Deliveries, mothers and newborn infants in Sweden, 1973–2000

Trends in obstetrics as reported to the Swedish Medical Birth Register

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Introduction. The aim of this report is to present descriptive data from the Swedish Medical Birth Register (MBR) reflecting trends in obstetric and neonatal practices over three decades.

Material. Since 1973 the MBR at the Swedish National Board of Health and Welfare receives information on all pregnancies in Sweden – around 95,000 annually – that have lead to delivery regarding the pregnancy, delivery and the newborn infant. In this study selected data from the MBR are presented as they have developed between 1973 and 2000.

Results. There was a shift in age distribution of childbearing women towards older women. Cigarette smoking in early pregnancy decreased from 30% to 12%. In-hospital time after both vaginal and cesarean (CS) delivery decreased and more than 50% of all women with a vaginal singleton delivery left hospital within 48 hours in 2000. The proportion of CS increased from 5 to 15% at singleton deliveries. The CS rate for breech deliveries increased and was nearly 80% in 2000. The mean birth weight increased, particularly the proportion of heavy infants. The proportion of early neonatal deaths decreased continuously, both for term infants and infants born after short gestational length, whereas no such downward trends was found for stillbirth during the last 10–15 years.

Conclusion. Although several of the changes regarding pregnancy and delivery that occurred between 1973 and 2000 could be expected to influence pregnancy outcome negatively, the trends described here generally suggest improvement in maternal and child health.

Key words: obstetrical trends; pregnancy outcome; medical birth registry

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There has been a profound development of antenatal, obstetrical and neonatal care during the past three decades. Several new methods for monitoring of pregnancy, labor and fetal well-being, growth and development have been implemented, effective analgesia during labor has become widely used and improved methods for caring for the premature or critically ill infant have been introduced. Apart from development of many medical methods in obstetrics and neonatal care, changes have also taken place outside the delivery room, that may have affected the circumstances under which women and men choose to have babies. For example, new methods for the treatment of infertility have become available to many couples. Society as a whole has changed dramatically with increasing migration across borders, one of several external factors that are likely to also affect trends in childbearing patterns.

In Sweden, general antenatal care services, free of charge to all pregnant women, have been available for more than 50 years. Nearly all (>98%) pregnant women attend antenatal care and more than 99% of Swedish deliveries take place at hospitals. Normal pregnancies and deliveries are attended by nurse-midwives with little involvement of obstetricians, whereas complicated pregnancies and deliveries are attended by obstetricians. Since
the middle of the 1980s nearly all women are offered a routine ultrasonography at 16–18 weeks of gestation, initially used for assessment of gestational age and multiple pregnancy, but gradually also for screening for major fetal malformations.

The effects of changes in medical practice and new interventions must always be assessed as a balance between benefits and risks. As it is extremely difficult and sometimes not possible to perform randomized controlled trials in many areas of obstetrics, continuous monitoring of trends of practice and subsequent outcome is important. The aim of this report is to present some descriptive data from the Swedish Medical Birth Register (MBR) that reflect trends in obstetric and neonatal practice over nearly 30 years. We propose that descriptive register data are valuable for long-term follow up of pregnancy outcome as well as of obstetric and neonatal practices and can generate hypotheses for further in-depth studies.

The Medical Birth Register

Since 1973 information regarding deliveries and newborn infants is reported to the Medical Birth Register (MBR) at the Swedish National Board of Health and Welfare. The purpose of the MBR is to form a national epidemiological database for general surveillance as well as for research and quality assessment of antenatal, obstetrical and neonatal care. A uniform national medical record was introduced into antenatal care as well as into obstetric and early neonatal care during the early 1970s, and all hospitals are obliged to submit copies from those records to the MBR since 1973. The records consist of information from all pregnancies that have lead to the delivery of a child, including stillborn infants of at least 28 weeks of gestation, regarding maternal characteristics such as age, previous pregnancies, health factors, smoking habits, family situation and drug exposure in early pregnancy, complications during pregnancy and delivery and use of pain relief during labor, mode of delivery and postpartum time at the maternity hospital ward. Information is also obtained regarding the newborn infant including stillbirth, live birth, single or multiple birth, birth weight, gestational age (mainly assessed according to last menstrual period until around mid-1980s and, thereafter, ultrasonography became the main method used), sex, Apgar score, infant diagnoses and neonatal death. The MBR has been widely used for research purposes, and it has been estimated that some 300 scientific studies have been published with data originating from the MBR. There are many examples of studies where data from the MBR have been used as a background to retrieve more detailed data from medical records or where data from MBR have been cross-linked with data from other registers at the National Board of Health and Welfare, such as the cancer register or the hospital discharge register, etc. A comprehensive list of scientific publications from the MBR can be obtained from the Swedish National Board of Health and Welfare (1). The quality of the information reported to MBR has been assessed and, although it is impossible to avoid missing data in a large register, the size of the register still makes it accurate for evaluation of aggregated data (2). Between 97% and 99% of all newborn infants registered as Swedish citizens at Statistics Sweden (SCB) are reported to the MBR. The MBR only receives information on infants born in Sweden, hospital births as well as the few home births, whereas Swedish children born outside of Sweden are only reported to the SCB.

Trends and comments

In the following, data will be presented as graphs to give an immediate impression of the time trends. The underlying exact figures can be obtained in tabulated form from the Swedish National Board of Health and Welfare (1).

Number of births and gender distribution

After a decline in the number of births during the 1970s and early 1980s, birth rates began to increase again to a peak between 1990–92 and dropped rapidly after that (Fig. 1). The peak around 1990 did not, however, reach the same level as in 1945, the year of the highest number of births ever, when 138 703 infants were born in Sweden.

More boys (51.5%) than girls (48.5%) are born, and there does not seem to be any change over time of that pattern (Fig. 1). It can be assumed that the higher number of boys born is Nature’s way of compensating for a higher mortality among boys and young men. Despite a higher mortality among males, it is not until around age 60 when the number of women in Sweden exceeds the number of men (Statistics Sweden, SCB).

Maternal age

There have been profound shifts in the age distribution among childbearing women. The proportion of young women, those below 25, has decreased whereas the older, those above 35, have increased (Fig. 2). The most common age
to have a baby in Sweden has remained between 25–29 years over the observation period (Fig. 2). In 1973, 15% of primiparous women were teenagers but during recent years, women in their teens have constituted less than 5% of primiparous women (Fig. 2). This age shift is also reflected in a profound increase in the median age at first birth, which was 23.7 in 1973 and increased to almost 28 in 2000 (Fig. 3).

**Number of children among childbearing women**

Between 40% and 45% of women giving birth in Sweden are primiparous and around 35% give birth to their second child (Fig. 4). There does not seem to have been any major shifts over time in the distribution of previous births to childbearing women although the proportion of women having four babies or more seems to have increased slightly during recent years.

**Smoking habits among pregnant women**

When smoking had been identified as a major risk factor for fetal growth and development and stillbirth, information on smoking habits at booking into antenatal care was obtained and incorporated into the MBR in 1983. Smoking has decreased in all age groups and the number of women smoking during early pregnancy seems to be very age-
specific, smoking being more common among younger women (Fig. 5). In 1983, every other teenage mother was a cigarette smoker, and, although the rate has decreased, still more than 30% of teenage mothers reported cigarette smoking at booking in 2000. During the past 3 years of the observation period, smoking seems to have increased slightly among women under 25.

Time at the maternity ward postpartum

In 1973, women would spend on average 6 days in hospital after a vaginal delivery and 9 days after a cesarean section, including all single births with or without complications. During the 1980s, programs for early discharge after normal delivery were gradually introduced in many maternity hospitals, resulting in shorter periods of hospital care (Fig. 6). Those programs vary between regions and sometimes include patient hotels or qualified follow-up at home or at local clinics, which is not reported to the MBR. Differences in time spent in hospital after delivery may also reflect local differences in resources and traditions in medical practice. Average time spent in hospital after a cesarean section in 2000 was shorter than the average time spent after a vaginal delivery in 1973, and the difference in average maternity ward time after vaginal and surgical delivery, respectively, has decreased from 3 to 2 days.
There has been a profound change over time in the proportion of women leaving hospital early, resulting in more than 50% of all women with a vaginal singleton delivery leaving hospital within 48 h (Fig. 7).

Use of pain relief during labor

Pain relief during labor was widely debated in the early 1970s and the Swedish Parliament stated that all women should be given the option of effective pain relief during labor (3). Nitrous oxide has always been widely used and during the 1970s and onwards, an increasing number of women were given epidural analgesia (Fig. 8). The increase in use of epidural analgesia, seen from 1990 and onwards is likely to be a reflection of the introduction of epidural with sufentanil, allowing the women to move around despite pain relief, which became very popular both among women in labor and hospital staff. The great increase followed by a profound decrease in the use of pudendal block, which is usually administered by midwives, is difficult to explain from scientific evidence. The decreasing use of opioids is probably reflecting reports about negative effects of those substances on the mother and fetus as well as their limited effect on labor pain (Fig. 8) (4). Since 1995, use of alternative pain relief methods, such as acupuncture, trans-
cutaneous nerve stimulation and intradermal injections of sterile water, are reported to the MBR. Acupuncture was given to around 15% of women in labor during the years 1995–2000.

Cesarean section and instrumental delivery

The proportion of cesarean sections (CS) has increased in two steps. The first increase occurred during the 1970s when the CS rate at single births increased from 5% to 11%, probably reflecting the introduction and widespread use of fetal monitoring. Having remained around 11% for some 15 years, the CS rate began to further increase around 1995 to around 15% in 2000 (Fig. 9). During 1998–2000, there was a much quoted debate in the mass media as well as among professionals about women’s right to have a CS on demand, which may reflect the increase in CS rate in the most recent years. Also the rate of CS at multiple birth has increased in two steps, the first increase occurred in the 1970s, the second in the 1990s, and in 2000 nearly every other multiple delivery was a CS (Fig. 10). There is an apparent trend in the age distribution for delivery with CS, the older the woman, the more likely she is to have a CS (Fig. 11). The rate of instrumental vaginal deliveries, of which vacuum extraction is by far the most prevalent method in Sweden, has only increased slightly during recent years (Figs 9 and 10).
Fig. 9. Proportion of cesarean sections (CS) instrumental deliveries at singleton births, 1973–2000.

Fig. 10. Proportion of cesarean sections (CS) instrumental deliveries at multiple births, 1973–2000.

Fig. 11. Distribution of cesarean sections (CS) by maternal age, 1973–2000.

Method of breech delivery

The controversy around the safest way of breech delivery has long been discussed among obstetricians in Sweden, resulting in a profound increase in CS at breech position already in the 1970s (Fig. 12). The CS rate in 2000 was close to 80% and it is probably not longer possible for most obstetricians and midwives to achieve enough practical training in vaginal breech delivery. The current CS rate, together with recent results of a large international study, showing that vaginal delivery at breech position, also at term, was associated with higher fetal risks, is likely to result in a further increase of the CS rate at breech position in the near future (5).

Multiple births

There has been an increase in the number of multiple births since the 1980s, especially of twins (Fig. 13). The most likely explanation for this is increasing use of various methods for assisted reproduction but also increasing average age among childbearing women may have contributed to the increase in multiple births. The proportion of triplets and quadruplets is low, but has increased slightly during the past 10 years. Because multiple birth is a serious complication of assisted reproduction, professional action has been taken to encourage careful monitoring of stimulated cycles and to reduce the number of embryos transferred after in vitro
fertilization (IVF). When IVF techniques were new, it was common for three embryos to be transferred, whereas improved techniques have allowed the transfer of one or two embryos, with encouraging results (6).

Birthweight
Mean birthweight has increased during the observation period (Fig. 14). The reason for this shift in birth weight is probably an increase in maternal weight and a decrease in the proportion of women who smoke during pregnancy. The increase in mean birth weight reflects the fact that the proportion of heavy (>4500 g) infants has increased, whereas there has been no increase in the proportion of extremely light (<1499 g) infants and a slight decrease in the proportion of light (1500–2499 g) infants (Fig. 15).

Gestational length
The proportion of singleton infants born with high gestational age (>42 weeks) gradually fell during the 1970s and has thereafter slowly increased, probably reflecting variations over time in policies.

Fig. 14. Mean birth weight (gram) among boys and girls, 1973–2000.

Fig. 15. Proportion of infants weighing less than 1500 g, between 1500 and 2499 g and those weighing >4500 g at birth, 1973–2000.
...and practices around labor induction at post-maturity (Fig. 16). During the observation period 1973–2000, the estimation of gestational length has changed from use of last menstrual period (LMP) to use of ultrasonography in gestational weeks 16–18. For comparison in this report, however, all gestational lengths have been calculated according to LMP and therefore it cannot be excluded that the true proportion of post-mature infants was lower during recent years than appearing in Fig. 16. There is a tendency towards an increase in the proportion of infants born in multiple pregnancy with very short (<32 weeks) and short (<36 weeks) gestational age and simultaneously the proportion of term (>36 weeks) infants decreased slightly (Fig. 17).

**Apgar score at 5 min**

The proportion of infants with low (<7) Apgar score born as singletons has not changed over time whereas the proportion of infants with low Apgar score born as multiples has decreased (Fig. 18). Low Apgar score is generally much more common at multiple births.
The definition of stillbirth in Sweden as reported to the MBR is the birth of an infant without any vital signs with a known gestational age of 28 completed weeks or more. If the gestational age is unknown the fetal length should be 35 cm or more. Intrauterine fetal death usually occurs before labor has started, and in 10–15% of the cases there is no apparent reason for the fetal death (7). From 1973 and the following 10 years, the proportion of stillborn infants and infants dying in the early (0–6 days) neonatal period decreased in parallel (Fig. 19). After that period, no further downward trend can be seen for stillbirth, whereas the proportion of early neonatal deaths has continued to decrease. Also the proportion of infants dying in the later (7–27 days) neonatal period has decreased during the period. There has been a profound decrease in early neonatal death among infants born after a short (<37 weeks) gestational length (Fig. 20). The short gestational length, as reported here, could of course reflect both maternal disease, spontaneous premature labor and premature delivery because of fetal problems, which to varying extents can affect the vitality of the newborn infant. A large proportion of premature infants

**Fig. 18.** Proportion of infants with Apgar score below 7 at 5 min, born after single and multiple pregnancy, respectively, 1973–2000.

**Fig. 19.** Proportion of stillborn term infants and term infants dying in the early (0–6 days) and late (7–28) neonatal period, 1973–2000.
who die neonatally are born with a malformation or a congenital disease. The decrease in neonatal death rates during the past 15 years may reflect both improved care for critically ill neonates as well as an increase since the mid-1980s of prenatal diagnosis with subsequent termination of pregnancies with a lethally or very severely malformed fetus.

Conclusion

During the period 1973–2000, profound changes have occurred in childbearing patterns, regarding the women and the circumstances around delivery and for the survival of the infants. This report is descriptive and does not aim to analyze the patterns seen, but rather to inspire further research. For example, a surprising difference was found between the recent profound decline in number of births in Sweden since 1992 and the lack of such a decline in nearby and culturally and politically similar Norway, whose reproductive patterns usually are similar to those of Sweden (8).

Many of the trends indicate improvement in maternal and child health over a 30-year period, although some of the most striking changes are increasing average age of women giving birth, shorter time spent at a maternity hospital postpartum, increase of cesarean section rate, a doubling of the proportion of multiple pregnancies and an increasing proportion of heavy infants, factors that could be expected to influence pregnancy outcome negatively. Improved obstetrical and neonatal medical care has certainly contributed to the positive pregnancy outcome, but, although it can only be assumed here, many of the changes in childbearing trends seen during the three decades are likely to reflect profound changes in society. Increased migration is likely to have changed the population of childbearing women which may also have had an impact on childbearing patterns and pregnancy outcome, an example of which was recently highlighted in a doctoral thesis from Sweden (9). The increasing proportion of women going through university education has probably contributed to the higher age at first birth. It can only be assumed that use of modern communication, including the Internet, has affected women’s awareness of their health options and increased their demand for sharing the decision making regarding pregnancy and delivery, which is also likely to have affected the patterns described here.

References


Fig. 20. Proportion of premature (<37 complete weeks) infants dying in the early (0–6 days) and late (7–27 days) neonatal period, 1973–2000.


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