

17. Charap, M. H.: The periodic health examination: genesis of a myth. *Ann Int Med* 95: 733-735, December 1981.

18. Stuart, R. B., and Davis, B.: Slim chance in a fat world, behavioral control of obesity. Research Press, Champaign, Ill., 1972, pp. 1-36.

The Frequency of Complications in Cesarean and Noncesarean Deliveries, 1970 and 1978

PAUL J. PLACEK, PhD
SELMA M. TAFFEL, BBA

The authors are statisticians in the Natality Statistics Branch, Division of Vital Statistics, National Center for Health Statistics, 3700 East-West Highway, Rm. 1-44, Hyattsville, Md. 20782. An earlier version of this paper was presented at the 109th Annual Meeting of the American Public Health Association, held in Los Angeles, Calif., November 1-5, 1981. Tearsheet requests to either author.

SYNOPSIS

National Hospital Discharge Survey data, collected by the National Center for Health Statistics, were

used to examine complications associated with cesarean and noncesarean deliveries in the years 1970 and 1978. Cesarean deliveries comprised 5.5 percent of all deliveries in 1970 and 15.2 percent in 1978. Two-thirds (68.4 percent) of the 1970 and 82.1 percent of the 1978 cesarean deliveries involved specified complications compared with only 14.6 percent of the 1970 vaginal deliveries and 17.8 percent of the 1978 vaginal deliveries. More than one-fourth of the 1970 and 1978 cesarean deliveries, but less than 1 percent of the vaginal deliveries, were preceded by a cesarean section delivery. From 1970 to 1978, there was both a rise in breech presentations and a shift toward surgical management of them. Also, cesarean deliveries were associated with placenta previa, fetopelvic disproportion, prolonged labor, and premature rupture of membranes. Several competing explanations have been offered for the rise in complication rates and in cesarean delivery rates.

A DRAMATIC OBSTETRICAL CHANGE in the United States has been the recent rise in the incidence of cesarean delivery, which by 1981 was the mode of delivery for 17.9 percent of all hospital deliveries. Consequently, there is increasing concern about what the maternal and infant indications for cesarean delivery are as compared with nonsurgical delivery. The study described here was undertaken to compare the frequency of complications of delivery in 1970, when the cesarean delivery rate was low, with these indications in 1978, when this rate was three times higher. The authors of a number of studies have reported an increased rate of cesarean births, discussed reasons for the rising rate, and identified some of the associated health conditions. Few investigators, however, have combined all three approaches. In our study, we examined the change in the rates of complications in delivery between two points in time with reference to the reasons for the change.

Study Methods

The National Center for Health Statistics collects data annually on discharges from short-stay hospitals

in the National Hospital Discharge Survey (NHDS). Information for the NHDS is abstracted from the face sheets of medical records, which are selected from inpatients discharged from a national sample of non-Federal general and special short-stay hospitals. Roughly 200,000 medical records are selected annually from the approximately 400 hospitals that participate in the survey, although the sampling numbers and fractions vary from year to year. A more detailed report on the design of the NHDS has been published (1). The statistics in our report are based on NHDS sample data from mothers' hospital discharge records and are "weighted up" to reflect national estimates. The numbers upon which the rates and percentages in the tables are based represent an unduplicated count of the women whose pregnancies resulted in either a live birth or a fetal death, numbers which compare well with U.S. vital statistics data on the numbers of deliveries.

The numbers and percentages of deliveries involving specified maternal and infant conditions are based on the Eighth Revision of the International Classification of Diseases (ICDA-8). There was a shift in 1979 from classifying diseases by the ICDA-

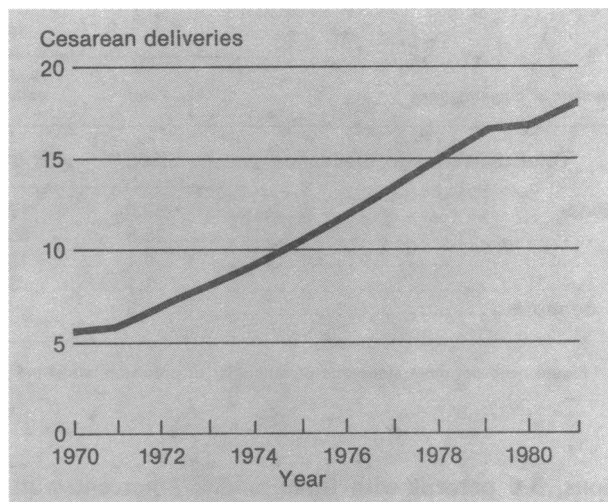
8 to classification by the Ninth Revision. Because these two classification systems are not readily comparable, 1978 was the most recent year that we could compare with 1970. Under the ICDA-8, a number of adverse infant conditions that might result in a cesarean delivery were not recorded on the mother's record, but instead were included in the ICDA-8 classification "Certain Causes of Perinatal Morbidity and Mortality." This grouping included such conditions as difficult labor, compression of the umbilical cord, RH incompatibility, and fetal distress. Thus, in our analysis, it was not possible to resolve the controversy over the role of fetal distress in determining whether a delivery would be by cesarean section, because the mother's and infant's records could not be matched. Therefore we have compared only those conditions that according to the ICDA-8 were classified as related to pregnancy rather than to delivery (such as anemia of pregnancy and genital tract infections during pregnancy), although delivery-related complications may have been implicated in cesarean delivery. Also, we did not compare the percentages for deliveries involving 4 or more complications or for some of the listed types of complications for which the weighted numerators for the percentages fell below 5,000 in 1970 or 1978 and thus failed to meet standards of reliability or precision. Percentages for these items, however, are shown in the tables to indicate the rarity of their occurrence.

Results

The chart shows that although cesarean deliveries comprised only 5.5 percent of all deliveries in 1970, this proportion rose steadily to 15.2 percent in 1978

'... there is increasing concern about what the maternal and infant indications for cesarean delivery are as compared with nonsurgical delivery. The study described here was undertaken to compare the frequency of complications of delivery in 1970, when the cesarean delivery rate was low, with these indications in 1978, when this rate was three times higher.'

Cesarean deliveries per 100 total deliveries, the United States, 1970-81



NOTE: 1970-78 data are based on the Eighth Revision International Classification of Diseases; 1979-81 data are based on the International Classification of Diseases, Ninth Revision, Clinical Modification in the National Hospital Discharge Survey.

and 17.9 percent in 1981, or from 195,000 deliveries in 1970 to 510,000 in 1978. In a previous analysis of this upward trend (2), we concluded that a fundamental and widespread change in obstetrical practice apparently had taken place, since there was a uniform increase in cesarean delivery rates in all regions, for women of all ages, for all marital statuses, for all hospital sizes, and for all types of hospital ownership.

Table 1 shows that in both 1970 and 1978, cesarean deliveries were about four times more likely than vaginal deliveries to be associated with the listed maternal and infant conditions complicating delivery. In 1970, most vaginal deliveries (85.4 percent) involved no complications of delivery; only 14.6 percent were associated with one or more complicating conditions. By 1978, four of five vaginal deliveries (78.2 percent) still involved no complications, although the percentage of vaginal deliveries associated with from one to four or more complications rose to 21.8 percent, and therefore was almost 50 percent higher than in 1970.

The trend for pregnant women to have more complications affecting delivery in 1978 than in 1970 is apparent for cesarean, as well as for vaginal deliveries (table 1). In two-thirds (68.4 percent) of the 1970 cesarean deliveries, there was one or more indications of complications compared with 82.1 percent for the 1978 deliveries. In 1978, 65.4 percent of the cesarean deliveries were associated with one complication, 12.3 percent with two complica-

Table 1. Percentage distribution of cesarean and vaginal deliveries by number of complications per delivery, United States, 1970 and 1978

Number of complications	1978			1970		
	Total	C-section deliveries	Vaginal deliveries	Total	C-section deliveries	Vaginal deliveries
Total deliveries in thousands ...	3,362	510	2,852	3,525	195	3,330
None	69.0	17.9	78.2	82.4	31.6	85.4
1	25.5	65.4	18.3	14.7	53.4	12.4
2	4.1	12.3	2.6	2.2	11.4	1.7
3	1.1	3.6	.6	.6	3.0	.5
4 or more .....	.3	.7	.2	.1	.6	.1

¹ Figure does not meet standards of reliability or precision; weighted numerator is under 5,000 deliveries.

tions, 3.6 percent with three, and 0.7 percent with four or more. The percentage of deliveries with one or more specified complications increased by 76 percent from 1970 to 1978 (from 17.6 to 31.0 percent).

Increases were noted in the percentage of all deliveries associated with placenta previa, retained placenta, fetopelvic disproportion, malpresentation of the fetus, other and unspecified prolonged labor of other origin, laceration of the perineum, premature rupture of membranes, previous cesarean section, umbilical cord complication, and other specified complications (table 2).

Notably, fetopelvic disproportion was reported for 1.3 percent of the 1970 deliveries compared with 4.2 percent of the 1978 deliveries. This rise should be interpreted cautiously, however, because the diagnosis of fetopelvic disproportion is relatively subjective. The tripling in its incidence from 1970 to 1978 may represent better reporting, better coding, or overdiagnosis to justify a cesarean delivery. A rise was also noted for breech presentation; it was reported for 2.3 percent of the 1970 deliveries compared with 3.1 percent of the 1978 deliveries. Premature rupture of the membranes increased from 1.4 percent of the 1970 deliveries to 3.3 percent of the 1978 deliveries. Finally, previous cesarean delivery was reported for only 1.4 percent of the 1970 deliveries compared with 4.4 percent of the 1978 deliveries. No decreases were noted in the rate of specified complications from 1970 to 1978.

Cesarean deliveries, as compared with vaginal deliveries, were associated with higher rates of the following specified complications, both in 1970 and 1978: placenta previa, premature separation of the placenta, fetopelvic disproportion, breech presentation, other and unspecified prolonged labor of other

origin, premature rupture of the membranes, and previous cesarean section. All these complications are medical indications for cesarean delivery and are not caused by it. Several of the complications appear to be particularly common in cesarean delivery. For example, of all 1978 cesarean deliveries, 6.8 percent involved premature rupture of the membranes, 8.7 percent prolonged labor of other origin (other and unspecified), 12.4 percent breech presentation, 24.5 percent fetopelvic disproportion, and 28.0 percent a previous cesarean birth.

Comparisons were not possible for some of the 1970 and 1978 percentages because the weighted numerator for these percentages represented less than 5,000 deliveries and thus did not meet standards of reliability or precision. These statistics are included in the tables only to indicate the rarity of certain complications.

Discussion

Various explanations that have been offered for the increased tendency for infants to be delivered by cesarean section include the following (3-7):

1. The technological monitoring of labor, which increases the chances of detecting as well as overdiagnosing fetal distress.
2. Breech presentations, for which the baby is now delivered surgically instead of vaginally.
3. A lower incidence of forceps deliveries because of their high risk to the fetus.
4. Our changing childbearing patterns in which many women delay child-bearing although it presents greater risks of complications after a woman is 30 years old.
5. The policy of having subsequent cesarean de-

Table 2. Percentage of cesarean and vaginal deliveries with specified complications, United States, 1970 and 1978

Complication of delivery	ICDA category No. ¹	1978			1970		
		Total	C-section deliveries	Vaginal deliveries	Total	C-section deliveries	Vaginal deliveries
Total deliveries in thousands		3,362	510	2,852	3,525	195	3,330
Placenta previa or antepartum hemorrhage:							
Placenta previa	651.0	0.5	2.4	0.2	0.3	4.3	0.1
Premature separation of placenta	651.1	.8	1.8	.6	.8	5.0	.5
Other antepartum hemorrhage	651.9	² .1	² .1	² .0	² .0	² .1	² .0
Retained placenta	652	1.2	² .7	1.2	.7	² .9	.7
Other postpartum hemorrhage	653	.9	² .9	.9	.7	² 1.2	.7
Abnormality of bony pelvis:							
Android	654.0	...	...	...	² .0	...	.0
Anthropoid	654.1	² .0	² .0	...	² .0	² .1	.0
Flat	654.2	² .0	² .1	² .0	² .0	...	.0
Combined type	654.3	...	...	...	² .0	² .1	² .0
Other and unspecified	654.9	.3	1.4	² .0	.2	2.6	² .1
Fetopelvic disproportion	655	4.2	24.5	.6	1.3	20.9	.2
Malpresentation of fetus:							
Breech presentation	656.0	3.1	12.4	1.5	2.3	6.1	2.1
Transverse presentation	656.1	.3	1.5	² .1	² .1	² 1.1	² .0
Brow presentation	656.2	² .1	² .2	² .0	² .1	² .3	² .0
Face presentation	656.3	² .1	² .4	² .0	² .1	² .4	² .1
Compound or shoulder presentation	656.4	² .1	² .5	² .1	² .1	² .3	² .0
Other specified presentation	656.8	.6	² .8	.6	.2	² .3	.2
Unspecified presentation	656.9	.6	² .3	.6	.4	² .2	.4
Prolonged labor of other origin:							
Multiple pregnancy	657.0	.9	2.3	.7	.8	² 1.3	.8
Uterine inertia	657.1	.6	1.5	.5	.5	² 1.6	.5
Cervical dystocia	657.2	² .1	² .4	² .0	² .1	² .9	² .0
Other and unspecified	657.9	.2	8.7	1.0	.8	5.5	.5
Laceration of perineum without mention of other laceration:							
First degree	658.0	2.9	² .0	3.4	2.3	...	2.4
Second degree	658.1	1.5	² .0	1.7	1.1	...	1.1
Third degree	658.2	3.2	² .0	3.7	1.5	² .1	1.6
Unspecified degree	658.9	1.0	...	1.2	1.0	...	1.0
Rupture of uterus	659	² .0	² .3	² .0	² .1	² .5	² .0
Other obstetrical trauma:							
Laceration of urethra	660.0	.3	...	.3	² 0.1	...	² .1
Laceration of cervix	660.1	.6	² .1	.7	.6	...	.7
Other and unspecified	660.9	.2	² .3	.2	.2	² 0.3	.2
Other complications:							
Premature rupture of membranes	661.0	3.3	6.8	2.6	1.4	3.2	1.3
Precipitate labor	661.1	.2	...	.2	² .1	...	.1
Previous cesarean section	661.2	4.4	28.0	.1	1.4	25.1	² .0
Umbilical cord complication	661.3	1.4	2.2	1.2	.7	² 1.9	.6
Stillborn delivery (gestation 28 or more weeks or not stated gestation)		.9	² .9	.9	.9	² 1.6	.9
Other specified complications	661.8	1.3	3.9	.8	.4	² 1.7	.3
Unspecified complication	661.9	.4	² .8	.4	² .0	...	² .0

¹ Category number of the Eighth Revision International Classification of Diseases. Adapted (ICDA), 1965.

² Figure does not meet standards of reliability or precision; weighted numerator is under 5,000 deliveries.

NOTE: Some of the percentages may add to more than 100.00 because there may be more than one complication per delivery. Leaders (...) indicate absolute zero, whereas .0 indicates that the number rounds to zero.

liveries if there has already been one such delivery (“once a C-section, always a C-section”).

6. The fear of malpractice suits, which may cause precautionary obstetrics to be practiced if there is any indication of fetal distress.

In 1970, 2.3 percent of all deliveries (6.1 percent of cesarean deliveries and 2.1 percent of vaginal deliveries) involved breech presentations. By 1978, the percentage of all deliveries that involved breech presentations rose to 3.1 percent—12.4 percent of

'The results of our analysis strongly support the obstetrical norm of "once a C-section, always a C-section." The cumulative effect of previous cesarean deliveries on the incidence of subsequent cesarean delivery is apparent in both 1970 and 1978. In each of these years, about one-fourth . . . of the cesarean births were to mothers who previously had had a cesarean delivery. . . .'

cesarean deliveries compared with only 1.5 percent of vaginal deliveries. No comparable rise in breech presentations has been reported in the medical literature (according to a July 30, 1982, personal communication from Dr. Warren Pearse, Executive Director, American College of Obstetricians and Gynecologists). Either improved reporting or else over-reporting to justify greater intervention may account for the 35 percent increase in the incidence of breech presentation in this period. Not only has there been an increase in reported breech presentations, but also a shift in the obstetrical management of breech presentations has taken place, so that a greater percentage of the infants involved are delivered surgically rather than vaginally. In 1978, the method of delivery in about 60 percent of the breech presentations was by cesarean section, whereas in 1970 this method was used for only 15 percent of the breech presentations (table not shown).

The results of our analysis strongly support the obstetrical norm of "once a C-section, always a C-section." The cumulative effect of previous cesarean deliveries on the incidence of subsequent cesarean delivery is apparent in both 1970 and 1978. In each of these years, about one-fourth (25.1 percent in 1970 and 28.0 percent in 1978) of the cesarean births were to mothers who previously had had a cesarean delivery. Because of the "once a C-section, always a C-section" norm, almost all deliveries following a cesarean delivery are likely to be cesarean. Evidence for this generalization can be found in the vaginal deliveries category: only 1/10th of 1 percent or less of the 1970 and 1978 vaginal deliveries were to women who had previously had a cesarean delivery. In our earlier study, we found that more than 1 in 10 teenage mothers had delivery by cesarean section in 1978, and this fact forebodes rising cesarean rates in the future since these young

mothers are in the early childbearing period, and many will experience subsequent deliveries, most of which may be by cesarean section.

We also found a trend toward reporting more complications in 1978 as compared with 1970. Part of this increase in reported complications is due to the inclusion of a previous cesarean delivery as one of those complications. As noted earlier, the percentage of all mothers who had at least one complication in 1970 was 17.6 percent, compared with 31.0 percent of all mothers in 1978.

Several additional feasible explanations could account for the greater number of maternal and infant complications and of cesarean deliveries in 1978. One is the widespread use of technological monitoring techniques, by which complications are detected that would have gone unnoticed in previous years. Thus, although the same conditions may have existed in 1970, they could not be detected as readily, so that cesarean delivery was less frequent. Also, precautionary obstetrics and an increased fear of medical malpractice suits may cause physicians to make a more meticulous assessment of complications and conditions. Empirical studies of these explanations are underway, and the medical community is beginning to take a closer look at the emerging obstetrical norms associated with the new technologies for the management of pregnancy.

References

1. Haupt, B. J.: Utilization of short-stay hospitals: annual summary for the United States, 1980. Vital and Health Statistics, Series 13, No. 64. National Center for Health Statistics, Hyattsville, Md., 1982.
2. Placek, P. J., and Taffel, S. M.: Trends in cesarean section rates for the United States, 1970-78. Public Health Rep 95: 540-548 (1980).
3. Marieskind, H. I.: An evaluation of cesarean section in the United States. Report to the Office of the Secretary, Department of Health, Education and Welfare. Washington, D.C., June 1979.
4. National Institute of Child Health and Human Development: Consensus Development Conference: Cesarean childbirth. DHHS Publication No. (NIH) 82-2067, October 1981. National Institutes of Health, Bethesda, Md.
5. Hobbins, J. C., Freeman, R., and Queenan, J. T.: The fetal monitoring debate (editorial). Obstet Gynecol 54: 1 (1979).
6. Williams, R. L., and Hawes, W. E.: Cesarean section, fetal monitoring and perinatal mortality in California. Am J Public Health 69: 867-870 (1979).
7. Petitti, D., Olson, R. O., and Williams, R. L.: Cesarean section in California 1960 through 1975. Am J Obstet Gynecol 133: 391-397 (1979).