

1

Supplementary figures and tables

eFigure 1. Calculation of the regional activity scores based on the regional rates of 3 key obstetric and 4 key neonatal interventions in T1, T2 and T3. See methods section.

eFigure 2. Major Neonatal Morbidities (MNM) in all one-year survivors born alive at 22 and 23 weeks in three time periods 2004-2007, 2014-16 and 2017-19.

eTable 1. Definitions

eTable 2. Characteristics of pregnancies and of infants born alive in health care regions with GA-specific perinatal activity scores above and below the national average

2

eFigure 1. Calculation of the regional activity scores based on the regional rates of 3 key obstetric and 4 key neonatal interventions in T1, T2 and T3. See methods section.

A

2014-2016 (T2). Proportion (%) of obstetric interventions, aggregate rates (22-23 wks)

Regions (n)	Birth at level III Units	Antenatal steroids	Cesarean delivery
A (29)	96.6/100	69.0	0
B (33)	84.8	81.8	36.4
C (67)	83.6	71.6	29.9
D (24)	87.5	87.5	37.5/100
E (46)	84.8	95.7/100	23.9
F (23)	91.3	82.6	8.7

2014-2016 (T2). Proportion (%) of neonatal interventions, aggregate rates (22-23 wks)

Regions (n)	Surfactant within 2hrs	Neonatologist present at birth	Intubation after birth	Transfer to NICU
A (29)	69.0	89.7	89.7	82.8
B (33)	69.7	93.9/100	93.9	78.8
C (67)	64.2	83.6	83.6	71.6
D (24)	83.3	91.7	91.7	95.8
E (46)	87.0/100	91.3	97.8/100	100/100
F (23)	82.6	91.3	91.3	91.3

Aggregate rates (22-23 weeks) in T2 (2014-2016) used for normalization of perinatal activity scores in T1, T2, and T3. Regions (in grey cells) with the highest rate for each indicator were given a score of 100.

T1, 2004-2007

B T1 (2004-2007), 22 weeks
Proportion (%) obstetric intervention, N = 49

Region (n)	Birth at level III units	Antenatal steroids	Cesarean delivery
A (5)	100	40.0	0
B (5)	40.0	60.0	0
C (20)	20.0	10.0	5.0
D (4)	75.0	100	0
E (10)	80.0	100	0
F (5)	20.0	20.0	40.0

Each regional percentage in proportion to the percentage in the region with highest figures in middle time period T2

103.5	41.8	0
41.4	62.7	0
20.7	10.4	13.3
77.6	104.5	0
82.8	104.5	0
20.7	20.9	106.7

Means of the normalized proportions

48
35
15
61
62
49

Mean neonatal and obstetric scores = Perinatal Activity Scores

A	40
B	42
C	18
D	61
E	62
F	32

T1 (2004-2007), 22 weeks
Proportion neonatal intervention, N=49

Region (n)	Surfactant within 2hrs	Neonatologist present at birth	Intubation after birth	Transfer to NICU
A (5)	0	80.0	0	40.0
B (5)	40.0	60.0	40.0	40.0
C (20)	10.0	35.0	10.0	25.0
D (4)	50.0	75.0	50.0	50.0
E (10)	50.0	50.0	70.0	60.0
F (5)	0	20.0	0	40.0

Each regional percentage in proportion to the percentage in the region with highest figures in middle time period T2

0	85.2	0	40.0
45.9	63.9	40.9	40.0
11.5	37.3	10.2	25.0
57.5	79.9	51.1	50.0
57.5	53.2	71.6	60.0
0	21.3	0	40.0

Means of the normalized proportions

31
48
21
60
61
15

C T1 (2004-2007), 23 weeks
Proportion obstetric intervention, N=101

Regions (n)	Birth at level III units	Antenatal steroids	Cesarean delivery
A (21)	81.0	85.7	0
B (15)	80.0	73.3	40.0
C (28)	82.1	78.6	7.1
D (8)	62.5	87.5	25.0
E (21)	81.0	95.2	28.6
F (8)	62.5	87.5	12.5

Each regional percentage in proportion to the percentage in the region with highest figures in middle time period T2

83.9	89.6	0
82.8	76.6	106.7
84.9	82.1	18.9
64.7	91.4	66.7
83.9	99.5	76.3
64.7	91.4	33.3

Means of the normalized proportions

58
89
62
74
87
63

Mean neonatal and obstetric scores = Perinatal Activity Scores

A	67
B	85
C	66
D	79
E	92
F	53

T1 (2004-2007), 23 weeks
Proportion neonatal intervention, N=101

Region (n)	Surfactant within 2hrs	Neonatologist Present at birth	Intubation direct after birth	Transfer to NICU
A (21)	52.4	85.7	71.4	81.0
B (15)	60.0	93.3	60.0	93.3
C (28)	53.6	75.0	57.1	67.9
D (8)	75.0	75.0	75.0	87.5
E (21)	90.5	81	95.2	100
F (8)	25.0	75.0	25.0	37.5

Each regional percentage in proportion to the percentage in the region with highest figures in middle time period T2

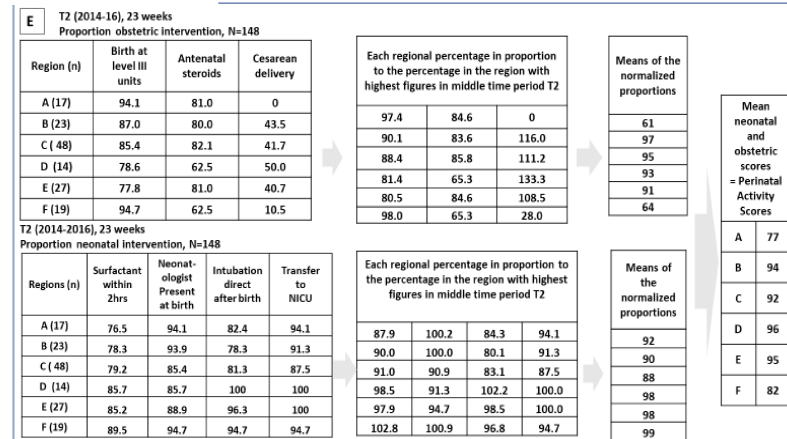
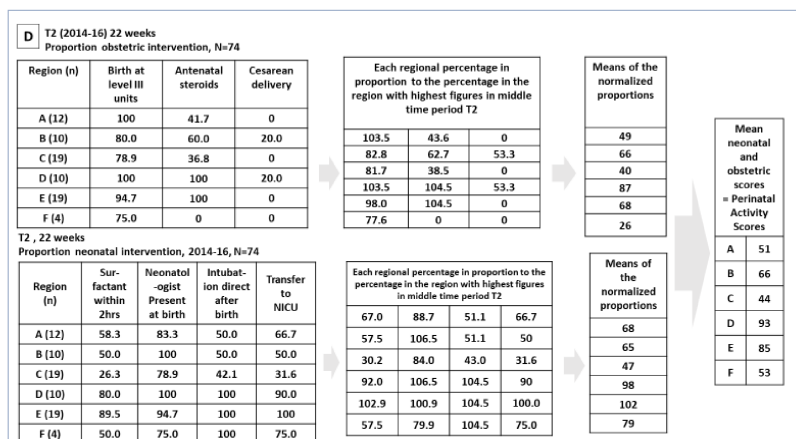
60.2	91.3	73.0	81.0
68.9	99.4	61.3	93.3
61.6	79.9	58.4	67.9
86.2	79.9	76.7	87.5
104.0	86.3	97.3	100.0
28.7	79.9	25.6	37.5

Means of the normalized proportions

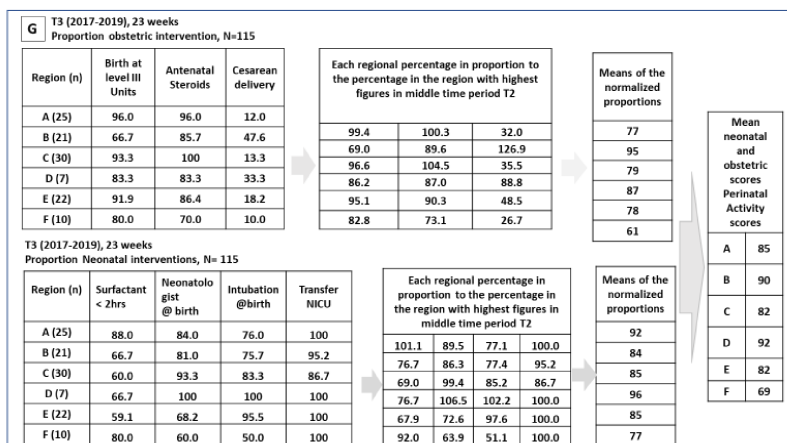
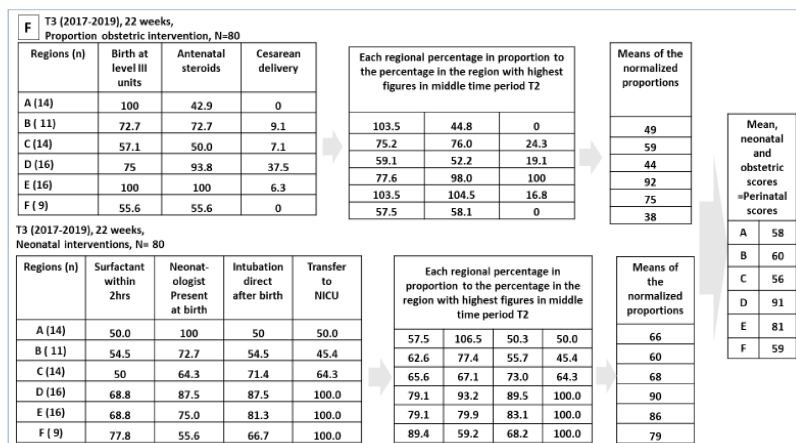
76
81
67
83
97
43

Figure 1. Calculation of the regional activity scores based on the regional rates of 3 key obstetric and 4 key neonatal interventions in T1, T2 and T3. See methods section (continued).

T2, 2014-2016



T3, 2017-2019

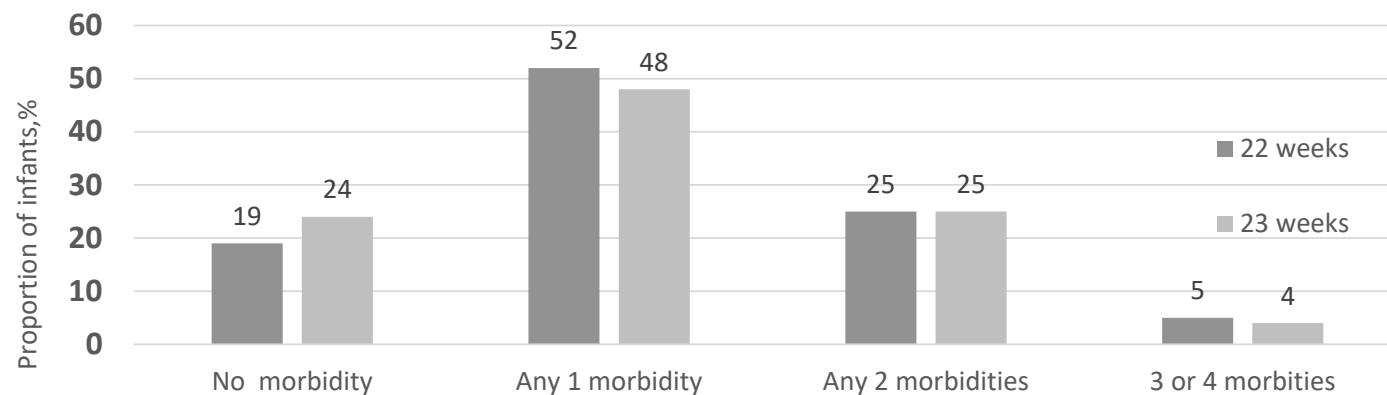


4

The perinatal activity scores comprised the mean obstetric and neonatal activity scores and were determined as follows. First, we calculated the aggregated rates of neonatal and obstetric interventions at 22 and 23 weeks in the middle time period (T2, 2014-2016) and the healthcare regions with the highest rate for each indicator were given a score of 100 (**A**). Then we created a perinatal activity score for each region by expressing them as a percentage of the highest scores. Each infant was then assigned a specific normalized perinatal activity score based on their GA and the region they were born in as shown in **B,C,D,E,F,G**

5

e Figure 2



Major Neonatal Morbidities (MNM) in all one-year survivors born alive at 22 and 23 weeks in three time periods 2004-2007, 2014-16 and 2017-19. MNM were defined as Intraventricular hemorrhage grade 3-4, cystic periventricular leukomalacia; Surgical necrotizing enterocolitis; retinopathy of prematurity stage ≥ 3 ; severe bronchopulmonary dysplasia [with $\geq 30\%$ oxygen at 36 w+ 0 d postmenstrual age)

eTable 1. Definitions

Live birth	Defined according to the World Health Organization (39)
Stillbirth	Defined according to the World Health Organization (39)
Small for gestational age (SGA)	Infants with birth weight SD scores < - 2 SDs were calculated according to the national intrauterine growth standard, based on ultrasonically estimated fetal weights (14)
Preeclampsia	Blood pressure, 140/90 mm Hg after 20 weeks of pregnancy and proteinuria \geq 0.3 g/24 hours or \geq 0.3 g/L
Preterm prelabor rupture of membranes	Spontaneous rupture of the membranes 1 hour before the onset of contractions
Chorioamnionitis	Diagnosis as set clinically by the obstetrician
Antenatal corticosteroid treatment	Any: at least one 12-mg dose of betamethasone; complete course: 2 doses of betamethasone with 24-hour interval
Intraventricular hemorrhage (IVH)	Defined according to Papile et al (15)
Cystic periventricular leukomalacia	Defined according to de Vries et al (16)
Retinopathy of prematurity (ROP)	Defined according to the International Committee for the Classification of Retinopathy of Prematurity (18)
Bronchopulmonary dysplasia (BPD)	Need for supplemental oxygen at 36 weeks of GA
Severe BPD	Need for \geq 30% oxygen at 36 weeks of GA
Major neonatal morbidity (MNM)	At least 1 of IVH of grade 3 or higher, cPVL, ROP of stage 3 or higher, severe BPD or surgical NEC.
Congenital anomalies	Classified according to the WHO International Classification of Diseases, 10th revision (dislocation of the hip joints Q65.0-Q65.5] Preauricular tags [Q17.0], undescended testes [Q53.0–Q53.9], and patent ductus arteriosus [Q25.0] were not classified as anomalies.

eTable 2. Characteristics of pregnancies and of infants born alive in health care regions with GA-specific perinatal activity scores above and below the national average

	T 1 2004-2007 ^a 22 Weeks		T 2 2014-2016 22 Weeks		T 3 2017-2019 22 Weeks		T 1 2004-2007 ^a 23 Weeks		T 2 2014-2016 23 Weeks		T 3 2017-2019 23 Weeks	
	N= 49		N=74		N=80		N= 101		N=148		N=115	
	Above average n=13	Below average n = 36	Above average n= 39	Below average n= 35	Above average n= 32	Below average n=48	Above average n = 36	Below average n=65	Above average n=131	Below average n=17	Above average n=53	Below average n=62
Total number, live births												
Number of infants in above and below average perinatal activity scoring regions ^b												
Mother												
Pregnancy complications												
Placental abruption/vaginal bleeding	0/13 (0)	5/36 (9)	11/39 (28)	5/35 (14)	7/32 (22)	12/48 (25)	6/36 (17)	3/62 (5)	29/131 (22)	1/17 (6)	11/53 (21)	19/62 (31)
Chorioamnionitis	1/13 (8)	9/36 (25)	6/39 (15)	5/35 (14)	5/32 (16)	5/48 (10)	3/36 (8)	8/65 (12)	22/131 (17)	1/17 (6)	4/53 (8)	8/62 (13)
Preeclampsia	0/13	2/36 (6)	0	0	2/32 (6)	0	2/36 (6)	2/63 (3)	6/125 (5)	0/17 (0)	2/53 (4)	4/362 (7)
PPROM	43/13 (23)	6/36 (17)	11/39 (28)	4/35 (11)	5/32 (16)	7/48 (15)	11/36 (31)	9/65 (14)	26/131 (20)	5/17 (29)	12/53 (23)	10/62 (16)
Multiple birth	3/13 (23)	7/36 (19)	9/39 (23)	11/35 (31)	7/32 (22)	9/48 (19)	3/36 (8)	5/65 (8)	29/131 (22)	4/17 (24)	10/53 (19)	13/62 (21)
Infant												
Gestational age, wks, median	22.7	22.6	22.6	22.6	22.6	22.4	23.4	23.6	23.4	23.4	23.4	23.4
Male sex	9/13 (69)	17/36 (47)	20/39 (51)	19/35 (54)	16/32 (50)	25/48 (52)	21/36 (58)	34/65 (52)	76/131 (58)	6/17 (35)	26/53 (49)	33/62 (53)
Birth weight, median (min-max), g	498 (361-710)	509 (280-730)	488 (380-618)	490 (345-670)	483 (322-605)	500 (370-648)	571 (436-690)	598 (320-808)	596 (300-1615)	535 (500-955)	572 (400-680)	558 (366-777)
SGA	2/13 (15)	2/36 (6)	5/39 (13)	3/35 (9)	3/32 (9)	3/48 (6)	3/36 (8)	4/64 (6)	16/131 (12)	0/17 (0)	1/51 (2)	9/62† (6)
One -year mortality All live-births	8/13 (62)	36/36† (100)	20/29 (51)	25/35 (71)	15/32 (47)	34/48† (71)	12/36 (33)	36/65† (55)	49/131 (37)	8/17 (47)	16/53 (30)	22/62 (36)

eTable2.Characteristics of pregnancies and of infants born alive in health care regions with GA-specific perinatal activity scores above and below the national average (continued)

	T 1 2004-2007 ^a 22 Weeks		T 2 2014-2016 22 Weeks		T 3 2017-2019 22 Weeks		T 1 2004-2007 ^a 23 Weeks		T 2 2014-2016 23 Weeks		T 3 2017-2019 23 Weeks	
	N= 49		N=74		N=80		N= 101		N=148		N=115	
Total number, live births												
Died in first 12 hrs of age	6/13 (46)	31/36†† (86)	9/39 (23)	18/35† (51)	4/32 (13)	19/48† (40)	2/36 (6)	25/65†† (39)	12/119 (9)	3/17 (12)	2/53 (4)	7/62 (11)
Alive at 1-year (live-born)	5/13 (39)††	0/36 0	19/39 (49)	10/35 (29)	17/32 (53)†	14/48 (29)	24/36 (67)†	29/65 (45)	82/131 (63)	9/17 (53)	37/53 (70)	40/62 (65)
Alive at 1 year without major neonatal morbidities	1/5 (20)	0	4/19 (21)	1/10 (10)	3/17 (18)	4/14 (29)	7/24 (29)	1/29 † (3)	22/82 (27)	1/9 (11)	12/37 (32)	7/40 (18)

Abbreviations, GA, gestational age; SGA, small for gestational age (birth weight < -2SD)¹⁵; PPRM, preterm prelabor rupture of membranes, Data are presented as *n* (%) unless otherwise indicated.

^a Data are from Fellman et al.¹¹

^b Among live-born at 22 weeks, the regions with perinatal activity scores above national average had a mean score of 81 (range 61-93) and regions with scores below the national average had a mean score of 45 (range 18-60). Among live-born infants at 23 weeks, regions with scores above the national average had a mean score of 91 (range 84-96) and those with below national average had a mean score of 73 (range 53-82).

P value determined using chi-square or Fisher's exact test (if the cell size was <5) for differences between the above and below - average perinatal activity scoring regions in T1, T2 and T3.

†P≤.05; ††P<.005