999	2019
Maternal age			
<30	542 669 (48.1)	20 687 (55.2)	20 798 (40.8)
30–39	552 976 (49.0)	23 039 (42.9)	28 190 (55.3)
≥40	24 699 (2.9)	976 (1.9)	1 980 (3.9)
Missing	1 (0.0)	0	0
Parity			
0	466 264 (41.3)	21 203 (39.5)	21 496 (42.2)
1	412 532 (36.6)	19 207 (35.8)	19 338 (37.9)
2	177 616 (15.7)	9 454 (17.6)	7 263 (14.3)
3	48 530 (4.3)	2 696 (5.0)	1 879 (3.7)
≥4	23 003 (2.0)	1 142 (2.1)	992 (1.9)
Preeclampsia			
Yes	28 811 (2.6)	1 864 (3.5)	970 (1.9)
No or missing	1 095 134 (97.4)	51 838 (96.5)	49 998 (98.1)
Diabetes			
Yes	32 606 (2.9)	596 (1.1)	2 906 (5.7)
No or missing	1 095 339 (97.1)	53 106 (98.9)	48 062 (94.3)
Smoking in third trimester			
No	841 420 (74.6)	33 018 (61.5)	43 448 (85.2)
Occasionally	8 433 (0.7)	849 (1.6)	115 (0.2)
Daily	69 116 (6.1)	7 539 (14.0)	587 (1.2)
Missing	208 976 (18.5)	12 296 (22.9)	6 818 (13.4)
ART	27 868 (2.5)	532 (1.0)	2 578 (5.1)
Total	1 127 945	53 702	50 968

study period. In gestational week 41, no decline in fetal deaths was observed (chi-square test, $p = 0.11$).

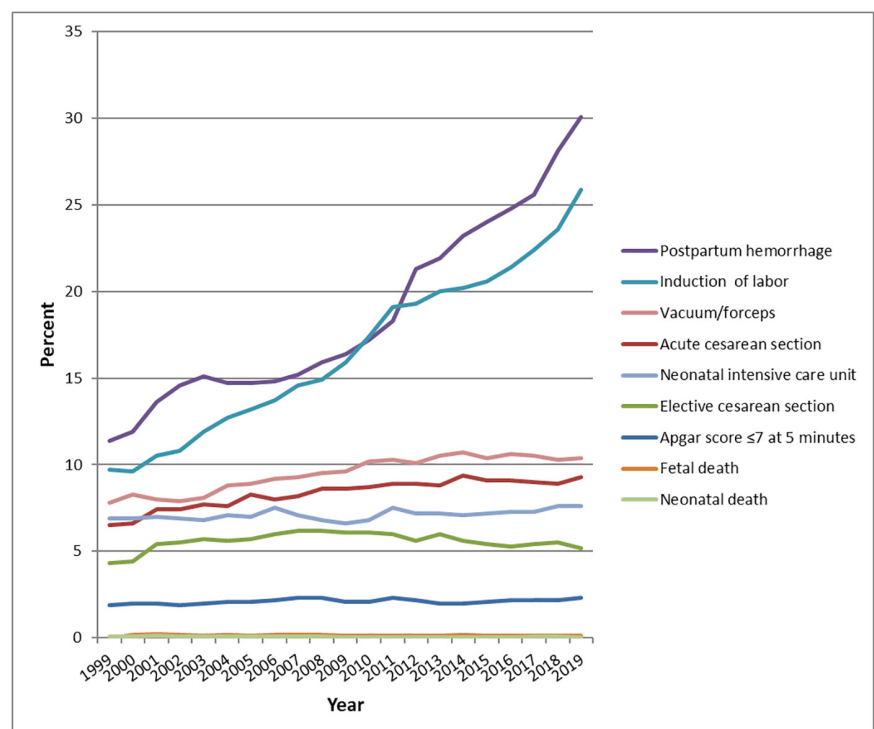
The proportion of women with postpartum hemorrhage ≥ 500 ml increased from 11.4% in 1999 to 30.1% in 2019 (Figure 2, Table 2). We performed separate analyses with postpartum hemorrhage 500–1500 ml and postpartum hemorrhage >1500 ml as outcomes. The increase in prevalence was similar for both outcomes (data not shown). The increase in postpartum hemorrhage was observed for all gestational weeks at delivery, but was most prominent in gestational weeks 41 (from 13.2% to 34.3%) and 42 (from 16.9% to 41.5%) (Figure 3, Table 3). The prevalence of postpartum hemorrhage was highest among women with induced labor. However, the increase in postpartum hemorrhage was observed both in women with and women without induction of labor (data not shown).

Acute cesarean section was performed in 6.5% (3496/53 702) of all deliveries in 1999, and in 9.3% (4726/50 968) in 2019. Vacuum and/or forceps assisted deliveries increased from 7.8% (4209/53 702) to 10.4% (5305/50 968) (Figure 2, Table 2). Thus, a decrease in nonoperative deliveries has occurred, from 81.3% (43 682/53 702) in 1999 to 75.1% (38 273/50 968) in 2019 (not shown in tables or figures). The increase in acute cesarean sections and vacuum and/or forceps assisted deliveries was observed across all gestational weeks (Figure 5, Table 3).

4 | DISCUSSION

The prevalence of labor induction in Norway increased from 9.7% to 25.9% during 1999–2019 in pregnancies in gestational week 37 and beyond. The decline in fetal deaths in the corresponding period was from 1.8 to 1.3 per thousand deliveries. Although the increase

FIGURE 2 Mode of delivery, maternal and perinatal outcome (in percent) according to year of delivery. All singleton births at term and post term in Norway during 1999–2019.



in labor inductions was highest in gestational weeks 41–42, two thirds of all prevented fetal deaths were in pregnancies between 37–40 weeks of gestation. There were no changes in the prevalence of other adverse perinatal outcomes.

Our study included all singleton births at term and post term in Norway during 20 years. Skewed selection of study participants is therefore unlikely to have biased our results. The Medical Birth Registry of Norway does not contain information about the indication for labor induction. The Medical Birth Registry of Norway record the time of delivery, however, we have no information about the exact time of death in cases of stillbirth.

For almost all women in our study sample (98%), gestational age at delivery was based on term date estimated at routine fetal ultrasonographic examination 17–19 weeks after the last menstrual period. Since the estimation of term date was performed many weeks prior to delivery, it is unlikely that gestational age at delivery was differentially misclassified by induction of labor or outcome of pregnancy.

Some of the decline in fetal deaths during our observation period could possibly be explained by terminations of pregnancies that otherwise would have resulted in fetal death in gestational week

37 or beyond. During 1999–2019, the yearly number of pregnancy terminations due to fetal anomalies or chromosomal abnormalities increased from 154 to 295.¹⁸ On the other hand, the proportion of pregnancies with increased risk of adverse outcomes has increased, such as pregnancies of women with advanced maternal age. Also, the proportion of nulliparous women, the proportion of pregnant women born in a non-Western country, or with a concomitant disease in pregnancy has increased.¹⁹

Our study is observational. Conclusions about causal relations and associations between labor induction and clinical outcomes can therefore not be drawn.

Labor induction has increased rapidly in many countries over the past decade. We are aware of two previous studies that have addressed the effect of labor induction on a population level. However, these studies reported the effects of induction of labor in gestational week 41 only. Both studied whether the more aggressive labor induction policy that was implemented in post term pregnancies in Denmark in 2011 was followed by changes in pregnancy outcomes. The first study reported a decline in perinatal deaths.⁶ The second study reported that the perinatal death rate remained unchanged, whereas the occurrence of uterine ruptures increased.⁷

TABLE 2 Mode of delivery, perinatal and maternal outcome (in numbers and percent/prevalence) according to year of delivery. All singleton births at gestational week 37–42 in Norway during 1999–2019 ($n = 1\,127\,945$)

Year	Total	Inductions	Acute CS	Elective CS	Vacuum/forceps	Apgar ≤ 7	NICU	Fetal death	Neonatal death	Postpartum hemorrhage
		Number (%)	Number (%)	Number (%)	Number (%)	Number (%)	Number (%)	Number (%)	Number (%)	Number (%)
1999	53 702	5189 (9.7)	3496 (6.5)	2315 (4.3)	4209 (7.8)	1024 (1.9)	3684 (6.9)	107 (0.20)	50 (0.09)	6147 (11.4)
2000	53 636	5140 (9.6)	3556 (6.6)	2381 (4.4)	4426 (8.3)	1083 (2.0)	3716 (6.9)	100 (0.19)	42 (0.08)	6399 (11.9)
2001	51 266	5408 (10.5)	3779 (7.4)	2750 (5.4)	4089 (8.0)	1002 (2.0)	3596 (7.0)	111 (0.22)	57 (0.11)	6951 (13.6)
2002	50 226	5414 (10.8)	3724 (7.4)	2755 (5.5)	3966 (7.9)	959 (1.9)	3481 (6.9)	84 (0.17)	39 (0.08)	7345 (14.6)
2003	51 562	6151 (11.9)	3950 (7.7)	2919 (5.7)	4193 (8.1)	1027 (2.0)	3488 (6.8)	78 (0.15)	44 (0.09)	7762 (15.1)
2004	51 958	6624 (12.7)	3930 (7.6)	2925 (5.6)	4570 (8.8)	1006 (2.1)	3708 (7.1)	89 (0.17)	39 (0.08)	7657 (14.7)
2005	51 842	6833 (13.2)	4303 (8.3)	2969 (5.7)	4601 (8.9)	1105 (2.1)	3634 (7.0)	77 (0.15)	42 (0.08)	7609 (14.7)
2006	53 516	7315 (13.7)	4295 (8.0)	3199 (6.0)	4937 (9.2)	1168 (2.2)	4002 (7.5)	83 (0.16)	44 (0.08)	7945 (14.8)
2007	53 253	7795 (14.6)	4356 (8.2)	3288 (6.2)	4964 (9.3)	1229 (2.3)	3806 (7.1)	84 (0.16)	42 (0.08)	8107 (15.2)
2008	55 528	8293 (14.9)	4776 (8.6)	3455 (6.2)	5298 (9.5)	1297 (2.3)	3792 (6.8)	89 (0.16)	41 (0.07)	8826 (15.9)
2009	57 051	9089 (15.9)	4911 (8.6)	3473 (6.1)	5493 (9.6)	1217 (2.1)	3792 (6.6)	88 (0.15)	27 (0.05)	9368 (16.4)
2010	56 890	9906 (17.4)	4969 (8.7)	3462 (6.1)	5794 (10.2)	1213 (2.1)	3842 (6.8)	84 (0.15)	25 (0.04)	9800 (17.2)
2011	56 051	10 695 (19.1)	4967 (8.9)	3376 (6.0)	5758 (10.3)	1296 (2.3)	4226 (7.5)	82 (0.15)	27 (0.05)	10 282 (18.3)
2012	55 985	10 809 (19.3)	5010 (8.9)	3147 (5.6)	5634 (10.1)	1227 (2.2)	4036 (7.2)	72 (0.13)	29 (0.05)	11 931 (21.3)
2013	54 930	11 005 (20.0)	4850 (8.8)	3270 (6.0)	5742 (10.5)	1121 (2.0)	3962 (7.2)	63 (0.11)	25 (0.05)	12 049 (21.9)
2014	55 102	11 119 (20.2)	5195 (9.4)	3102 (5.6)	5905 (10.7)	1109 (2.0)	3922 (7.1)	92 (0.17)	30 (0.05)	12 811 (23.2)
2015	54 893	11 287 (20.6)	4978 (9.1)	2959 (5.4)	5718 (10.4)	1130 (2.1)	3973 (7.2)	65 (0.12)	21 (0.04)	13 159 (24.0)
2016	55 097	11 812 (21.4)	5018 (9.1)	2932 (5.3)	5859 (10.6)	1228 (2.2)	4028 (7.3)	80 (0.15)	25 (0.05)	13 637 (24.8)
2017	52 858	11 840 (22.4)	4761 (9.0)	2870 (5.4)	5548 (10.5)	1176 (2.2)	3860 (7.3)	63 (0.12)	30 (0.06)	13 556 (25.6)
2018	51 631	12 165 (23.6)	4594 (8.9)	2817 (5.5)	5317 (10.3)	1150 (2.2)	3922 (7.6)	80 (0.15)	29 (0.06)	14 498 (28.1)
2019	50 968	13 215 (25.9)	4726 (9.3)	2664 (5.2)	5305 (10.4)	1165 (2.3)	3885 (7.6)	55 (0.11)	18 (0.04)	15 351 (30.1)

Abbreviations: CS, cesarean section; NICU, neonatal intensive care unit.

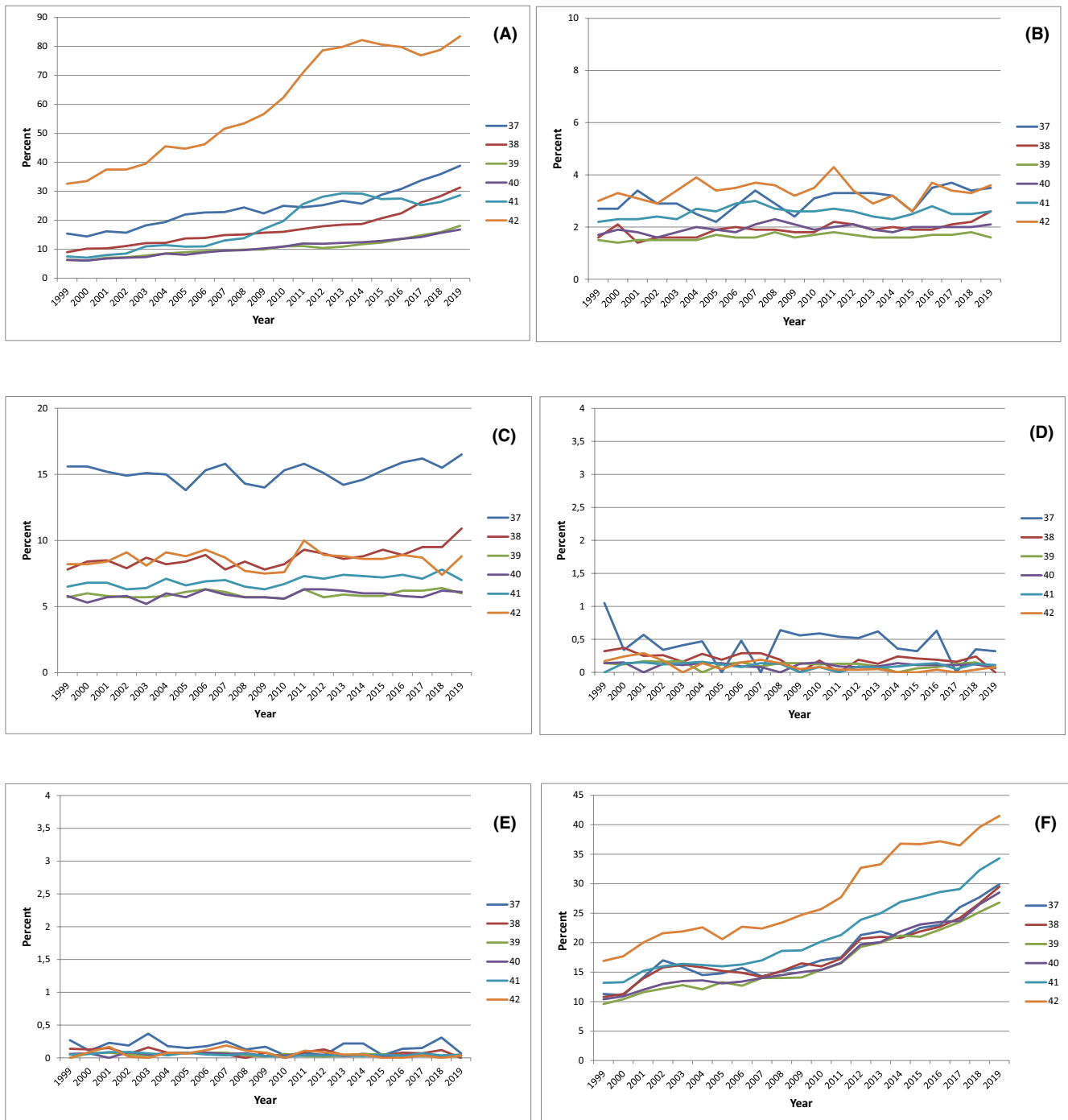


FIGURE 3 Maternal and perinatal outcome (in percent) per gestational week in all singleton births at term and post term in Norway during 1999–2019. (A) Induction of labor, (B) Apgar score ≤ 7 at 5 min, (C) neonatal intensive care unit, (D) fetal death, (E) neonatal death, and (F) postpartum hemorrhage.

Several randomized controlled trials have been performed to evaluate whether routine induction of labor in gestational week 41 is superior to labor induction in gestational week 42, but the results are inconclusive. The most recent randomized controlled trial, the Swedish Post term Induction Study (SWEPIIS),⁴ reported that routine induction of labor in gestational week 41 reduced the risk of perinatal deaths. The study was stopped early due to a higher occurrence of perinatal deaths in the expectant management

group compared to the induction group. Results from randomized controlled trials are not necessarily free from bias.²⁰ The critics of the SWEPIIS claim that the effect of labor induction may have been systematically overestimated, since stopping a randomized controlled trial early after rare events may cause biased estimates.²¹ Additionally, in the SWEPIIS, the occurrence of perinatal deaths in the expectant management group was much higher than in the Swedish background population, suggesting systematic bias

TABLE 3 Mode of delivery, perinatal and maternal outcome (in numbers and percent/prevalence) according to gestational week and year of delivery. (A) Induction of labor. (B) Acute cesarean section. (C) Elective cesarean section. (D) Vacuum/forceps. (E) Apgar ≤ 7 at 5 min. (F) Neonatal Intensive Care Unit. (G) Fetal death. (H) Neonatal death. (I) Postpartum hemorrhage. All singleton births at gestational week 37–42 in Norway during 1999–2019 ($n = 1\ 127\ 945$)

Year	37		38		39		40		41		42	
	Number (%)	Total	Number (%)	Total	Number (%)	Total	Number (%)	Total	Number (%)	Total	Number (%)	Total
<i>(A) Induction of labor</i>												
1999	396 (15.4)	2572	591 (9.0)	6603	811 (6.4)	12714	1022 (6.3)	16115	817 (7.5)	10935	1552 (32.6)	4763
2000	379 (14.4)	2633	685 (10.2)	6738	787 (6.1)	12849	976 (6.1)	16011	770 (7.1)	10802	1543 (33.5)	4603
2001	426 (16.2)	2637	696 (10.3)	6742	881 (7.1)	12357	1026 (6.8)	15135	824 (8.0)	10244	1555 (37.5)	4151
2002	415 (15.7)	2638	754 (11.1)	6797	878 (7.2)	12117	1060 (7.1)	14907	834 (8.5)	9843	1473 (37.5)	3924
2003	487 (18.2)	2683	854 (12.1)	7077	963 (7.8)	12371	1120 (7.3)	15239	1116 (11.0)	10115	1611 (39.5)	4077
2004	535 (19.4)	2761	878 (12.2)	7203	1074 (8.5)	12655	1314 (8.5)	15507	1164 (11.4)	10185	1659 (45.5)	3647
2005	568 (22.0)	2585	960 (13.7)	6984	1130 (9.0)	12499	1241 (8.1)	15335	1131 (10.9)	10405	1803 (44.7)	4034
2006	615 (22.7)	2712	1002 (13.9)	7203	1223 (9.4)	13023	1408 (8.9)	15818	1169 (11.0)	10650	1898 (46.2)	4110
2007	650 (22.8)	2848	1088 (14.9)	7280	1253 (9.5)	13148	1491 (9.5)	15662	1368 (13.0)	10545	1945 (51.6)	3770
2008	728 (24.4)	2984	1167 (15.1)	7751	1371 (9.9)	13911	1582 (9.7)	16378	1496 (13.8)	10857	1949 (53.4)	3647
2009	641 (22.4)	2866	1183 (15.7)	7513	1375 (9.9)	13898	1778 (10.3)	17255	2002 (17.0)	11792	2110 (56.6)	3727
2010	682 (25.0)	2726	1147 (16.0)	7173	1530 (11.0)	13886	1875 (10.9)	17231	2419 (19.7)	12258	2253 (62.3)	3616
2011	641 (24.5)	2612	1170 (17.0)	6889	1510 (11.1)	13558	2057 (12.0)	17208	3312 (25.6)	12957	2005 (70.9)	2827
2012	674 (25.2)	2674	1286 (17.9)	7181	1444 (10.4)	13946	2032 (11.9)	17132	3600 (28.1)	12796	1773 (78.6)	2256
2013	730 (26.7)	2734	1274 (18.5)	6880	1504 (10.9)	13776	2042 (12.2)	16707	3708 (29.3)	12643	1747 (79.8)	2190
2014	716 (25.7)	2785	1316 (18.7)	7029	1600 (11.7)	13664	2118 (12.4)	17015	3660 (29.2)	12529	1709 (82.2)	2080
2015	816 (28.8)	2832	1485 (20.7)	7168	1665 (12.3)	13546	2188 (12.9)	16954	3304 (27.3)	12123	1829 (80.6)	2270
2016	876 (30.8)	2843	1613 (22.4)	7185	1852 (13.5)	13738	2316 (13.6)	17033	3284 (27.5)	11953	1871 (79.8)	2345
2017	923 (33.7)	2735	1761 (26.1)	6744	1923 (14.8)	13012	2307 (14.2)	16200	2917 (25.2)	11555	2009 (76.9)	2612
2018	1025 (35.9)	2858	1908 (28.3)	6733	2073 (15.9)	13071	2449 (15.6)	15719	2865 (26.3)	10909	1845 (78.8)	2341
2019	1096 (38.8)	2825	2191 (31.3)	6992	2269 (18.1)	12565	2597 (16.8)	15452	3070 (28.6)	10748	1992 (83.5)	2386
<i>(B) Acute cesarean section</i>												
1999	255 (9.9)	2572	400 (6.1)	6603	594 (4.7)	12714	817 (5.1)	16115	818 (7.5)	10935	612 (12.8)	4763
2000	258 (9.8)	2633	428 (6.4)	6738	582 (4.5)	12849	829 (5.2)	16011	845 (7.8)	10802	614 (13.3)	4603
2001	288 (10.9)	2637	458 (6.8)	6742	654 (5.3)	12357	913 (6.0)	15135	897 (8.8)	10244	569 (13.7)	4151
2002	315 (11.9)	2638	482 (7.1)	6797	633 (5.2)	12117	909 (6.1)	14907	838 (8.5)	9843	547 (13.9)	3924
2003	344 (12.8)	2683	530 (7.5)	7077	669 (5.4)	12371	897 (5.9)	15239	883 (8.7)	10115	627 (15.4)	4077
2004	318 (11.5)	2761	496 (6.9)	7203	693 (5.5)	12655	955 (6.2)	15507	864 (8.5)	10185	604 (16.6)	3647

TABLE 3 (Continued)

Year	37		38		39		40		41		42	
	Number (%)	Total	Number (%)	Total	Number (%)	Total	Number (%)	Total	Number (%)	Total	Number (%)	Total
2005	335 (13.0)	2585	547 (7.8)	6984	737 (5.9)	12499	1039 (6.8)	15335	1000 (9.6)	10405	645 (16.0)	4034
2006	388 (14.3)	2712	558 (7.7)	7203	645 (5.0)	13023	1003 (6.3)	15818	984 (9.2)	10650	717 (17.4)	4110
2007	374 (13.1)	2848	514 (7.1)	7280	762 (5.8)	13148	1058 (6.8)	15662	978 (9.3)	10545	670 (17.8)	3770
2008	376 (12.6)	2984	634 (8.2)	7751	786 (5.7)	13911	1220 (7.4)	16378	1121 (10.3)	10857	639 (17.5)	3647
2009	388 (13.5)	2866	627 (8.3)	7513	820 (5.9)	13898	1242 (7.2)	17255	1185 (10.0)	11792	649 (17.4)	3727
2010	406 (14.9)	2726	613 (8.5)	7173	820 (5.9)	13886	1193 (6.9)	17231	1293 (10.5)	12258	644 (17.8)	3616
2011	321 (12.3)	2612	593 (8.6)	6889	828 (6.1)	13558	1217 (7.1)	17208	1471 (11.4)	12957	537 (19.0)	2827
2012	392 (14.7)	2674	610 (8.5)	7181	826 (5.9)	13946	1263 (7.4)	17132	1452 (11.3)	12796	467 (20.7)	2256
2013	366 (13.4)	2734	610 (8.9)	6880	829 (6.0)	13776	1159 (6.9)	16707	1410 (11.2)	12643	476 (21.7)	2190
2014	348 (12.5)	2785	627 (8.9)	7029	952 (7.0)	13664	1301 (7.6)	17015	1515 (12.1)	12529	452 (21.7)	2080
2015	381 (13.5)	2832	644 (9.0)	7168	838 (6.2)	13546	1289 (7.6)	16954	1323 (10.9)	12123	503 (22.2)	2270
2016	396 (13.9)	2843	669 (9.3)	7185	868 (6.3)	13738	1312 (7.7)	17033	1323 (11.1)	11953	450 (19.2)	2345
2017	399 (14.6)	2735	628 (9.3)	6744	844 (6.5)	13012	1149 (7.1)	16200	1259 (10.9)	11555	482 (18.5)	2612
2018	406 (14.2)	2858	598 (8.9)	6733	769 (5.9)	13071	1156 (7.4)	15719	1228 (11.3)	10909	437 (18.7)	2341
2019	370 (13.1)	2825	720 (10.3)	6992	809 (6.4)	12565	1122 (7.3)	15452	1213 (11.3)	10748	492 (20.6)	2386
(C) Elective cesarean section												
1999	207 (8.0)	2572	956 (14.5)	6603	804 (6.3)	12714	176 (1.1)	16115	96 (0.9)	10995	76 (1.6)	4763
2000	223 (8.5)	2633	973 (14.4)	6738	836 (6.5)	12849	189 (1.2)	16011	89 (0.8)	10802	71 (1.5)	4603
2001	261 (9.9)	2637	1184 (17.6)	6742	974 (7.9)	12357	176 (1.2)	15135	95 (0.9)	10244	60 (1.4)	4151
2002	294 (11.1)	2638	1238 (18.2)	6797	910 (7.5)	12117	177 (1.2)	14907	81 (0.8)	9843	55 (1.4)	3924
2003	313 (11.7)	2683	1352 (19.1)	7077	940 (7.6)	12371	186 (1.2)	15239	73 (0.7)	10115	55 (1.3)	4077
2004	305 (11.0)	2761	1339 (18.6)	7203	968 (7.6)	12655	182 (1.2)	15507	93 (0.9)	10185	38 (1.0)	3647
2005	242 (9.4)	2585	1258 (18.0)	6984	1182 (9.5)	12499	162 (1.1)	15335	75 (0.7)	10405	50 (1.2)	4034
2006	272 (10.0)	2712	1390 (19.3)	7203	1201 (9.2)	13023	182 (1.2)	15818	94 (0.9)	10650	60 (1.5)	4110
2007	276 (9.7)	2848	1393 (19.1)	7280	1320 (10.0)	13148	172 (1.1)	15662	83 (0.8)	10545	44 (1.2)	3770
2008	318 (10.7)	2984	1484 (19.1)	7751	1380 (9.9)	13911	153 (0.9)	16378	75 (0.7)	10857	45 (1.2)	3647
2009	283 (9.9)	2866	1449 (19.3)	7513	1428 (10.3)	13898	175 (1.0)	17255	101 (0.9)	11792	37 (1.0)	3727
2010	263 (9.6)	2726	1342 (18.7)	7173	1555 (11.2)	13886	186 (1.1)	17231	86 (0.7)	12258	30 (0.8)	3616
2011	242 (9.3)	2612	1201 (17.4)	6889	1620 (11.9)	13558	197 (1.1)	17208	90 (0.7)	12957	26 (0.9)	2827
2012	238 (8.9)	2674	1160 (16.2)	7181	1508 (10.8)	13946	152 (0.9)	17132	82 (0.6)	12796	7 (0.3)	2256
2013	257 (9.4)	2734	1054 (15.3)	6880	1664 (12.1)	13776	170 (1.0)	16707	105 (0.8)	12643	20 (0.9)	2190

TABLE 3 (Continued)

Year	37		38		39		40		41		42	
	Number (%)	Total	Number (%)	Total	Number (%)	Total	Number (%)	Total	Number (%)	Total	Number (%)	Total
2014	251 (9.0)	2785	1143 (16.3)	7029	1422 (10.4)	13664	175 (1.0)	17015	96 (0.8)	12529	15 (0.7)	2080
2015	255 (9.0)	2832	1062 (14.8)	7168	1379 (10.2)	13546	157 (0.9)	16954	93 (0.8)	12123	13 (0.6)	2270
2016	237 (8.3)	2843	986 (13.7)	7185	1479 (10.8)	13738	153 (0.9)	17033	61 (0.5)	11953	16 (0.7)	2345
2017	234 (8.6)	2735	938 (13.9)	6744	1462 (11.2)	13012	156 (1.0)	16200	66 (0.6)	11555	14 (0.5)	2612
2018	280 (9.8)	2858	938 (13.9)	6733	1395 (10.7)	13071	138 (0.9)	15719	58 (0.5)	10909	8 (0.3)	2341
2019	289 (10.2)	2825	921 (13.2)	6992	1262 (10.0)	12565	116 (0.8)	15452	67 (0.6)	10748	9 (0.4)	2386
<i>(D) Vacuum/forceps</i>												
1999	141 (5.5)	2572	318 (4.8)	6603	774 (6.1)	12714	1264 (7.8)	16115	1123 (10.3)	10935	589 (12.4)	4763
2000	137 (5.2)	2633	347 (5.1)	6738	810 (6.3)	12849	1299 (8.1)	16011	1155 (10.7)	10802	678 (14.7)	4603
2001	135 (5.1)	2637	363 (5.4)	6742	741 (6.0)	12357	1234 (8.2)	15135	1079 (10.5)	10244	537 (12.9)	4151
2002	143 (5.4)	2638	337 (5.0)	6797	720 (5.9)	12117	1258 (8.4)	14907	1027 (10.4)	9843	481 (12.3)	3924
2003	151 (5.6)	2683	349 (4.9)	7077	782 (6.3)	12371	1297 (8.5)	15239	1090 (10.8)	10115	524 (12.9)	4077
2004	163 (5.9)	2761	396 (5.5)	7203	865 (6.8)	12655	1413 (9.1)	15507	1188 (11.7)	10185	545 (14.9)	3647
2005	161 (6.2)	2585	403 (5.8)	6984	832 (6.7)	12499	1359 (8.9)	15335	1197 (11.5)	10405	649 (16.1)	4034
2006	157 (5.8)	2712	438 (6.1)	7203	953 (7.3)	13023	1441 (9.1)	15818	1330 (12.5)	10650	618 (15.0)	4110
2007	184 (6.5)	2848	433 (5.9)	7280	929 (7.1)	13148	1459 (9.3)	15662	1351 (12.8)	10545	608 (16.1)	3770
2008	206 (6.9)	2984	452 (5.8)	7751	1097 (7.9)	13911	1622 (9.9)	16378	1323 (12.2)	10857	598 (16.4)	3647
2009	186 (6.5)	2866	420 (5.6)	7513	1065 (7.7)	13898	1724 (10.0)	17255	1461 (12.4)	11792	637 (17.1)	3727
2010	181 (6.6)	2726	448 (6.2)	7173	1077 (7.8)	13886	1807 (10.5)	17231	1614 (13.2)	12258	667 (18.4)	3616
2011	181 (6.9)	2612	486 (7.1)	6889	1074 (7.9)	13558	1798 (10.4)	17208	1727 (13.3)	12957	492 (17.4)	2827
2012	198 (7.4)	2674	544 (7.6)	7181	1055 (7.6)	13946	1820 (10.6)	17132	1616 (12.6)	12796	401 (17.8)	2256
2013	212 (7.8)	2734	479 (7.0)	6880	1157 (8.4)	13776	1819 (10.9)	16707	1688 (13.4)	12643	387 (17.7)	2190
2014	227 (8.2)	2785	528 (7.5)	7029	1173 (8.6)	13664	1816 (10.7)	17015	1783 (14.2)	12529	378 (18.2)	2080
2015	219 (7.7)	2832	507 (7.1)	7168	1131 (8.3)	13546	1851 (10.9)	16954	1610 (13.3)	12123	400 (17.6)	2270
2016	216 (7.6)	2843	504 (7.0)	7185	1183 (8.6)	13738	1865 (10.9)	17033	1638 (13.7)	11953	543 (19.3)	2345
2017	208 (7.6)	2735	500 (7.4)	6744	1058 (8.1)	13012	1769 (10.9)	16200	1568 (13.6)	11555	445 (17.0)	2612
2018	229 (8.0)	2858	475 (7.1)	6733	1064 (8.1)	13071	1673 (10.6)	15719	1464 (13.4)	10909	412 (17.6)	2341
2019	243 (8.6)	2825	514 (7.4)	6992	1031 (8.2)	12565	1723 (11.2)	15452	1400 (13.0)	10748	394 (16.5)	2386
<i>(E) Apgar ≤ 7 at 5 min</i>												
1999	70 (2.7)	2572	105 (1.6)	6603	195 (1.5)	12714	276 (1.7)	16115	236 (2.2)	10935	142 (3.0)	4763
2000	72 (2.7)	2633	141 (2.1)	6738	179 (1.4)	12849	297 (1.9)	16011	244 (2.3)	10802	150 (3.3)	4603

TABLE 3 (Continued)

Year	37		38		39		40		41		42	
	Number (%)	Total	Number (%)	Total	Number (%)	Total	Number (%)	Total	Number (%)	Total	Number (%)	Total
2001	89 (3.4)	2637	94 (1.4)	6742	191 (1.5)	12357	265 (1.8)	15135	236 (2.3)	10244	127 (3.1)	4151
2002	76 (2.9)	2638	108 (1.6)	6797	182 (1.5)	12117	244 (1.6)	14907	235 (2.4)	9843	114 (2.9)	3924
2003	78 (2.9)	2683	115 (1.6)	7077	188 (1.5)	12371	273 (1.8)	15239	236 (2.3)	10115	137 (3.4)	4077
2004	69 (2.5)	2761	116 (1.6)	7203	194 (1.5)	12655	305 (2.0)	15507	280 (2.7)	10185	142 (3.9)	3647
2005	58 (2.2)	2585	131 (1.9)	6984	210 (1.7)	12499	297 (1.9)	15335	271 (2.6)	10405	138 (3.4)	4034
2006	76 (2.8)	2712	142 (2.0)	7203	208 (1.6)	13023	291 (1.8)	15818	308 (2.9)	10650	143 (3.5)	4110
2007	96 (3.4)	2848	141 (1.9)	7280	206 (1.6)	13148	329 (2.1)	15662	319 (3.0)	10545	138 (3.7)	3770
2008	87 (2.9)	2984	151 (1.9)	7751	250 (1.8)	13911	383 (2.3)	16378	294 (2.7)	10857	132 (3.6)	3647
2009	70 (2.4)	2866	135 (1.8)	7513	218 (1.6)	13898	363 (2.1)	17255	310 (2.6)	11792	121 (3.2)	3727
2010	84 (3.1)	2726	130 (1.8)	7173	235 (1.7)	13886	323 (1.9)	17231	315 (2.6)	12258	126 (3.5)	3616
2011	86 (3.3)	2612	149 (2.2)	6889	249 (1.8)	13558	346 (2.0)	17208	344 (2.7)	12957	122 (4.3)	2827
2012	88 (3.3)	2674	149 (2.1)	7181	232 (1.7)	13946	354 (2.1)	17132	328 (2.6)	12796	76 (3.4)	2256
2013	90 (3.3)	2734	132 (1.9)	6880	215 (1.6)	13776	320 (1.9)	16707	301 (2.4)	12643	63 (2.9)	2190
2014	88 (3.2)	2785	143 (2.0)	7029	223 (1.6)	13664	304 (1.8)	17015	284 (2.3)	12529	67 (3.2)	2080
2015	73 (2.6)	2832	135 (1.9)	7168	216 (1.6)	13546	341 (2.0)	16954	306 (2.5)	12123	59 (2.6)	2270
2016	99 (3.5)	2843	134 (1.9)	7185	227 (1.7)	13738	349 (2.0)	17033	332 (2.8)	11953	87 (3.7)	2345
2017	100 (3.7)	2735	144 (2.1)	6744	227 (1.7)	13012	327 (2.0)	16200	289 (2.5)	11555	89 (3.4)	2612
2018	98 (3.4)	2858	150 (2.2)	6733	234 (1.8)	13071	318 (2.0)	15719	272 (2.5)	10909	78 (3.3)	2341
2019	99 (3.5)	2825	182 (2.6)	6992	199 (1.6)	12565	322 (2.1)	15452	278 (2.6)	10748	85 (3.6)	2386
(F) Neonatal intensive care unit												
1999	402 (15.6)	2572	517 (7.8)	6603	726 (5.7)	12714	937 (5.8)	16115	711 (6.5)	10935	391 (8.2)	4763
2000	411 (15.6)	2633	568 (8.4)	6738	772 (6.0)	12849	854 (5.3)	16011	732 (6.8)	10802	379 (8.2)	4603
2001	400 (15.2)	2637	575 (8.5)	6742	713 (5.8)	12357	861 (5.7)	15135	699 (6.8)	10244	348 (8.4)	4151
2002	394 (14.9)	2638	540 (7.9)	6797	696 (5.7)	12117	871 (5.8)	14907	622 (6.3)	9843	358 (9.1)	3924
2003	405 (15.1)	2683	813 (8.7)	7077	704 (5.7)	12371	785 (5.2)	15239	650 (6.4)	10115	331 (8.1)	4077
2004	414 (15.0)	2761	590 (8.2)	7203	730 (5.8)	12655	924 (6.0)	15507	719 (7.1)	10185	331 (9.1)	3647
2005	357 (13.8)	2585	590 (8.4)	6984	760 (6.1)	12499	881 (5.7)	15335	690 (6.6)	10405	356 (8.8)	4034
2006	414 (15.3)	2712	642 (8.9)	7203	823 (6.3)	13023	1002 (6.3)	15818	740 (6.9)	10650	381 (9.3)	4110
2007	449 (15.8)	2848	570 (7.8)	7280	801 (6.1)	13148	923 (5.9)	15662	736 (7.0)	10545	327 (8.7)	3770
2008	428 (14.3)	2984	648 (8.4)	7751	790 (5.7)	13911	936 (5.7)	16378	709 (6.5)	10857	281 (7.7)	3647
2009	402 (14.0)	2866	584 (7.8)	7513	799 (5.7)	13898	981 (5.7)	17255	748 (6.3)	11792	278 (7.5)	3727

(Continues)

TABLE 3 (Continued)

Year	37		38		39		40		41		42	
	Number (%)	Total	Number (%)	Total	Number (%)	Total	Number (%)	Total	Number (%)	Total	Number (%)	Total
2010	417 (15.3)	2726	585 (8.2)	7173	783 (5.6)	13886	960 (5.6)	17231	822 (6.7)	12258	275 (7.6)	3616
2011	414 (15.8)	2612	640 (9.3)	6889	860 (6.3)	13558	1089 (6.3)	17208	940 (7.3)	12957	283 (10.0)	2827
2012	404 (15.1)	2674	646 (9.0)	7181	799 (5.7)	13946	1072 (6.3)	17132	914 (7.1)	12796	201 (8.9)	2256
2013	389 (14.2)	2734	595 (8.6)	6880	814 (5.9)	13776	1036 (6.2)	16707	935 (7.4)	12643	193 (8.8)	2190
2014	406 (14.6)	2785	616 (8.8)	7029	790 (5.8)	13664	1014 (6.0)	17015	918 (7.3)	12529	178 (8.6)	2080
2015	434 (15.3)	2832	665 (9.3)	7168	791 (5.8)	13546	1018 (6.0)	16954	869 (7.2)	12123	196 (8.6)	2270
2016	452 (15.9)	2843	638 (8.9)	7185	845 (6.2)	13738	996 (5.8)	17033	889 (7.4)	11953	208 (8.9)	2345
2017	443 (16.2)	2735	643 (9.5)	6744	811 (6.2)	13012	917 (5.7)	16200	820 (7.1)	11555	226 (8.7)	2612
2018	443 (15.5)	2858	642 (9.5)	6733	840 (6.4)	13071	978 (6.2)	15719	846 (7.8)	10909	173 (7.4)	2341
2019	467 (16.5)	2825	760 (10.9)	6992	752 (6.0)	12565	940 (6.1)	15452	755 (7.0)	10748	211 (8.8)	2386
(G) Fetal death												
1999	27 (1.05)	2572	21 (0.32)	6603	18 (0.14)	12714	22 (0.14)	16115	11 (0.10)	10935	8 (0.17)	4763
2000	9 (0.34)	2633	25 (0.37)	6738	16 (0.12)	12849	24 (0.15)	16011	15 (0.14)	10802	11 (0.24)	4603
2001	15 (0.57)	2637	17 (0.25)	6742	21 (0.17)	12357	31 (0.20)	15135	15 (0.15)	10244	12 (0.29)	4151
2002	9 (0.34)	2638	18 (0.26)	6797	19 (0.16)	12117	19 (0.13)	14907	12 (0.12)	9843	7 (0.18)	3924
2003	11 (0.41)	2683	11 (0.16)	7077	21 (0.17)	12371	17 (0.11)	15239	14 (0.14)	10115	4 (0.10)	4077
2004	13 (0.47)	2761	20 (0.28)	7203	13 (0.10)	12655	22 (0.14)	15507	16 (0.16)	10185	5 (0.14)	3647
2005	13 (0.50)	2585	13 (0.19)	6984	15 (0.12)	12499	21 (0.14)	15335	13 (0.12)	10405	2 (0.05)	4034
2006	13 (0.48)	2712	21 (0.29)	7203	19 (0.15)	13023	15 (0.09)	15818	9 (0.08)	10650	6 (0.15)	4110
2007	17 (0.60)	2848	21 (0.29)	7280	12 (0.09)	13148	12 (0.08)	15662	15 (0.14)	10545	7 (0.19)	3770
2008	19 (0.64)	2984	15 (0.19)	7751	19 (0.14)	13911	17 (0.10)	16378	14 (0.13)	10857	5 (0.14)	3647
2009	16 (0.56)	2866	15 (0.20)	7513	20 (0.14)	13898	23 (0.13)	17255	12 (0.10)	11792	2 (0.05)	3727
2010	16 (0.59)	2726	13 (0.18)	7173	16 (0.12)	13886	26 (0.15)	17231	10 (0.08)	12258	3 (0.08)	3616
2011	14 (0.54)	2612	21 (0.30)	6889	17 (0.13)	13558	16 (0.09)	17208	13 (0.10)	12957	1 (0.04)	2827
2012	14 (0.52)	2674	14 (0.19)	7181	18 (0.13)	13946	14 (0.08)	17132	11 (0.09)	12796	1 (0.04)	2256
2013	17 (0.62)	2734	9 (0.13)	6880	12 (0.09)	13776	15 (0.09)	16707	9 (0.07)	12643	1 (0.05)	2190
2014	10 (0.36)	2785	17 (0.24)	7029	28 (0.20)	13664	24 (0.14)	17015	11 (0.09)	12529	2 (0.10)	2080
2015	9 (0.32)	2832	15 (0.21)	7168	8 (0.06)	13546	18 (0.11)	16954	15 (0.12)	12123	0 (0.00)	2270
2016	18 (0.63)	2843	14 (0.19)	7185	11 (0.08)	13738	19 (0.11)	17033	17 (0.14)	11953	1 (0.04)	2345
2017	11 (0.40)	2735	11 (0.16)	6744	17 (0.13)	13012	18 (0.11)	16200	6 (0.05)	11555	0 (0.00)	2612
2018	10 (0.35)	2858	16 (0.24)	6733	20 (0.15)	13071	19 (0.12)	15719	14 (0.13)	10909	1 (0.04)	2341
2019	9 (0.32)	2825	14 (0.20)	6992	7 (0.06)	12565	11 (0.07)	15452	12 (0.11)	10748	2 (0.08)	2386

TABLE 3 (Continued)

Year	37		38		39		40		41		42	
	Number (%)	Total	Number (%)	Total	Number (%)	Total	Number (%)	Total	Number (%)	Total	Number (%)	Total
<i>(H) Neonatal death</i>												
1999	7 (0.27)	2572	9 (0.14)	6603	13 (0.10)	12714	10 (0.06)	16115	6 (0.05)	10935	5 (0.10)	4763
2000	3 (0.11)	2633	9 (0.13)	6738	9 (0.07)	12849	11 (0.07)	16011	6 (0.06)	10802	4 (0.09)	4603
2001	6 (0.23)	2637	10 (0.15)	6742	10 (0.08)	12357	15 (0.10)	15135	9 (0.09)	10244	7 (0.17)	4151
2002	5 (0.19)	2638	4 (0.06)	6797	6 (0.05)	12117	14 (0.09)	14907	9 (0.09)	9843	1 (0.02)	3924
2003	10 (0.37)	2683	11 (0.16)	7077	5 (0.04)	12371	7 (0.05)	15239	7 (0.07)	10115	4 (0.10)	4077
2004	5 (0.18)	2761	6 (0.08)	7203	9 (0.07)	12655	12 (0.07)	15507	4 (0.04)	10185	3 (0.08)	3647
2005	4 (0.15)	2585	5 (0.07)	6984	10 (0.08)	12499	12 (0.08)	15335	8 (0.08)	10405	3 (0.07)	4034
2006	5 (0.18)	2712	6 (0.08)	7203	11 (0.08)	13023	12 (0.08)	15818	5 (0.05)	10650	5 (0.12)	4110
2007	7 (0.25)	2848	4 (0.05)	7280	11 (0.08)	13148	9 (0.06)	15662	4 (0.04)	10545	7 (0.19)	3770
2008	4 (0.13)	2984	8 (0.10)	7751	6 (0.04)	13911	12 (0.07)	16378	7 (0.06)	10857	4 (0.11)	3647
2009	5 (0.17)	2866	6 (0.08)	7513	3 (0.02)	13898	6 (0.03)	17255	4 (0.03)	11792	3 (0.08)	3727
2010	1 (0.04)	2726	7 (0.10)	7173	8 (0.06)	13886	7 (0.04)	17231	2 (0.02)	12258	0 (0.00)	3616
2011	2 (0.08)	2612	6 (0.09)	6889	4 (0.03)	13558	7 (0.04)	17208	5 (0.04)	12957	3 (0.11)	2827
2012	1 (0.04)	2674	9 (0.13)	7181	3 (0.02)	13946	9 (0.05)	17132	5 (0.04)	12796	2 (0.09)	2256
2013	6 (0.22)	2734	3 (0.04)	6880	5 (0.04)	13776	5 (0.03)	16707	5 (0.04)	12643	1 (0.05)	2190
2014	6 (0.22)	2785	4 (0.06)	7029	8 (0.06)	13664	7 (0.04)	17015	4 (0.03)	12529	1 (0.05)	2080
2015	1 (0.04)	2832	3 (0.04)	7168	7 (0.05)	13546	4 (0.02)	16954	6 (0.05)	12123	0 (0.00)	2270
2016	4 (0.14)	2843	6 (0.08)	7185	5 (0.04)	13738	6 (0.04)	17033	4 (0.03)	11953	0 (0.00)	2345
2017	4 (0.15)	2735	5 (0.07)	6744	4 (0.03)	13012	8 (0.05)	16200	8 (0.07)	11555	1 (0.04)	2612
2018	9 (0.31)	2858	8 (0.12)	6733	4 (0.03)	13071	4 (0.03)	15719	4 (0.04)	10909	0 (0.00)	2341
2019	2 (0.07)	2825	0 (0.00)	6992	4 (0.03)	12565	6 (0.04)	15452	5 (0.05)	10748	1 (0.04)	2386
<i>(I) Postpartum hemorrhage</i>												
1999	290 (11.3)	2572	715 (10.8)	6603	1220 (9.6)	12714	1675 (10.4)	16115	1442 (13.2)	10935	805 (16.9)	4763
2000	292 (11.1)	2633	760 (11.3)	6738	1339 (10.4)	12849	1751 (10.9)	16011	1441 (13.3)	10802	816 (17.7)	4603
2001	373 (14.1)	2637	935 (13.9)	6742	1434 (11.6)	12357	1823 (12.0)	15135	1555 (15.2)	10244	831 (20.0)	4151
2002	448 (17.0)	2638	1073 (15.8)	6797	1476 (12.2)	12117	1931 (13.0)	14907	1571 (16.0)	9843	846 (21.6)	3924
2003	426 (15.9)	2683	1144 (16.2)	7077	1589 (12.8)	12371	2053 (13.5)	15239	1659 (16.4)	10115	891 (21.9)	4077
2004	400 (14.5)	2761	1141 (15.8)	7203	1527 (12.1)	12655	2114 (13.6)	15507	1650 (16.2)	10185	825 (22.6)	3647
2005	383 (14.8)	2585	1059 (15.2)	6984	1664 (13.3)	12499	2003 (13.1)	15335	1668 (16.0)	10405	832 (20.6)	4034
2006	426 (15.7)	2712	1073 (14.9)	7203	1657 (12.7)	13023	2118 (13.4)	15818	1738 (16.3)	10650	933 (22.7)	4110

(Continues)

TABLE 3 (Continued)

Year	37		38		39		40		41		42	
	Number (%)	Total	Number (%)	Total	Number (%)	Total	Number (%)	Total	Number (%)	Total	Number (%)	Total
2007	408 (14.3)	2848	1031 (14.2)	7280	1839 (14.0)	13148	2198 (14.0)	15662	1788 (17.0)	10545	843 (22.4)	3770
2008	451 (15.1)	2984	1178 (15.2)	7751	1946 (14.0)	13911	2379 (14.5)	16378	2017 (18.6)	10857	855 (23.4)	3647
2009	456 (15.9)	2866	1237 (16.5)	7513	1959 (14.1)	13898	2591 (15.0)	17255	2204 (18.7)	11792	921 (24.7)	3727
2010	463 (17.0)	2726	1146 (16.0)	7173	2139 (15.4)	13886	2653 (15.4)	17231	2470 (20.2)	12258	929 (25.7)	3616
2011	457 (17.5)	2612	1189 (17.3)	6889	2233 (16.5)	13558	2858 (16.6)	17208	2761 (21.3)	12957	784 (27.7)	2827
2012	569 (21.3)	2674	1490 (20.7)	7181	2690 (19.3)	13946	3383 (19.7)	17132	3061 (23.9)	12796	738 (32.7)	2256
2013	599 (21.9)	2734	1444 (21.0)	6880	2753 (20.0)	13776	3358 (20.1)	16707	3166 (25.0)	12643	729 (33.3)	2190
2014	583 (20.9)	2785	1459 (20.8)	7029	2903 (21.2)	13664	3726 (21.9)	17015	3375 (26.9)	12529	765 (36.8)	2080
2015	637 (22.5)	2832	1567 (21.9)	7168	2846 (21.0)	13546	3917 (23.1)	16954	3359 (27.7)	12123	833 (36.7)	2270
2016	653 (23.0)	2843	1632 (22.7)	7185	3055 (22.2)	13738	4011 (23.5)	17033	3414 (28.6)	11953	872 (37.2)	2345
2017	711 (26.0)	2735	1632 (24.2)	6744	3061 (23.5)	13012	3833 (23.7)	16200	3365 (29.1)	11555	954 (36.5)	2612
2018	791 (27.7)	2858	1799 (26.7)	6733	3300 (25.2)	13071	4158 (26.5)	15719	3522 (32.3)	10909	928 (39.6)	2341
2019	845 (29.9)	2825	2062 (29.5)	6992	3371 (26.8)	12565	4400 (28.5)	15452	3683 (34.3)	10748	990 (41.5)	2386

in the recruitment. In total, 85.5% of the eligible women were excluded or declined study participation. Also, the lack of fetal surveillance in the expectant management group has been criticized. In the Stockholm region, an ultrasonographic examination was performed before randomization to confirm a normal pregnancy. Pregnancies with diagnosed pathology were therefore not included. No deaths occurred in the expectant management group in this region (0/557). Among the included pregnancies in the expectant management group in other regions in Sweden, ultrasonographic scans were not routinely performed, and six perinatal deaths occurred in these regions (6/822).

A Dutch randomized controlled study (INDEX),⁵ comparing routine labor induction in gestational week 41 with expectant management until gestational week 42, reported no significant difference in perinatal deaths between the induction group and the expectant management group. The absolute risks of severe adverse perinatal outcomes was low in both groups. Also in the INDEX study, a large proportion of eligible women was not included (70.4%), mainly because they opposed participation.

Despite a large increase in labor inductions in Norway during our study period, the decline in fetal deaths was modest. No decline in other adverse perinatal outcomes, such as low Apgar score, admission to the neonatal intensive care unit, or neonatal deaths was observed. The low prevalence of fetal death in gestational week 41 already at the beginning of our study period,¹ may explain why the large increase in labor inductions was not accompanied by a decrease in adverse pregnancy outcomes.

In our study, the decline in fetal deaths in gestational week 42 accounted for 30% of the overall decline in fetal deaths. This decline may partly be explained by a decline in the number of pregnancies that continued beyond gestational week 41. However, there was also a decline in the prevalence of fetal death in the remaining ongoing pregnancies, which may be explained by successful selection of low risk pregnancies to be continued beyond gestational week 41. Routine clinical examination in gestational week 41 including fetal ultrasonographic examination and cardiotocography, followed by induction of labor in high risk pregnancies, may have prevented fetal deaths. By the end of our study period, there was almost no fetal deaths left to prevent in gestational week 42. To prevent the 0–2 yearly fetal deaths which now occur in gestational week 42, an additional 8000 labor inductions must be performed by the end of gestational week 41.

Induction of labor is not a procedure which is performed without complications. It has been associated with prolonged labor and uterine rupture.^{22,23} It is also discussed whether labor induction has an impact on the risk of operative deliveries.^{7,15,24} Thus, the increase in cesarean sections and operative vaginal deliveries in our study, may possibly be a result of an increase in labor inductions. A higher prevalence of high risk pregnancies may also explain why operative deliveries are more frequently performed. On the other hand, the overall prevalence of operative deliveries in Norway is low compared to other countries in the western world. It cannot be ruled out that labor induction has prevented some operative deliveries during our study period.²⁴

FIGURE 4 The proportion of births by gestational week among all singleton births at term and post term in Norway during 1999–2019.

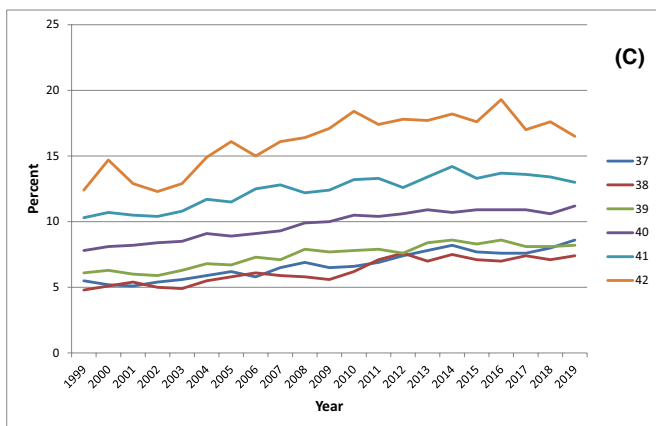
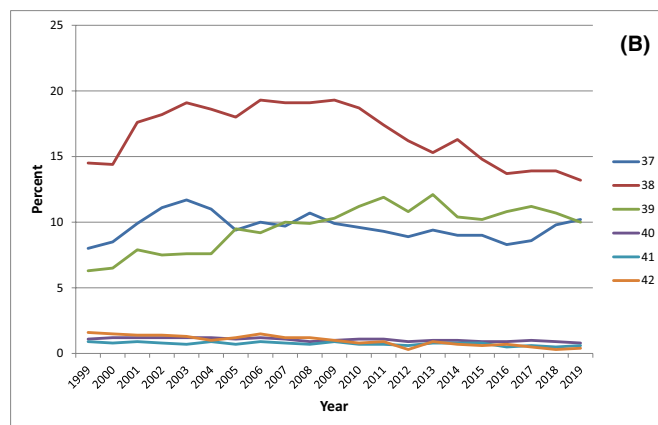
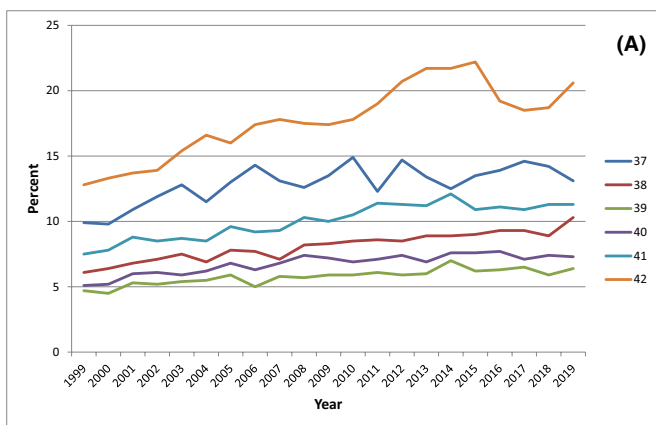
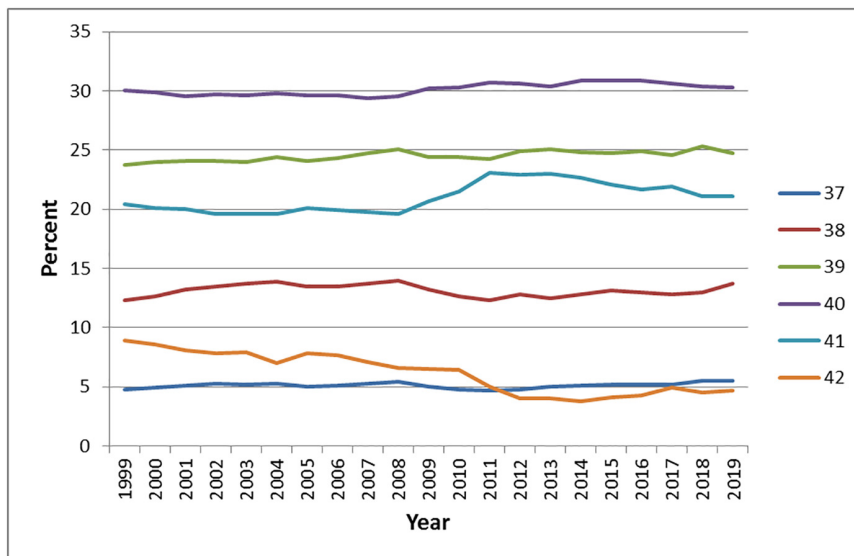


FIGURE 5 Mode of delivery (in percent) per gestational week in all singleton births at term and post term in Norway during 1999–2019. (A) Acute cesarean section, (B) elective cesarean section, and (C) vacuum/forceps.

We report a large increase in the prevalence of postpartum hemorrhage ≥ 500 ml during our study period. It has been suggested that induction of labor impacts the risk of postpartum hemorrhage.²⁵ However, the large increase of postpartum hemorrhage also in

women without labor induction suggests that there could be other factors that explain the increase. A substantial increase in augmentation of labor,²⁶ the increase in cesarean sections, as well as the increasing proportion of women at risk, such as primiparous, obese⁹

and women of advanced age, may have influenced the prevalence of postpartum hemorrhage.²⁶

In many countries it is being discussed whether labor induction in all ongoing pregnancies should be implemented at a specific gestational age to prevent adverse outcomes, such as fetal deaths. However, routine labor induction of all ongoing pregnancies is costly²⁷ and may lead to allocation of health care resources to low risk rather than high risk pregnancies. Whether or not labor induction in all ongoing pregnancies should be implemented at a specific gestational age,²⁸ may largely depend on the expected prevalence of adverse outcome in the population of interest.

5 | CONCLUSION

In Norway during the years 1999–2019, there was a major increase in labor inductions, but only a moderate overall decrease in fetal deaths. There was no decrease in other adverse perinatal outcomes. Before implementation of more aggressive guidelines regarding induction of labor, the preventive potential of labor inductions must be considered. Our study suggests that routine induction of labor in all ongoing pregnancies in gestational week 41 would not result in significantly better outcomes.

AUTHOR CONTRIBUTIONS

CH conducted the statistical analysis and wrote the manuscript. NHM and ODS contributed to the writing of the article. AE contributed to the data analysis, the interpretation of the results and writing the article. All authors reviewed the manuscript and made important intellectual contributions to the final version.

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CONFLICT OF INTEREST

The authors confirm there are no conflicts of interest.

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