


KANSAS

Cesarean Section Rates and Vaginal Birth After Previous Cesarean Rates, Kansas, 1990-1999



Research Summary

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Introduction

This report presents trends in cesarean rates (total and primary) and vaginal birth after previous cesarean (VBAC) rates from Kansas birth certificate data for 1990-1999. A comparison of rates for two 5-year periods (1990-1994, 1995-1999) is presented by selected characteristics.

A c-section is a surgical procedure associated with childbirth in which the infant is delivered through an incision made in the mother's abdominal and uterine wall. When a woman undergoes this procedure for the first time it is referred to as a primary cesarean.

The c-section rate in this country has come under scrutiny due to its dramatic increase in the 1970s and 1980s and because it is among the highest for developed nations. Some alarm has been expressed at the frequency of the procedure. Although this procedure can save lives, it is associated with increased risks for maternal death and morbidity and perinatal morbidity. (CDC MMWR Weekly, Vol. 44, No. 15, 1995) C-sections have long been regarded as more dangerous than vaginal births, with medical risks for the mother, including infection, hemorrhage, psychological complications, injury to other organs and even death. For the infant, prematurity, laceration, and respiratory problems are possible risks. Additionally, a cesarean costs nearly twice as much as a vaginal birth. In response, the U.S. Department of Health and Human Services has targeted a 15 percent cesarean rate as one of the Healthy People 2000 Objectives. According to the World Health Organization (WHO), no region in the world is justified in having a cesarean rate greater than 10 to 15 percent. (Slon, Online) However, there has been some concern on the part of maternal and child health professionals that the federal government's Healthy People 2000 goal of reducing the U.S. cesarean delivery rate to 15 percent of deliveries may put some mothers and infants at risk. An article in the *New England Journal of Medicine* (1999), written by four Harvard Medical School doctors, contends that the advantages of a vaginal delivery only apply to safe vaginal deliveries and that reducing the rate of c-section deliveries may lead to higher costs and more complications for mothers and their babies. Even so, the Healthy People 2010 goal remains at 15 per hundred deliveries. (Sachs et al., Online)

One proposed strategy to reduce the c-section rate is to encourage women to attempt a vaginal birth (VBAC) after they've had a cesarean. Therefore, in addition to establishing the Healthy People 2000 objective that monitors the cesarean delivery rate, an objective was established to increase the VBAC rate to 35.0 per 100 women who had a previous cesarean. The old adage "Once a c-section, always a c-section" is outdated now that most uterine incisions are low and horizontal and reduce the risk of rupturing the uterus. According to the American College of Obstetricians and Gynecologists (ACOG), most low risk women who have had a low transverse c-section can deliver vaginally in subsequent deliveries. (Slon, Online) A major risk of a VBAC, which involves attempting a natural vaginal delivery after a previous cesarean, is that the uterus may rupture during labor, resulting in hemorrhage, and require hysterectomy. This risk of uterine rupture is approximately one percent. For the fetus, the risk is hypoxic injury. (Sachs et al., Online)

In July 1999, ACOG issued a new guideline which continues to endorse VBAC, but recommends a cautious approach and consideration of maternal risk factors before attempting labor after a previous cesarean. ACOG emphasized the need for institutions offering VBAC to have the facilities and personnel, including obstetric, nursing and anesthesia personnel, immediately available to perform emergency cesarean delivery when attempting a natural vaginal delivery for women with an existing uterine scar. (Rose, Online) The article in the *New England Journal of Medicine* gives doctors another reason to rethink strict adherence to the Healthy People goals. The authors call for a moratorium on efforts to further reduce the nation's c-section rate until the safety of women and their babies can be assured. They suggest that decisions to perform c-sections are more likely to be based on economic concerns than on concern for the mother and her child. (Sachs et al., Online)

However, this more cautious approach may lead to increases in cesarean deliveries. A report from the National Center for Health Statistics shows that the rate of c-section deliveries in the U.S., after falling steadily from 1990-1996, has began to rise (Figure 2). (National Vital Statistics Report, Vol. 49, No. 1, 2001) According to Sally Curtin of the center, the reasons for the increase aren't clear, but it is widespread among women of all ages and across most of the country, which suggests a change in medical practice. (Schmid) The rise in the overall cesarean rate, after a steady decline during the decade, may indicate that ACOG's more cautious approach may result in more repeat and total cesareans, and fewer VBACs. This reversed trend may also be due to patients' concerns about complications related to VBAC and to the fact that as VBACs become more prevalent and lawsuits related to uterine rupture increase, physicians are more likely to suggest a repeat c-section. (Shelton, Online) Dr. Frederic Frigoletto, of ACOG, states that "Many of us think that the present turn up (in cesareans) has been the result of the growing awareness of this risk on the part of the mother and the doctor." (Schmid) The increasing c-section rate signals the need for further research and discussion.

Comparisons of rates or percents have been tested for statistical significance, and a statement that one is higher or lower than another indicates that the difference is indeed statistically significant. Information on the methods used to test for statistical significance, as well as additional information on residence data, computation of rates, rate reliability, race/ethnicity, adequacy of prenatal care utilization index, and handling of unknowns, is presented in the technical notes.

Cesarean Rates

There were over 6,000 c-section births to Kansas residents each year from 1990 to 1999. A total of 71,632 c-section births during these years accounted for 19.0 percent of all Kansas resident live births (Table 1). In the 1990s Kansas' cesarean section rate reached a low of 16.6 per 100 births in 1998 but climbed to 19.7 the following year. This increase in the cesarean rate comes after a steady decline between 1990-1998, from 21.8 to 16.6, and may result in Kansas not reaching the 15 percent Healthy People goal in 2000 (Table 1 and Figure 1).

The primary cesarean rate followed the same pattern in the 1990s, dropping from 14.0 at the beginning to 10.2 in 1998. In 1999, the rate rose 28.4 percent to 13.1 (Table 1 and Figure 1).

During the 1990s the Kansas cesarean rate was consistently below that of the U.S. (National Vital Statistics Report, Vol. 49, No. 1, 2001) The Kansas rate reached a low of 16.6 in 1998, which was 21.7 percent lower than the U.S. rate of 21.2 (Figure 2).

Cesarean rates generally declined from the early to late 1990s in most demographic and pregnancy risk groups, as shown in Table 2, where rates were calculated for two 5-year periods, 1990-1994 and 1995-1999, by selected characteristics. Overall, the cesarean rate fell 12.8 percent, from 20.3 to 17.7, from the earlier to the later time period. Meanwhile, rates for whites and blacks dropped 13.2 percent and 10.2 percent, respectively. The rate for Hispanic mothers declined 9.8 percent. Rates for married and unmarried mothers fell 11.7 and 16.3 percent, respectively.

By age group, the largest declines in rates were among the youngest mothers: 21.1 percent for mothers younger than 20, 17.9 percent for mothers aged 20-24, and 14.8 percent for mothers aged 25-29. These declines in rates for younger mothers from earlier to later 1990s had the effect of magnifying the disparity in rates between age groups, since rates were already higher for older women. For 1990-1994, the rate of 23.6 for mothers aged 35 and over was 42.2 percent higher than the rate of 16.6 for mothers younger than 20. For 1995-1999, the difference in rates from youngest to oldest was 70.2 percent.

Cesarean rates were lowest during both time periods for mothers giving birth to a fourth or higher-order child, as opposed to a first, second, or third child; however, the greatest decline in rates from 1990-1994 to 1995-1999, 15.9 percent, was for first births.

Cesarean rates were lower for mothers who gained between 15 and 33 pounds during pregnancy than for those who gained either less than 15 pounds or 34 or more pounds. The rate for those gaining less than 15 pounds showed the smallest drop, 6.7 percent, over time. In fact, rates rose from 1990-1994 to 1995-1999, though not by a statistically significant amount, for births of less than 32 weeks gestation and for infants weighing less than 1,500 grams.

Cesarean rates were lowest, and showed the greatest decline over time, for mothers with less than 12 years of education. They rose with educational level until college graduation, when rates fell again. Rates were lower, also, for mothers who received inadequate or intermediate care, based on the Kotelchuck Index, than for those receiving adequate or adequate plus care. Rates for mothers receiving adequate plus care were by far the highest.

By medical risk factor, the highest cesarean rates were for mothers who experienced genital herpes and pre-eclampsia, though those rates fell 18.0 and 14.6 percent, respectively, from 1990-1994 to 1995-1999. The largest drops in rates between the two time periods were for anemia, 30.2 percent,

and renal disease, 27.5 percent. By complications of labor and delivery, the highest rates were for cephalopelvic disproportion, breech presentation, and placenta previa. Those rates declined only 4.2, 1.1 and 2.4 percent, respectively, although the last two were not statistically significant.

Vaginal Births After Cesarean Rates

The rate of vaginal birth after cesarean (VBAC) increased dramatically between 1990 and 1997, by 56.5 percent, from 17.0 to 26.6 vaginal births per 100 births to women with a previous cesarean. The VBAC rate fell 18.5 percent between 1998 and 1999 (from 23.8 to 19.4) and has declined 27.1 percent since 1997 (Table 1 and Figure 1). Based on the decreasing VBAC rates since 1997, Kansas may not meet the Healthy People goal (35.0) in 2000. (CDC MMWR Weekly, Vol. 44, No. 15, 1995)

As would be expected, declines in cesarean rates from 1990-1994 to 1995-1999 were accompanied by increases in the VBAC rate for almost every category of the selected characteristics in Table 3. Overall, the VBAC rate rose from 20.1 to 23.7, an increase of 17.9 percent.

VBAC rates increased most, 29.1 percent, for mothers under 20, whose rates were initially higher than those of older mothers. They also were highest and increased most for first (live) births, by 43.3 percent, perhaps partly because such births would be more likely to occur to younger mothers. The reason that VBAC rates can be calculated for first births is because cesarean sections may have been performed for previous deliveries other than live births.

The VBAC rate was lowest for mothers gaining less than 15 pounds during pregnancy. However, that was also the group whose rate increased the most between the two time periods, from 15.9 to 19.2. As mentioned above, there is an association between low maternal weight gain and low-birth weight and preterm infants, for whom the likelihood of cesarean delivery is greatest. Therefore, one would expect VBAC rates to be lowest for births of those infants; and, in fact, where there were enough events to calculate rates, there were lower rates for lower birth weights and for fewer weeks of gestation.

For the groupings by mother's education and prenatal care, VBAC rates rose in a pattern similar to the fall of cesarean rates, being highest for mothers with less than 12 years of education and those receiving inadequate or intermediate levels of prenatal care. For medical risk factors and complications of labor and delivery, in the cases where there were enough events to calculate rates, differences between rates from 1990-1994 and 1995-1999 were not statistically significant.

Highlights

- A cesarean section is major abdominal surgery. When a cesarean is necessary, it can be a life-saving technique.

- A cesarean section poses documented medical risks to the mother, including infection, hemorrhage, psychological complications, injury to other organs and even death.
- A c-section increases the risk to the infant of premature birth, laceration, and respiratory problems.
- Healthy People 2000 set a goal of reducing the c-section rate to 15 c-sections per 100 deliveries. This goal remains unchanged for Healthy People 2010 even though there is concern that the movement to reduce the c-section rate may ultimately lead to higher costs and more complications at delivery.
- Cesarean rates are generally higher for women who are older, are married, have generally higher levels of education and better prenatal care. These trends are reversed for VBACs, except that differences in rates by mother's education, and marital status were not statistically significant.
- Of the 71,632 c-sections to Kansas residents in the 1990s, 30,415 (42.5 percent) were repeat operations (Table 1). In the U.S., during this same time period, over one-third (36.1 percent) of all cesareans (1,348,288) are repeat cesareans (486,119). Therefore, a major initiative for reducing the cesarean delivery rate has been to encourage women to attempt a vaginal birth after a cesarean delivery (VBAC).
- In the past, it was believed that once a woman had a cesarean section, all of her subsequent deliveries should also be cesarean. Current medical opinion is that most of these women can attempt a natural vaginal delivery. According to ACOG, most low risk women who have had a low transverse c-section can deliver vaginally in subsequent deliveries.
- In July 1999, ACOG issued a new guideline which continues to endorse VBAC, but recommends a cautious approach and consideration of maternal risk factors before attempting a natural vaginal delivery after a previous cesarean.
- Efforts to reduce the rise in c-sections for Kansas residents have had some success in the 1990s. Findings in this report indicate that from 1990-1999 the overall cesarean rate dropped 9.6 percent to 19.7 while the VBAC rate rose 14.1 percent to 19.4. However, after falling each year from 1990 to 1998, the rate rose in 1999. A report from the National Center for Health Statistics showed a similar trend nationally. The rate of c-section deliveries in the U.S., after falling steadily from 1990 to 1996, increased again in 1999.
- The rise in the overall cesarean rate, after a steady decline during the decade, may indicate the more cautious approach may lead to increases in cesarean deliveries.

Table 1
 Number and Rate of Births by Cesarean and by Vaginal Birth After Cesarean
 Kansas Residents, 1990-1999

Year	Number of Live Births	Total Cesarean		Primary Cesarean		VBAC	
		Number	Rate*	Number	Rate**	Number	Rate***
1990	38,872	8,487	21.8	4,838	14.0	748	17.0
1991	37,630	8,074	21.5	4,585	13.8	814	18.9
1992	37,848	7,577	20.0	4,391	13.0	866	21.4
1993	37,283	7,222	19.4	4,157	12.5	843	21.6
1994	37,269	7,047	18.9	4,101	12.2	840	22.2
1995	37,087	6,619	17.8	3,844	11.5	892	24.3
1996	36,524	6,366	17.4	3,653	11.1	873	24.3
1997	37,191	6,252	16.8	3,498	10.5	998	26.6
1998	38,372	6,351	16.6	3,557	10.2	875	23.8
1999	38,748	7,637	19.7	4,593	13.1	735	19.4

* Rate per 100 live births

** Rate per 100 births to women with no previous cesarean

*** Rate per 100 births to women with a previous cesarean

Table 2
 Number and Rate* of Cesarean Sections, with Percent Change From 1990-1994 to 1995-1999
 by Selected Characteristics
 Kansas Resident Live Births

Selected Characteristics	1990-1994			1995-1999			Percent Change of Rate from 1990-1994 to 1995-1999
	Number of Live Births	Cesarean Deliveries		Number of Live Births	Cesarean Deliveries		
		Number	Rate*		Number	Rate*	
Total Reported	188,902	38,398	20.3	187,922	33,225	17.7	-12.8
Race/Hispanic Origin** of Mother:							
White	167,418	34,187	20.4	167,370	29,624	17.7	-13.2
Black	16,155	3,325	20.6	14,029	2,593	18.5	-10.2
Other	5,133	875	17.0	6,205	972	15.7	-7.6
N.S.	196	11	n.a.	318	36	n.a.	n.a.
Hispanic Origin	11,043	2,139	19.4	17,612	3,089	17.5	-9.8
Age of Mother:							
< 20	23,604	3,907	16.6	24,270	3,180	13.1	-21.1
20-24	52,735	10,317	19.6	50,042	8,040	16.1	-17.9
25-29	56,460	11,804	20.9	53,326	9,503	17.8	-14.8
30-34	39,737	8,506	21.4	39,762	7,939	20.0	-6.5
35 and over	16,366	3,864	23.6	20,495	4,562	22.3	-5.5
N.S.	-	-	n.a.	27	1	n.a.	n.a.
Marital Status of Mother:							
Married	143,342	29,500	20.6	136,468	24,806	18.2	-11.7
Unmarried	45,485	8,895	19.6	51,377	8,415	16.4	-16.3
N.S.	75	3	n.a.	77	4	n.a.	n.a.
Live Birth Order:							
First	73,526	15,716	21.4	73,419	13,214	18.0	-15.9
Second	61,947	12,673	20.5	61,096	10,684	17.5	-14.6
Third	33,530	6,751	20.1	32,697	5,966	18.2	-9.5
Fourth or Higher	19,896	3,257	16.4	20,681	3,358	16.2	-1.2
N.S.	3	1	n.a.	29	3	n.a.	n.a.
Weight Gain:							
Under 15 Pounds	11,515	2,579	22.4	13,407	2,805	20.9	-6.7
15-27 Pounds	56,764	10,530	18.6	53,759	8,775	16.3	-12.4
28-33 Pounds	39,695	7,575	19.1	36,974	5,833	15.8	-17.3
34 or More Pounds	76,340	16,896	22.1	78,227	14,792	18.9	-14.5
N.S.	4,588	818	n.a.	5,555	1,020	n.a.	n.a.
Mother's Education:							
< 12 Years	32,554	6,032	18.5	33,897	5,294	15.6	-15.7
12 Years	66,836	14,084	21.1	56,841	10,359	18.2	-13.7
13-15 Years	46,406	10,046	21.6	46,860	8,900	19.0	-12.0
16 or More Years	42,060	8,128	19.3	49,749	8,606	17.3	-10.4
Kind./None/N.S.	1,046	108	n.a.	575	66	n.a.	n.a.
Prenatal Care (Kotelchuck Index):							
Inadequate	20,035	3,332	16.6	16,707	2,510	15.0	-9.6
Intermediate	18,235	3,031	16.6	18,245	2,745	15.0	-9.6
Adequate	108,374	21,372	19.7	106,824	17,451	16.3	-17.3
Adequate Plus	40,918	10,459	25.6	44,228	10,268	23.2	-9.4
N.S.	1,340	204	n.a.	1,918	251	n.a.	n.a.

Table 2
 Number and Rate* of Cesarean Sections, with Percent Change From 1990-1994 to 1995-1999
 by Selected Characteristics
 Kansas Resident Live Births

Selected Characteristics	1990-1994			1995-1999			Percent Change of Rate from 1990-1994 to 1995-1999
	Number of Live Births	Cesarean Deliveries		Number of Live Births	Cesarean Deliveries		
		Number	Rate*		Number	Rate*	
Period of Gestation:							
Less than 32 Weeks	2,312	789	34.1	2,652	965	36.4	6.7
32-36 Weeks	10,752	3,176	29.5	12,489	3,447	27.6	-6.4
37-41 Weeks	167,435	32,669	19.5	167,778	27,909	16.6	-14.9
42 Weeks or More	7,487	1,677	22.4	4,559	868	19.0	-15.2
N.S.	916	87	n.a.	444	36	n.a.	n.a.
Birth Weight:							
< 1,500 Grams	2,184	813	37.2	2,428	946	39.0	4.8
1,500-2,499 Grams	9,883	2,994	30.3	10,509	2,930	27.9	-7.9
2,500 Grams or More	176,808	34,591	19.6	174,958	29,349	16.8	-14.3
N.S.	27	-	n.a.	27	-	n.a.	n.a.
Medical Risk Factors:							
Uterine Bleeding	2,831	840	29.7	2,322	554	23.9	-19.5
Hydramnios/Oligohydramnios	1,847	695	37.6	1,805	636	35.2	-6.4
Eclampsia	112	65	***	121	63	***	n.a.
Pre-eclampsia	5,592	2,301	41.1	6,344	2,224	35.1	-14.6
Genital Herpes	2,243	974	43.4	2,036	724	35.6	-18.0
Anemia	3,504	905	25.8	2,789	503	18.0	-30.2
Hemoglobinopathy	79	18	***	62	11	***	n.a.
Cardiac Disease	595	159	26.7	623	150	24.1	-9.7
Diabetes	3,731	1,352	36.2	3,785	1,258	33.2	-8.3
Hypertension, Chronic	1,098	418	38.1	1,206	420	34.8	-8.7
Acute/Chronic Lung Disease	821	204	24.8	1,498	306	20.4	-17.7
Renal Disease	858	231	26.9	698	136	19.5	-27.5
Complications of Labor/Delivery:							
Placenta Previa	528	376	71.2	547	380	69.5	-2.4
Placenta Abruptio	1,208	554	45.9	1,000	484	48.4	5.4
Other Intrapartum Hemorrhage	471	103	21.9	503	114	22.7	3.7
PROM****	5,081	1,340	26.4	4,250	1,013	23.8	-9.8
Dysfunctional Labor	3,305	1,998	60.5	2,308	1,277	55.3	-8.6
Precipitous Labor	5,489	60	1.1	4,966	40	0.8	-27.3
Prolonged Labor	2,624	932	35.5	1,915	614	32.1	-9.6
Cephalopelvic Disproportion	6,747	6,052	89.7	4,027	3,460	85.9	-4.2
Fetal Distress	7,333	4,176	56.9	5,726	3,273	57.2	0.5
Febrile	1,465	517	35.3	1,272	410	32.2	-8.8
Meconium	8,790	1,989	22.6	7,966	1,633	20.5	-9.3
Breech Presentation	5,446	4,492	82.5	5,241	4,278	81.6	-1.1
Seizures	75	47	***	67	36	***	n.a.
Cord Prolapse	323	216	66.9	260	173	66.5	-0.6
Anesthetic Complications	59	25	***	63	27	***	n.a.

* Rate per 100 live births

** Hispanic origin may be of any race.

*** Rate does not meet statistical standards of precision or reliability (designated whenever the denominator is less than 200).

**** Premature rupture of membrane

Table 3
 Number and Rate* of Vaginal Birth After Cesarean Section,
 with Percent Change From 1990-1994 to 1995-1999
 by Selected Characteristics
 Kansas Resident Live Births

Selected Characteristics	1990-1994			1995-1999			Percent Change of Rate from 1990-1994 to 1995-1999
	Repeat + VBAC	VBAC		Repeat + VBAC	VBAC		
		Number	Rate*		Number	Rate*	
Total Reported	20,427	4,101	20.1	18,450	4,371	23.7	17.9
Race/Hispanic Origin** of Mother:							
White	18,190	3,582	19.7	16,598	3,883	23.4	18.8
Black	1,818	402	22.1	1,400	363	25.9	17.2
Other	414	116	28.0	435	120	27.6	-1.4
N.S.	5	1	n.a.	17	5	n.a.	n.a.
Hispanic Origin	1,199	280	23.4	1,906	485	25.4	8.5
Age of Mother:							
< 20	794	221	27.8	521	187	35.9	29.1
20-24	4,851	1,016	20.9	3,835	976	25.4	21.5
25-29	6,792	1,365	20.1	5,760	1,427	24.8	23.4
30-34	5,646	1,108	19.6	5,356	1,183	22.1	12.8
35 and over	2,344	391	16.7	2,977	598	20.1	20.4
N.S.	-	-	n.a.	1	-	n.a.	n.a.
Marital Status of Mother:							
Married	16,778	3,333	19.9	14,903	3,452	23.2	16.6
Unmarried	3,648	768	21.1	3,546	919	25.9	22.7
N.S.	1	-	n.a.	1	-	n.a.	n.a.
Live Birth Order:							
First***	260	99	38.1	306	167	54.6	43.3
Second	11,207	2,201	19.6	9,530	2,136	22.4	14.3
Third	6,098	1,120	18.4	5,548	1,215	21.9	19.0
Fourth or Higher	2,862	681	23.8	3,065	852	27.8	16.8
N.S.	-	-	n.a.	1	1	n.a.	n.a.
Weight Gain:							
Under 15 Pounds	1,615	257	15.9	1,838	353	19.2	20.8
15-27 Pounds	6,245	1,325	21.2	5,619	1,382	24.6	16.0
28-33 Pounds	4,264	898	21.1	3,452	873	25.3	19.9
34 or More Pounds	7,807	1,543	19.8	6,888	1,635	23.7	19.7
N.S.	496	78	n.a.	653	128	n.a.	n.a.
Mother's Education:							
< 12 Years	3,159	700	22.2	2,802	742	26.5	19.4
12 Years	7,723	1,403	18.2	5,969	1,372	23.0	26.4
13-15 Years	5,241	1,007	19.2	5,162	1,130	21.9	14.1
16 or More Years	4,250	971	22.8	4,480	1,117	24.9	9.2
Kind./None/N.S.	54	20	n.a.	37	10	n.a.	n.a.
Prenatal Care (Kotelchuck Index):							
Inadequate	1,944	459	23.6	1,507	437	29.0	22.9
Intermediate	1,694	359	21.2	1,687	514	30.5	43.9
Adequate	11,877	2,496	21.0	10,357	2,537	24.5	16.7
Adequate Plus	4,811	774	16.1	4,755	845	17.8	10.6
N.S.	101	13	n.a.	144	38	n.a.	n.a.

Table 3
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 with Percent Change From 1990-1994 to 1995-1999
 by Selected Characteristics
 Kansas Resident Live Births

Selected Characteristics	1990-1994			1995-1999			Percent Change of Rate from 1990-1994 to 1995-1999
	Repeat + VBAC	VBAC		Repeat + VBAC	VBAC		
		Number	Rate*		Number	Rate*	
Period of Gestation:							
Less than 32 Weeks	151	18	****	168	24	****	n.a.
32-36 Weeks	1,128	155	13.7	1,212	170	14.0	2.2
37-41 Weeks	18,672	3,792	20.3	16,753	4,057	24.2	19.2
42 Weeks or More	436	134	30.7	299	117	39.1	27.4
N.S.	40	2	n.a.	18	3	n.a.	n.a.
Birth Weight:							
< 1,500 Grams	156	20	****	152	20	****	n.a.
1,500-2,499 Grams	923	129	14.0	931	160	17.2	22.9
2,500 Grams or More	19,348	3,952	20.4	17,367	4,191	24.1	18.1
N.S.	-	-	n.a.	-	-	n.a.	n.a.
Medical Risk Factors:							
Uterine Bleeding	403	75	18.6	294	60	20.4	9.7
Hydramnios/Oligohydramnios	213	33	15.5	234	36	15.4	-0.6
Eclampsia	8	1	****	10	2	****	n.a.
Pre-eclampsia	570	72	12.6	599	95	15.9	26.2
Genital Herpes	363	60	16.5	315	56	17.8	7.9
Anemia	489	108	22.1	331	88	26.6	20.4
Hemoglobinopathy	9	1	****	10	3	****	n.a.
Cardiac Disease	91	23	****	83	16	****	n.a.
Diabetes	698	86	12.3	718	108	15.0	22.0
Hypertension, Chronic	174	21	****	191	27	****	n.a.
Acute/Chronic Lung Disease	97	15	****	196	40	****	n.a.
Renal Disease	119	31	****	71	17	****	n.a.
Complications of Labor/Delivery:							
Placenta Previa	112	5	****	122	8	****	n.a.
Placenta Abruptio	126	16	****	122	21	****	n.a.
Other Intrapartum Hemorrhage	54	13	****	57	15	****	n.a.
PROM*****	393	141	35.9	320	132	41.3	15.0
Dysfunctional Labor	378	57	15.1	246	50	20.3	34.4
Precipitous Labor	133	123	****	131	127	****	n.a.
Prolonged Labor	164	72	****	121	51	****	n.a.
Cephalopelvic Disproportion	1,345	13	1.0	758	3	0.4	-60.0
Fetal Distress	675	100	14.8	561	82	14.6	-1.4
Febrile	102	47	****	101	40	****	n.a.
Meconium	652	258	39.6	646	263	40.7	2.8
Breech Presentation	738	26	3.5	656	9	1.4	-60.0
Seizures	2	1	****	10	1	****	n.a.
Cord Prolapse	29	3	****	21	1	****	n.a.
Anesthetic Complications	11	2	****	13	3	****	n.a.

* Rate per 100 live births to women who had a previous cesarean (repeat cesarean + VBAC)

** Hispanic origin may be of any race.

*** VBAC rates for first births exist because cesarean section may have been performed for previous pregnancies, not just live births

**** Rate does not meet statistical standards of precision or reliability (designated whenever the denominator is less than 200).

***** Premature rupture of membrane

Figure 1.

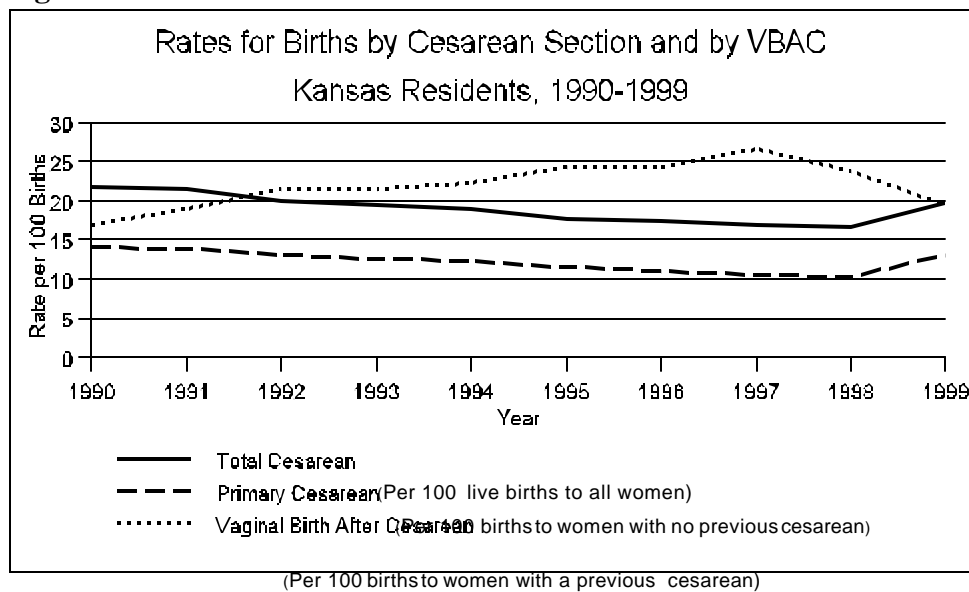
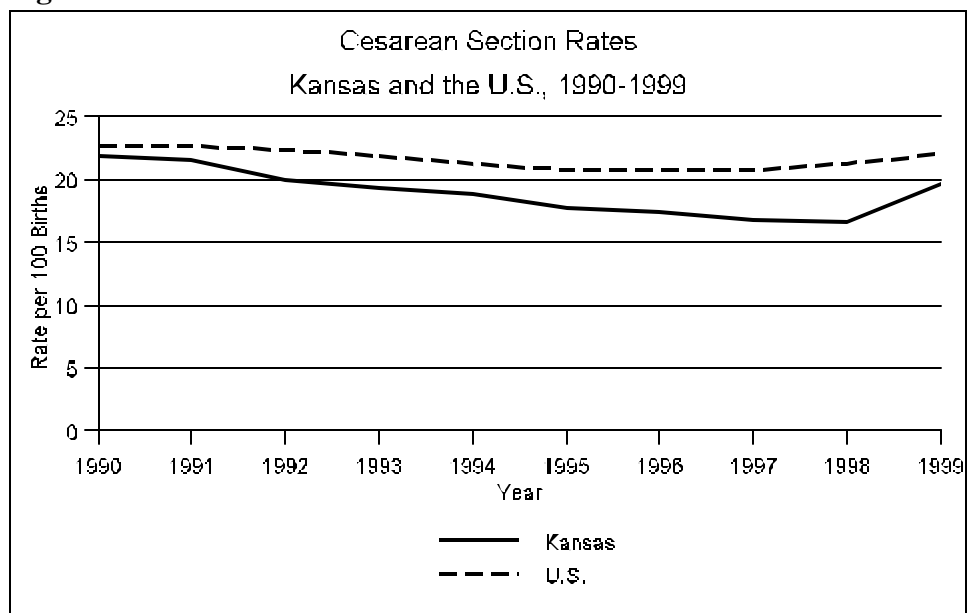


Figure 2.



Technical Notes

Residence Data

Residence data is information compiled according to the usual residence regardless of where the event occurred (including events occurring out of state).

Computation of Rates

Only records in which the method of delivery item was stated were used in the computation of cesarean and VBAC rate. The formula for the total cesarean rate is:

$$\frac{\text{Number of live births by cesarean}}{\text{Number of live births}} \times 100$$

The primary cesarean rate relates the number of first cesarean births to the total number of births to women who have not had a previous cesarean. The formula for the primary cesarean rate is:

$$\frac{\text{Number of primary cesarean births}}{\text{Number of primary cearean births} + \text{number of vaginal births (excluding VBAC's)}} \times 100$$

The VBAC rate relates the number of vaginal births to women who had a previous cesarean to the total number of women with a previous cesarean. The formula for the VBAC rate is:

$$\frac{\text{Number of vaginal births after a previous cesarean}}{\text{Number of vaginal births after a previous cesarean} + \text{number of repeat cesarean births}} \times 100$$

Rate Reliability

According to U.S. Census 2000, blacks are the dominant racial minority in Kansas, making up 5.7 percent of the total population. All other racial minority groups made up 8.1 percent of the total population (U.S. Census Bureau, Online). Due to the small minority population, and/or small number of events occurring within these minority groups, rates should be used with caution. Rates based on a relatively small number of events tend to be subject to more random variation than rates based on a

large number of events.

Race/Ethnicity

Please note that persons of Hispanic origin are those who classified themselves as Mexican, Puerto Rican, Cuban, Central or South American or other and unknown Spanish in response to questions asked on the Kansas birth certificate. Hispanic origin is not a race. It can be viewed as the ancestry or country of birth of the person or the person's parents or ancestors before their arrival in the United States. Persons of Hispanic origin may be of any race.

Adequacy of Prenatal Care Utilization (APNCU) Index

An assessment of the adequacy of prenatal care measured by the APNCU Index (often referred to as the Kotelchuck Index) is a composite measure based on gestational age of the newborn, the trimester prenatal care began, and the number of prenatal visits made.

Handling of Unknowns

For all variables, "not stated" responses were shown in tables of frequencies, but were dropped before rates were computed. To ensure the accuracy of the data, the not stated have been removed from totals when calculating percentages.

Confidence Intervals and Significance Tests

Since more than 99 percent of all births and deaths are registered, the number of vital events reported for Kansas is essentially a complete count. Although these numbers are not subject to sampling errors, they may be affected by non-sampling errors, such as mistakes in recording the mother's residence or age during the registration process.

The potential impact of variation increases as the number of events decreases. This makes resulting rates subject to volatility, and requires caution when comparing them to rates from other populations, geographic areas, and time periods.

The 95 percent confidence interval is the range of values for the number of events, rates or percent of events that you could expect in 95 out of 100 cases (95 out of 100 rule). The confidence limits are the end points of this range of values (the highest and lowest values). Confidence limits for numbers, rates and percents can be estimated from the actual number of events. Procedures differ for rates and percent calculations and also differ depending on the number of events on which the statistics are based.

Confidence limits are important in determining whether one rate is “significantly” different from another. The term “significantly” refers to whether or not the difference between two rates indicates a small probability (< 5%) the difference might have occurred by chance.

Confidence limits specify the degree of certainty that can be placed on a given number or rate. Similarly statistical significance tests try to specify how often a difference between two rates could be expected.

If the difference between two rates would occur due to variability less than 5 times out of 100, the difference is statistically significant at the 95% level. In essence, there is a 95 percent level of confidence the difference is not due to the chance variability in the rates or the number of events on which the rates are based.

On the other hand, if the difference would occur more than 5 times out of 100, then the difference is not statistically significant. If the level of certainty is only 50 percent, or even 94 percent, the difference could not occur by chance, then the difference is not statistically significant. There must be a 95 percent level of confidence when the 95 percent significance test is used.

Computing confidence limits, and ultimately statistical significance, for pairs of rates varies depending on the number of events on which each rate was created. The procedures are listed below.

Confidence limits for rates based on less than 100 events

When the numerator’s number of events is less than 100, the confidence interval for a rate can be estimated using the two formulas which follow and the values in Table 4 .

$$\text{Lower limit} = R \times L$$

$$\text{Upper limit} = R \times U$$

where:

- R = the rate (birth rate, mortality rate, etc.)
- L = the value in Table 4 that corresponds to the number N in the numerator of the rate
- U = the value in Table 4 that corresponds to the number N in the numerator of the rate

Confidence limits for rates when the numerator is 100 or more

In this case, use the following formula for the rate R based on the number of events N:

$$\text{Lower limit} = R - [1.96 \times (R / \sqrt{N})]$$

$$\text{Upper limit} = R + [1.96 \times (R / \sqrt{N})]$$

where:

R = the rate (birth rate, mortality rate, etc.)
 N = the number of events (births, deaths, etc.)

Significance test when at least one of the rates is based on fewer than 100 events

To compare two rates, when one or both of those rates are based on less than 100 events, first compute the confidence intervals for both rates. Then check to see if those intervals overlap. If they do overlap, the difference is not statistically significant at the 95-percent level. If they do not overlap, the difference is indeed “statistically significant.”

Significance test when both rates are based on 100 or more events

To compare two rates when both are based on 100 or more events, first calculate the difference between the two rates by subtracting the lower rate from the higher rate. This difference is considered statistically significant if it exceeds the statistic in the formula below. This statistic equals 1.96 times the standard error for the difference between two rates.

$$1.96 \sqrt{\frac{R_1^2}{N_1} + \frac{R_2^2}{N_2}}$$

where:

R_1 = the first rate
 R_2 = the second rate
 N_1 = the first number of events
 N_2 = the second number of events

- If the difference is greater than this statistic, then the difference would occur by chance less than 5 times out of 100. The difference is statistically significant at the 95 percent confidence level.
- If the difference is less than this statistic, the difference might occur by chance more than 5 times out of 100. The difference is not statistically significant at the 95 percent confidence level.

Confidence limits and statistical significance between two percents

When testing the difference between two percents, both percents must meet the following conditions:

$$B \times p \geq 5 \quad \text{and} \quad B \times q \geq 5$$

where:

B = number of births in the denominator
 p = percent divided by 100
 $q = 1 - p$

When both percents meet these conditions then the difference between the two percents is considered statistically significant if it exceeds the statistic in the formula below. This statistic equals 1.96 times the standard error for the difference between two percents.

$$1.96 \sqrt{p(1-p) \left(\frac{1}{B_1} + \frac{1}{B_2} \right)}$$

where:

B_1 = number of events in the denominator for the first percent
 B_2 = number of events in the denominator for the second percent

$$P = \frac{B_1 p + B_2 p}{B_1 + B_2}$$

p_1 = first percent divided by 100

Note:

The National Center for Health Statistics was used as a source for cesarean and VBAC rate formulas, as well as for confidence interval and significance tests.

Table 4. Values of Lower (L) and Upper (U) Limits for Calculating 95 % Confidence Limits For Numbers of Events and Rates When the Number of Events Is Less Than 100

N	L	U	N	L	U
1	0.02532	5.57164	50	0.74222	1.31838
2	0.12110	3.61234	51	0.74457	1.31482
3	0.20622	2.92242	52	0.74685	1.31137
4	0.27247	2.56040	53	0.74907	1.30802
5	0.32470	2.33367	54	0.75123	1.30478
6	0.36698	2.17658	55	0.75334	1.30164
7	0.40205	2.06038	56	0.75539	1.29858
8	0.43173	1.97040	57	0.75739	1.29562
9	0.45726	1.89831	58	0.75934	1.29273
10	0.47954	1.83904	59	0.76125	1.28993
11	0.49920	1.78928	60	0.76311	1.28720
12	0.51671	1.74680	61	0.76492	1.28454
13	0.53246	1.71003	62	0.76669	1.28195
14	0.54671	1.67783	63	0.76843	1.27943
15	0.55969	1.64935	64	0.77012	1.27698
16	0.57159	1.62394	65	0.77178	1.27458
17	0.58254	1.60110	66	0.77340	1.27225
18	0.59266	1.58043	67	0.77499	1.26996
19	0.60207	1.56162	68	0.77654	1.26774
20	0.61083	1.54442	69	0.77806	1.26556
21	0.61902	1.52861	70	0.77955	1.26344
22	0.62669	1.51401	71	0.78101	1.26136
23	0.63391	1.50049	72	0.78244	1.25933
24	0.64072	1.48792	73	0.78384	1.25735
25	0.64715	1.47620	74	0.78522	1.25541
26	0.65323	1.46523	75	0.78656	1.25351
27	0.65901	1.45495	76	0.78789	1.25165
28	0.66449	1.44528	77	0.78918	1.24983
29	0.66972	1.43617	78	0.79046	1.24805
30	0.67470	1.42756	79	0.79171	1.24630
31	0.67945	1.41942	80	0.79294	1.24459
32	0.68400	1.41170	81	0.79414	1.24291
33	0.68835	1.40437	82	0.79533	1.24126
34	0.69253	1.39740	83	0.79649	1.23965
35	0.69654	1.39076	84	0.79764	1.23807
36	0.70039	1.38442	85	0.79876	1.23652
37	0.70409	1.37837	86	0.79987	1.23499
38	0.70766	1.37258	87	0.80096	1.23350
39	0.71110	1.36703	88	0.80203	1.23203
40	0.71441	1.36172	89	0.80308	1.23059
41	0.71762	1.35661	90	0.80412	1.22917
42	0.72071	1.35171	91	0.80514	1.22778
43	0.72370	1.34699	92	0.80614	1.22641
44	0.72660	1.34245	93	0.80713	1.22507
45	0.72941	1.33808	94	0.80810	1.22375
46	0.73213	1.33386	95	0.80906	1.22245
47	0.73476	1.32979	96	0.81000	1.22117
48	0.73732	1.32585	97	0.81093	1.21992
49	0.73981	1.32205	98	0.81185	1.21868
			99	0.81275	1.21746

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