RESEARCH REPORT

Register based monitoring shows decreasing socioeconomic differences in Finnish perinatal health

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Study objective: Several studies on differences in infant outcome by socioeconomic position have been done, but these have usually been based on ad hoc data linkages. The aim of this paper was to investigate whether socioeconomic differences in perinatal health in Finland could be regularly monitored using routinely collected data from one single register.
Design and setting: Since October 1990, the Finnish Medical Birth Register (MBR) has included data on maternal occupation. A special computer program that converted the occupation name into an occupational code and into a socioeconomic position was prepared. Perinatal health was measured with five different indicators. The Finnish MBR data for years 1991 to 1999 (n=565 863 newborns) were used in the study. The study period was divided into three, three year periods to study time trends.
Results: An occupational code was derived for 95% of women, but it was not possible to define a socioeconomic position for 22% of women, including, for example, students and housewives (the group "Others"). For the rest, the data showed socioeconomic differences in all perinatal health indicators. Maternal smoking explained up to half of the excess risk for adverse perinatal outcome in the lowest socioeconomic group. The socioeconomic differences narrowed during the 1990s: infant outcome improved in the lowest socioeconomic group, but remained at the same level or even deteriorated in other groups. When comparing the lowest group with the highest group, the odds ratios (OR) adjusted for maternal background characteristics at least halved for prematurity (from 1.32 (95% confidence intervals 1.24 to 1.43) in 1991–1993 to 1.16 (1.08 to 1.25) in 1997–1999), for low birth weight (from 1.49 (1.36 to 1.63) to 1.25 (1.17 to 1.40)), and for perinatal mortality (from 1.79 (1.44 to 2.21) to 1.33 (1.07 to 1.66)).
Conclusions: Social inequality in perinatal health outcomes exists in Finland, but seems to have diminished in the 1990s. These data showed that routinely collected birth register data provide a good source for studies on socioeconomic health differences in the perinatal period, but that uncertainty, mainly attributable to the large group of women with difficult to classify socioeconomic status, remains.

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Socioeconomic health differences have been studied widely in all Nordic countries. The Nordic welfare societies have declared an aim to diminish social health inequality, but socioeconomic differences in mortality, morbidity, and the utilisation of healthcare services among the general populations have been reported for all these countries in the 1980s and 1990s.[1] This is also true as regards perinatal and childhood health. According to previous Finnish studies based on data for the 1987–1993 period, there is increased risk for adverse infant outcome among unmarried women,[2] among women with short education[3 4] and among women with low socioeconomic status as defined by maternal occupation.[5 6]

After a steep economic recession in the early 1990s, Finland experienced a boom economy that substantially enlarged differences in income distribution.[7] This, along with continuously high unemployment rates, may have widened socioeconomic health differences. Compared with the previous decade, the socioeconomic differences in mortality intensified in the 1990s, mainly because of increased mortality attributable to cardiovascular diseases and increased use of alcohol in the lowest socioeconomic groups.[8] In contrast, the differences in morbidity did not change.[9] The trends regarding socioeconomic differences in perinatal health have not been investigated after the early 1990s.

Studies on socioeconomic differences require large datasets. Collection of ad hoc research data tends to be expensive and time consuming,[10] which decreases the feasibility of their use in such studies. National administrative health registers provide an alternative data source,[11 12] but they usually include only limited background information. In the most extreme case only data on age, sex, and residence are collected.[13] In Finland, this limitation can be bypassed with data linkage to other sources, such as the Central Population Register, which contains information on occupation,[5] and to the Education Register,[3] the Taxation Register,[14] and census data, which include several variables related to living conditions.[15] Even though the existence of a nationwide person identification system makes such data linkage technically comparatively easy, it may be administratively complicated and expensive.[16] In addition, data linkage has to be done in a research context, and routine linkage is prohibited by the Finnish data protection legislation.

Since October 1990, the Finnish Medical Birth Register (MBR) has included information on the mother's occupation at the time of birth. The aim of this study was to investigate the feasibility of using that information in studying socioeconomic differences in perinatal health by using the 1991–1999 MBR with information on more than 565 000 newborns. We also wanted to test, whether socioeconomic differences increased among newborns in Finland in the 1990s, as was the case with socioeconomic differences in mortality among the adult population.[8]

METHODS

The MBR was started in 1987 and it is run by the National Research and Development Centre for Welfare and Health. The register includes information on maternal background, on

Table 1 Parturients by socioeconomic groups, Finland, 1991–1999, %

		1991–1993	1994–1996	1997–1999	1991–1999	Number
I	Upper white collar workers	14.2	15.3	15.9	15.1	84175
II	Lower white collar workers	48.0	45.1	41.2	44.9	250391
III	Blue collar workers	18.9	17.8	16.5	17.8	99040
O	Others	18.9	21.8	26.4	22.2	123687
	—of which					
	Entrepreneurs	0.9	0.9	1.0	0.9	5118
	Farmers	1.0	1.0	1.0	1.0	5635
	Students	5.0	6.9	7.5	6.4	35790
	Retired	0.1	0.1	0.1	0.1	407
	Unemployed	0.2	0.5	0.6	0.4	2292
	Housewives	6.5	7.8	7.0	7.1	39582
	Unclassifiable	1.7	0.6	2.8	1.7	9346
	Missing	3.5	4.0	6.4	4.6	25465
Total		100.0	100.0	100.0	100.0	557293

care and interventions during pregnancy and delivery, and on newborns' outcome until the age of seven days. The data are collected at all delivery hospitals, and in case of home births, by the assisting health care personnel.[17] All live births and stillbirths with a gestational age of 22 weeks or more, or with a birth weight of 500 grammes or more, are included in the register.[18] During the study period from 1991 to 1999, in total 74% of the data were received electronically, with an observed increase by time from 67% in 1991 to 82% in 1999.

According to a 1991 data quality study, most of the MBR content corresponded well or satisfactorily with the hospital record data. The information on maternal occupation recorded in the MBR was in concordance with the hospital record data in 94% of cases,[17] and when categorised into four broad social classes was in concordance for 96% of cases.[19]

SAS and SQL software were used to prepare a special computer program to transform the occupation name into an occupational code and subsequently into a socioeconomic grouping (table 1). Both codings were based on national standards by Statistics Finland.[20 21] If only the highest education level was given instead of an occupation name, education was converted into a socioeconomic group according to the national classification on education.[22] The socioeconomic groups were further aggregated into four groups: SES Group I included upper white collar workers, SES Group II included lower white collar workers, SES Group III included blue collar workers, and the SES Group "Others" included all other groups.

To study trends in socioeconomic differences, the study period was divided to three, three year periods: 1991–1993, 1994–1996, and 1997–1999.

The following indicators were used to monitor perinatal outcome: (1) the number of preterm births (<37 gestation weeks based on the best estimate at delivery) per 100 deliveries, (2) mean birth weight, (3) the number of low birthweight children (<2500 grammes) per 100 newborns, (4) the number of small for gestational age (SGA) children per 100 newborns (as defined by national standards for birth weight and gestational age[23]), and (5) perinatal deaths (early neonatal deaths for infant up to seven days of life and stillbirths of 22 gestation weeks or more or with a birth weight of 500 grammes or more) per 1000 newborns.

We used *t* tests, the test for relative proportions, and χ^2 tests to study differences in background variables and perinatal outcomes by socioeconomic group. The Breslow-Day test for heterogeneity and linear regression was used to study the trend by time period.

To adjust for differences in maternal background variables, adjusted odds ratios (OR) with 95% confidence intervals (CI) for differences by socioeconomic group were calculated. Two different multiple logistic regression models were utilised: In Model I, maternal age (continuous), parity defined as the number of previous deliveries (continuous) and mother's county of residence (six) were included as confounders. To investigate how much of the socioeconomic differences was caused by maternal smoking during pregnancy, Model II further included smoking (non-smoker, smoker, no information). The contribution of smoking to socioeconomic differences was measured by the percentage reduction between the ORs for model with smoking and the OR without smoking.[24]

For all logistic regressions, only data for singletons (n=548 913) were used.

RESULTS

The feasibility of determining socioeconomic position

Creation of the program to change the occupation name into an occupational code and into a socioeconomic position was found to be challenging. For the 1991 data, all occupational codes were reviewed and entered manually into the occupational database, but subsequently only previously uncoded occupations had to be coded manually. However, information on occupation was written in Finnish and Swedish (the two official languages in Finland), and more recently increasingly also in English, which increased the work load related to coding. Furthermore, misspellings and the transfer of special characters, especially the Scandinavian letters, caused technical problems for the coding. These were solved by creating special double checking procedures to improve the quality of our program.

The final database had 25 018 different occupations and their combinations, including misspellings. We were able to assign an occupational code to 21 924 of these (87.6%) and a socioeconomic group to 23 335 (93.3%). There were an additional 787 entries (3.1%) for which only the highest education level was given, and we were able to convert 777 of them into socioeconomic status. Thus, the socioeconomic group was determined in total for 24 112 occupations, or 96.4% of those included in the database. When calculating the successful determination per woman, an occupation code was defined for 95.4%, and a socioeconomic group for 93.8% of women who were registered as having given birth.

During the study period the proportion of women in SES Group I increased (from 14% to 16%), while the proportions of those in SES Group II and in SES Group III decreased from 48% to 41% and from 19% to 17%, respectively (table 1). The proportion of women in the SES Group "Others" increased from 19% to 26%. One main reason was that the proportion of women giving birth who had no reported occupation increased from 3.5% to 6.4%. Also the proportion of those

Table 2 Maternal background characteristics by socioeconomic group and by time period, Finland, 1991–1999 (n=557293)*

		Total		1991–1993		1994–1996		1997–1999		p†
Births (n)		557293		196570		187906		172817		
Maternal age, mean and SD, years										
Upper white collar workers	I	32.0	4.5	31.7	4.2	32.0	5.1	32.3	4.2	0.026
Lower white collar workers	II	30.1	4.8	29.5	4.8	30.2	4.7	30.6	5.0	0.094
Blue collar workers	III	28.6	5.2	28.1	5.1	28.7	5.1	29.1	5.2	0.169
Others	O	27.7	5.8	27.8	5.8	27.5	5.7	27.8	5.8	0.987
	Total	29.6	5.0	29.3	5.0	29.6	5.1	29.9	5.1	0.080
Number of previous pregnancies, mean and SD										
Upper white collar workers	I	1.3	1.4	1.2	1.4	1.3	1.4	1.3	1.5	0.058
Lower white collar workers	II	1.4	1.6	1.4	1.5	1.4	1.5	1.5	1.7	0.070
Blue collar workers	III	1.5	1.5	1.4	1.4	1.5	1.5	1.6	1.6	0.305
Others	O	1.8	2.2	1.9	2.2	1.8	2.2	1.7	2.2	0.126
	Total	1.5	1.7	1.5	1.6	1.5	1.7	1.5	1.7	0.005
Number of previous births, mean and SD										
Upper white collar workers	I	0.9	1.1	0.9	1.1	0.9	1.1	0.9	1.1	0.899
Lower white collar workers	II	1.0	1.2	1.0	1.2	1.0	1.2	1.1	1.3	<0.001
Blue collar workers	III	1.0	1.1	1.0	1.1	1.0	1.1	1.0	1.2	0.346
Others	O	1.3	1.9	1.4	1.9	1.3	1.9	1.2	1.8	0.012
	Total	1.1	1.3	1.0	1.3	1.1	1.3	1.1	1.4	0.306
Single mother, %										
Upper white collar workers	I	5.0		3.3		6.3		5.5		0.118
Lower white collar workers	II	7.9		5.1		9.7		9.1		<0.001
Blue collar workers	III	12.9		9.1		15.6		14.2		0.004
Others	O	10.3		7.3		12.2		11.8		0.002
	Total	8.9		6.0		10.8		10.1		0.529
Smoked during pregnancy, %										
Upper white collar workers	I	4.6		5.5		4.2		4.1		<0.001
Lower white collar workers	II	13.0		14.2		12.6		12.1		0.475
Blue collar workers	III	26.0		28.2		25.2		24.5		<0.001
Others	O	18.0		18.1		18.0		17.9		<0.001
	Total	15.2		16.3		14.7		14.4		0.314
Multiple birth, %										
Upper white collar workers	I	1.8		1.5		1.8		2.1		0.158
Lower white collar workers	II	1.6		1.4		1.6		1.8		0.063
Blue collar workers	III	1.4		1.4		1.4		1.5		0.058
Others	O	1.3		1.2		1.2		1.4		0.080
	Total	1.5		1.4		1.5		1.7		0.076

*All differences between the socioeconomic groups are statistically significant, p<0.001. †p Value for trend over time.

women who had an unclear, unclassifiable occupation increased during the study period. An increase was also observed in the proportions of students (from 5% to 8%) and unemployed women (from 0.2% to 0.6%), while the proportion of housewives increased at first, but levelled off to 7% in the late 1990s (table 1).

Differences by socioeconomic group

There were substantial differences in the maternal background characteristics by socioeconomic group. Upper white collar workers (SES Group I) were almost two years older than lower white collar workers (SES Group II), more than three years older than blue collar workers (SES Group III), and more than four years older than the women in the SES Group "Others". There was the least number of single mothers in SES Group I (5%) and the most in SES Group III (13%). In total 26% of women in SES Group III smoked during pregnancy, while smoking was much less frequent in SES Groups II (13%) and I (5%). The number of previous pregnancies and deliveries was highest in the SES Group "Others", but otherwise a clear reversed gradient was observed. The proportion of multiple births was highest in SES Group I (table 2).

In all socioeconomic groups the trends in maternal background factors were similar for mean maternal age (increased) and the proportion of single mothers (first increased, then decreased). The mean number of previous pregnancies and deliveries increased by 8% to 10% in SES Groups II and III, remained at the same level in SES Group I, but decreased by more than 10% in the SES Group "Others". The prevalence of smokers decreased by 13% to 14% in SES Groups II and III and by 26% in SES Group I, but remained at the same level for the SES Group "Others". The number of multiple births increased more for SES Groups I-III (34% to 40%) than in the SES Group "Others" (10%), but the Breslow-Day test for time trends remained insignificant (table 2).

A clear gradient in favour of the highest socioeconomic group was found for SES Groups I to III for all selected infant outcomes, while the mixed SES Group "Others" fell between the two extremes. An exception was perinatal mortality, for which the SES Group "Others" had the poorest outcome (table

Table 3 Perinatal outcome by socioeconomic group, Finland, 1991–1999 (n=565863)*

Children		Total	Unadjusted OR§	Adjusted OR, Model I¶	Adjusted OR, Model II**	Explanation percentage for smoking
Number		565863	548913	548913	548913	
Prematurity, %†						
Upper white collar workers	I	5.0	1.00	1.00	1.00	
Lower white collar workers	II	5.2	1.02 (0.99 to 1.06)	1.11 (1.05 to 1.18)	1.09 (1.06 to 1.13)	18
Blue collar workers	III	5.5	1.09 (1.05 to 1.14)	1.35 (1.25 to 1.45)	1.20 (1.15 to 1.25)	42
Others	O	5.1	0.98 (0.95 to 1.02)	1.30 (1.20 to 1.40)	1.23 (1.18 to 1.28)	22
Low birth weight, %‡						
Upper white collar workers	I	4.0	1.00	1.00	1.00	
Lower white collar workers	II	4.2	1.03 (0.99 to 1.07)	1.20 (1.10 to 1.27)	1.11 (1.06 to 1.15)	48
Blue collar workers	III	4.6	1.16 (1.11 to 1.22)	1.42 (1.35 to 1.49)	1.25 (1.19 to 1.31)	41
Others	O	4.1	1.01 (0.97 to 1.06)	1.41 (1.35 to 1.48)	1.31 (1.24 to 1.37)	26
Small for gestational age, %						
Upper white collar workers	I	2.1	1.00	1.00	1.00	
Lower white collar workers	II	2.3	1.07 (1.01 to 1.13)	1.20 (1.14 to 1.27)	1.11 (1.05 to 1.17)	46
Blue collar workers	III	2.8	1.30 (1.22 to 1.38)	1.57 (1.48 to 1.67)	1.28 (1.20 to 1.37)	51
Others	O	2.3	1.04 (0.98 to 1.11)	1.46 (1.37 to 1.55)	1.29 (1.17 to 1.37)	37
Perinatal mortality, 1/1000						
Upper white collar workers	I	5.6	1.00	1.00	1.00	
Lower white collar workers	II	6.2	1.10 (0.99 to 1.22)	1.18 (1.06 to 1.31)	1.15 (1.04 to 1.28)	15
Blue collar workers	III	7.4	1.32 (1.18 to 1.49)	1.50 (1.33 to 1.60)	1.41 (1.25 to 1.59)	18
Others	O	8.1	1.42 (1.27 to 1.58)	1.49 (1.32 to 1.67)	1.43 (1.27 to 1.62)	11

*All differences between the socioeconomic groups are statistically significant, p<0.001. †Gestational age less than 37 weeks, per delivery. ‡Birth weight less than 2500 g. §Crude odds ratio with 95% confidence intervals. Singletons only. ¶OR with 95% confidence interval adjusted by maternal age, parity, and county of residence. Singletons only. **OR with 95% confidence interval adjusted by maternal age, parity, county of residence, and smoking. Singletons only.

3). Similar results were found when only including singletons in the analysis (data not shown).

Adjusting for background variables in multiple logistic regression increased the differences between the socioeconomic groups as the biological background variables—especially maternal age—were in favour of the lower socioeconomic groups. The risk for women in SES Group III to have a premature birth was 35% higher than in SES Group I. The relative risk was even higher for other variables: 42% for having a low birthweight infant, 50% for perinatal mortality and 57% for having a SGA infant (table 3).

When including smoking in the logistic regression models, the excess risk for adverse perinatal outcome was reduced most for SES Group III and least for the SES Group "Others". Smoking explained up to half of the socioeconomic differences in variables related to birth weight, but less than one fifth of those in perinatal mortality (table 3).

The time trends in infant outcome were divergent. The proportions of premature births, low birthweight infants, and SGA infants increased and the mean birth weight decreased, but on the other hand the perinatal mortality rate decreased (table 4). The time trends differed by socioeconomic group: the highest socioeconomic groups as well as the SES Group "Others" followed the general pattern of deterioration, while the infant outcome in SES Group III improved. An exception was perinatal mortality, which remained unchanged in the highest socioeconomic group, but decreased in all other groups.

After adjusting for maternal background characteristics the differences between SES Groups I and II remained at the same level and remained statistically significant over the study period. This was true for all outcome variables excluding perinatal mortality, for which the differences between 1994 and 1996 and between 1997 and 1999 became statistically insignificant. When comparing SES Group III to SES Group I, the excess risk for prematurity and that for low birth weight halved from 32% to 16% and from 49% to 25%, respectively; the decrease was even larger for perinatal mortality, from 79% to 33%, but there was no change in the risk of having an SGA infant. The difference between SES Group I and the SES Group "Others" remained statistically significant for all outcome variables excluding perinatal mortality, for which a decrease in the difference was observed (table 4).

DISCUSSION

Socioeconomic differences were observed for all variables measuring perinatal outcome. Against our hypothesis, these differences decreased for all perinatal health indicators—except for tSGA—during the 1990s, even though Finland faced a severe economic recession that led to reduced social welfare benefits[25] and subsequently to increased income differences.[7] Our results also deviate from the widening mortality differences[8] and unchanged morbidity differences[9] observed among the general population in Finland, and from the widening socioeconomic differences in perinatal health in other countries (for example, in the United States[26]).

Two developments were uncovered. Firstly, the proportion of newborns with adverse infant outcome increased among the whole population, but especially in the highest socioeconomic groups. This can partly be explained by the increase in some maternal risk factors among upper white collar women: the mean maternal age increased because of further postponed childbearing,[27] and the proportion of multiple births increased.[28] The latter may be attributable to more intensive use of advanced infertility treatments.

Secondly, the newborns of the mothers in the lowest socioeconomic group had less adverse outcomes over time. This trend was not explained by maternal risk factors included in our study, and the changes in other background variables were not in favour of the lowest socioeconomic group, as the example of maternal smoking shows. We could find no reason for the both absolute and relative improvement in the lowest socioeconomic group. One explanation could be the change in the composition of occupations. As in the general population, the percentage of women in the highest socioeconomic group increased, and the proportion of women in the two lower socioeconomic groups declined. It is, however, unlikely that these changes could explain our results, because the relative changes in the sizes of the groups were relatively small.

The proportion of women in the SES Group "Others" increased from 19% to 26% during the study period, largely because of the increasing number of women with no indicated occupation (accounting for 39% of the increase) or with an unclassifiable occupation (15%). However, less than one tenth of the alterations in perinatal outcome over time would be explained if women without health problems moved from the

Table 4 Perinatal outcome by socioeconomic group and by time, Finland, 1991–1999 (n=563952)*

		1991–1993	1994–1996	1997–1999	p†	Adjusted OR‡ 1991–1993	1994–1996	1997–1999
Number		199289	190839	175735		193924	185052	169937
Prematurity, %								
Upper white collar workers	I	4.9	4.9	5.2	0.352	1.00	1.00	1.00
Lower white collar workers	II	5.1	5.1	5.3	0.506	1.13 (1.06 to 1.21)	1.16 (1.09 to 1.23)	1.10 (1.03 to 1.17)
Blue collar workers	III	5.6	5.6	5.4	0.012	1.32 (1.24 to 1.43)	1.32 (1.24 to 1.43)	1.16 (1.08 to 1.25)
Others	O	5.0	5.0	5.2	0.778	1.27 (1.17 to 1.38)	1.33 (1.24 to 1.43)	1.25 (1.17 to 1.34)
	Total	5.1	5.1	5.3	0.469			
Low birth weight, %								
Upper white collar workers	I	3.8	4.0	4.4	0.206	1.00	1.00	1.00
Lower white collar workers	II	3.9	4.2	4.4	0.021	1.14 (1.05 to 1.24)	1.21 (1.12 to 1.30)	1.16 (1.08 to 1.24)
Blue collar workers	III	4.6	4.8	4.5	0.003	1.49 (1.36 to 1.63)	1.52 (1.40 to 1.66)	1.25 (1.17 to 1.40)
Others	O	3.9	4.1	4.2	0.836	1.36 (1.23 to 1.50)	1.49 (1.37 to 1.62)	1.37 (1.26 to 1.49)
	Total	4.0	4.2	4.4	0.126			
SGA, %								
Upper white collar workers	I	2.1	2.1	2.2	0.610	1.00	1.00	1.00
Lower white collar workers	II	2.2	2.3	2.5	0.424	1.14 (1.03 to 1.26)	1.24 (1.13 to 1.37)	1.19 (1.09 to 1.31)
Blue collar workers	III	2.8	2.7	2.8	0.235	1.44 (1.30 to 1.63)	1.69 (1.51 to 1.89)	1.45 (1.34 to 1.66)
Others	O	2.2	2.2	2.4	0.829	1.20 (1.07 to 1.36)	1.59 (1.42 to 1.78)	1.39 (1.25 to 1.55)
	Total	2.3	2.3	2.5	0.342			
Perinatal mortality, 1/1000								
Upper white collar workers	I	5.7	5.4	5.6	0.258	1.00	1.00	1.00
Lower white collar workers	II	6.8	5.9	5.8	0.333	1.38 (1.14 to 1.68)	1.14 (0.95 to 1.37)	1.08 (0.89 to 1.30)
Blue collar workers	III	8.3	7.1	6.8	0.794	1.79 (1.44 to 2.21)	1.50 (1.22 to 1.85)	1.33 (1.07 to 1.66)
Others	O	9.0	8.6	6.5	0.012	1.81 (1.46 to 2.26)	1.57 (1.27 to 1.93)	1.33 (1.08 to 1.64)
	Total	7.3	6.6	6.1	0.088			
Birth weight, mean and SD, g								
	I	3554 576	3550 580	3524 584	0.340			
	II	3555 587	3543 591	3524 594	0.129			
	III	3518 605	3514 606	3499 594	0.272			
	O	3541 603	3525 601	3505 594	0.057			
	Total	3545 592	3535 594	3515 592	0.169			

*All differences between the socioeconomic groups are statistically significant, p<0.001. See also table 3. †p Value for test for trend over time. ‡Adjusted by maternal age, parity, and county of residence. Singletons only.

highest socioeconomic group to the SES Group "Others" over time, and at the same time women with health problems moved from the lowest group to the SES Group "Others". Unemployment and avoidance of harmful work exposure, increased knowledge about preventive and health promoting behaviour, and improved prenatal and delivery care are further hypothetical explanations.

Previous Finnish studies on socioeconomic differences in perinatal health that have used socioeconomic position based on maternal occupation have studied perinatal mortality only. The unadjusted OR in this study (1.50 with 95% confidence intervals 1.33 to 1.60, see table 3) is comparable to those observed in other studies: 1.35 to 1.55.[6 29 30] Previous Finnish studies on perinatal health by education[3] and by marital position[2] from the late 1980s have reported larger socioeconomic differences than observed in our study. A more recent study combining the 1991 MBR with the Education Register[4] reported higher socioeconomic differences for prematurity (adjusted OR with 95% confidence intervals 1.67 (1.47 to 1.89) *v* 1.32 (1.24 to 1.43)) and for low birth weight (2.09 (1.78 to 2.49) *v* 1.49 (1.36 to 1.63)) than did our 1991–1993 data, as shown in table 4. For perinatal mortality, the ORs were similar: (1.85 (1.33 to 2.57) *v* 1.79 (1.44 to 2.21)). This suggests that socioeconomic differences may be more prominent when investigated by education or marital status than by occupation.

Beside the general importance of promoting equity in health in all age groups, the lessening of inequalities in perinatal health is especially important because of the theory—even though controversial—suggesting that health problems in utero and right after birth are related to several major diseases in adulthood.[31 32] Socioeconomic health differences in early life may manifest as even larger differences in adulthood. The known behavioural risk factors, such as smoking and

Key points

- Monitoring of socioeconomic differences over time is important, but it can seldom be done routinely.
- This article shows that a routinely collected administrative register can include a measurement of socioeconomic status.
- Socioeconomic differences in perinatal health still exit in Finland, but our data suggest that they have decreased in the 1990s.
- Smoking explains up to half of adverse perinatal outcome among mothers in the lowest socioeconomic group.

unhealthy diet, are over-represented among the lower socioeconomic groups,[33 34] and it has been suggested that conditions like economic hardship, poor living conditions, low social support, and other social problems in early life may be connected with poor adult health.[35 36]

Our data showed that up to half of the differences in the adverse perinatal outcome could be explained by maternal smoking. This is in accordance with a previous observational study in Finland.[37] But this need not mean that the observed effect is directly causal: smokers may also have other characteristics or circumstances, not measured in the MBR data, which may have contributed to the adverse outcome. Smoking cessation trials, however, have benefits for the infants.[38] These trials support the notion that maternal smoking causes adverse perinatal outcomes.

An essential requirement for our conclusions is that the register information be of high quality. This has been shown for occupational data in the Finnish MBR.[17] The national classifications on occupations and socioeconomic position were updated in 1997,[39] but they have not been implemented in the MBR because such changes tend to be costly and time consuming. This may not, however, affect our results as the socioeconomic position was categorised in four broad groups, minimising the effect of modified classifications.

During the 1990s, the Finnish labour market underwent a major structural change, and this may have affected the collection of socioeconomic data that uses maternal occupation. So called "atypical work contracts" have become more common: young people—especially young women of reproductive age—do not receive permanent work contracts, but short-term ones only. There is no evidence about how this affects the collection of occupational data. It is probable that this may increase the number of women with hard to classify work situations, especially if short-term work contracts are followed by a period of unemployment or further education. Thus, our finding of decreasing socioeconomic differences in perinatal health has to be verified by data linkages with other (register based) data on socioeconomic position.

Ideally, information gathered on occupation would also include data on the working place. However, it is unrealistic to attempt to gather reliable information on both occupation and the work place in routine data collection, the primary aim of which is to collect medical information. We doubt that the collection of reliable information on health by disposable income—as proposed by the European Parliament and the Commission of the European Communities[40]—can be done routinely, but the example of Estonia shows that the collection of information on completed education can be feasible as regards a nationwide MBR.[41]

Previous Finnish studies have reported that mothers' socioeconomic position is a more powerful indicator of health inequalities than is fathers' socioeconomic position,[42] but information on fathers' socioeconomic position could be used to get a more complete picture on socioeconomic circumstances. In Finland, information on husbands and on men who have confirmed their fatherhood in a juridical process[43] can be obtained from the Central Population Register for ad hoc research, but not for routine surveillance. Also the use of general social assistance can be used as a surrogate socioeconomic measurement indicating economic hardship and/or poverty in Finland, because both the applicant's and his/her spouse's identification numbers are available at national level.

To conclude, in Finland routine register data can be used in monitoring socioeconomic differences in perinatal health. Our data collection method would be important for countries where data linkages between different registers are prohibited or where the lack of unique identification numbers makes such linkages complex and time consuming. To minimise systematic bias related to our data collection method, the validity of our data as well as our results on decreasing socioeconomic differences should be verified by data linkages to other data sources.

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