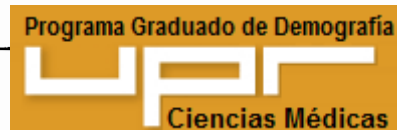


PUBLIC HEALTH

Cesarean Childbirth in Puerto Rico: The Facts

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SUMMARY. According to the last Island-wide survey carried out in 1982 in Puerto Rico, the cesarean rate for the trienium of 1980-82 was estimated in 27 percent. Since 1989, an item about the type of delivery has been included in the live birth certificate. These data indicate that the incidence of cesarean deliveries continued to increase and by 1994 it amounted to 31 percent, undoubtedly the highest rate of the world. However, its fluctuation since 1990 suggests that this type of delivery has finally steadied in Puerto Rico. The high proportion of repeated cesareans and the low percentage of vaginal birth after cesarean (VBAC) deliveries were important factors contributing to the overall rate.

Unexpectedly high risk mothers such as, adolescents, unwed and those of the lower socioeconomic status had highest cesarean rates than their counterparts. Similarly, mothers who had the most adequate prenatal care had the highest percentages of surgical deliveries. In spite of dealing with a selected clientele, the cesarean rate in private hospitals was more than twice that of public institutions. In fact, a multiple correlation analysis demonstrate that the type of hospital of delivery was the most important correlate of a cesarean. *Key words:* Cesarean childbirth, cesarean sections, repeated cesarean, VBAC deliveries, prenatal care.

During the last decades cesarean deliveries have become one of the most common surgical interventions around the world (1). As a result, many countries have experienced an enormous increase in the proportion of this type of delivery (2). One of the countries showing one of the highest levels and rates of increase is the United States although it seems that its rate has steadied during the last years (3).

In Puerto Rico, studies undertaken during the 1970's, based on fragmentary data, indicated a high incidence and an increasing trend in surgical deliveries (4). An Island-wide study carried out with 1980 data, demonstrated that Puerto Rico was probably the country with the highest rate of cesareans (5). Data obtained by the Department of Health of Puerto Rico (6) and the results of a survey carried out in 1982 (7) indicated that this type of delivery increased dramatically during the last decades and that undoubtedly Puerto Rico had the highest incidence of the world.

According to the 1982 survey, for example, the proportion of cesarean childbirth had increased continuously from 5.4 percent during the period of 1960-64 to 27.4 for the trienium of 1980-82 (7). In 1989, a new item about the type of delivery was included in the Puerto Rico's live birth certificate. In addition, the questions about mother's pregnancy risks and delivery complications were changed from "open ended" to "precoded" to standardized the responses. Based in this new data, now available for the six years period of 1989 to 1994, the author will try to confirm the findings of previous studies in relation to the level and trend of surgical deliveries in Puerto Rico. In addition, some puzzling results of previous studies, as for example, the direct association between cesarean childbirth and mother's socioeconomic status (7) will be examined.

Method

The data to be analyzed were derived from the files of all live births registered during the period of 1989 to 1994. These computerized files were obtained from the Office of Health Statistics of the Department of Health of Puerto Rico. To avoid counting mothers more than once, in the

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case of multiple births, only the data corresponding to first orders will be considered. This is a descriptive study; the proportion of cesarean deliveries will be utilized in a contingency analysis (between groups comparisons) to determine the relationships between a set of demographic and socioeconomic variables and cesarean childbirth. The same procedure will be used to examine the association between surgical deliveries and prenatal care as well as with pregnancy medical risks and delivery complications. In this detailed analysis only the 1994 data will be utilized. In trying to determine the most important predictors of cesarean childbirth a "logistic" correlation analysis will be undertaken. In this case, the dichotomy, a cesarean delivery, yes (1) or no (0), will be the dependent variable.

Results

According to live birth data, surgical deliveries continued to increase throughout the 1980's and during the first years of the 1990 decade. The rate for 1989 was 29.9 percent increasing to 31 percent in 1990 (Table 1). Since then it has fluctuated around this figure, a fact which suggests that this type of delivery has finally steadied in Puerto Rico. Similar trends are observed with respect to primary and repeated cesareans.

One of the most remarkable features of surgical deliveries in Puerto Rico is the high level of repeated cesareans. During the period of 1989 to 1994, it has fluctuated between 41 and 43 percent (Table 1). This is more than twice the corresponding figure for the United States which in 1989 was of only 17 percent. This enormous difference is mainly due to the notable difference in the incidence of vaginal births after a cesarean (VBAC). In 1989, this rate was of only 8.3 percent in Puerto Rico as compared with 18.5 in the United States .

Table 1. Cesarean Childbirth Indicators Puerto Rico: 1989-1994

Indicator Cesarean Rate*	1994	1993	1992	1991	1990	1989
All cesareans	30.9	31.3	31.0	31.3	30.7	29.9
Primary	18.3	18.0	17.6	18.0	17.6	17.3
Repeated	12.6	13.3	13.4	13.3	13.1	12.6
Percent repeated**	40.8	42.5	43.1	42.5	42.7	42.1
Percent VBAC***	9.3	8.8	8.9	8.6	8.5	8.3
Number of mothers	64,330	64,656	63,885	63,932	65,995	66,169

*Number of cesarean deliveries as a percent of all deliveries.

**Number of repeated cesareans as a percent of all cesarean.

***Number of vaginal births after a cesarean (VBAC) as percent of all mothers with a previous cesareans.

Cesarean childbirth differentials. In spite of its small territory, the incidence of cesareans varied considerably throughout the Island. In 1994, figures over 40 percent were

recorded among mothers residing in the municipalities of Yauco and Toa Alta whereas rates under 20 percent were reported for mothers living in Loiza, and Santa Isabel. And surprisingly, the geographical pattern of surgical deliveries has remained fairly stable during the period of 1989-94. In general, the proportion of cesareans tends to increase with mother's age; the lowest figures recorded among adolescents. This is true for primary as well as for repeated cesareans (Table 2). Mother's marital arrangement is clearly associated with surgical deliveries; those legally married having the highest rate both for primary as well as for repeated cesareans. Consensually married mothers had the lowest incidence of primary cesareans but the unwed (those not cohabiting with child's father) have the lowest rate of repeated (Table 2).

Table 2. Cesarean Childbirth Rates (In percent) by Selected Mother's Characteristics, Puerto Rico: 1994

Characteristic	All cesareans	Primary	Repeated	No. of mothers
Age				
Under 20	18.6	15.2	3.4	12,709
20-25	26.8	17.6	9.2	20,299
25-29	35.8	18.9	16.9	16,622
30-34	40.8	18.3	22.5	8,605
35 and over	45.0	21.4	23.6	4,477
Parity				
One	33.3	33.3	---	26,372
Two	33.8	7.2	26.6	19,245
Three	30.0	8.4	21.6	10,748
Four	19.6	8.4	11.2	4,094
Five or more	12.3	7.8	4.5	6,492
Marital arrangement				
Legally married	37.1	20.7	16.4	37,034
Consensually Married	22.3	13.3	9.0	20,195
Unwed*	23.1	15.9	7.2	6,492

* Not cohabiting with child's father.

Mother's schooling and father's occupation, two of the most commonly used socioeconomic indicators of the couple, showed, as in previous studies (7), a direct association with the rate of surgical deliveries (Table 3). In the case of mother's schooling no important differences are observed between those groups who had not completed the high school level but after that point the rate increases considerably as the number of school years completed by the mother increases. The rate of cesareans among mothers with 16 years of school completed or more, for example, was 2.5 times that of mothers who had not completed the high school level. A strong association was found with

respect to father's occupation. Mothers whose newborns had fathers with "white collar" occupations had the highest incidence of surgical deliveries whereas those whose infants had fathers with agricultural jobs had the lowest (Table 3). Working mothers had cesarean rates almost twice those of mothers out of the labor force (Table 3). This, in part, is due to the effect of the previously discussed relationship between socioeconomic status and cesarean childbirth as mothers of the highest socioeconomic strata had much higher labor force participation rates than those of lowest.

Table 3. Cesarean Childbirth Rates (In percent) by Some Socioeconomic Indicators, Puerto Rico: 1994

Indicators	All cesareans	Primary	Repeated	No. of mothers
Mother's years of school completed				
0-6	20.0	11.9	9.1	2,636
7-9	18.2	11.5	6.7	10,068
10-11	19.8	13.1	12.7	8,295
12	29.6	16.9	12.7	17,771
13-15	38.1	22.3	15.8	14,690
16 or more	45.2	26.6	18.6	11,045
Mother's labor force participation				
In labor force	46.2	27.1	19.1	18,174
Not in labor force	24.8	14.8	10.0	45,566
Father's occupation*				
White collar	38.9	21.9	17.0	17,473
Services	30.3	17.3	13.0	9,794
Manual workers	26.6	16.4	12.2	29,766
Agriculture	21.1	11.8	9.3	2,075
Unknown occupations	21.8	16.0	5.8	4,632

*White collar includes, professionals, administrators, officials, etc., clerical and sales workers. Services are all types of services. Manual workers are, craftsmen, operators and nonfarm laborers. Agriculture are farmers, farm administrators and farm laborers.

Health Care and Health Problems. Adequate prenatal care seems to be directly associated with the incidence of surgical deliveries. As shown in Table 4, the proportion of cesarean increases as the number of prenatal visits increases. Similarly, mothers who began the care in the first trimester of pregnancy have the highest rate. As a result, the Kessner Index of adequate care (8), which in addition to the number of visits and the trimester of

pregnancy in which the care began, takes into account the duration of pregnancy, shows a direct association with the incidence of surgical deliveries; the more adequate the care the highest the cesarean rate.

Table 4. Cesarean Childbirth Rates (In percent) by Prenatal Care Indicators, Puerto Rico: 1994

Indicators	All cesareans	Primary	Repeated	No. of mothers
Prenatal visits				
0-3	14.1	7.9	6.2	2,494
4-6	19.7	11.5	8.2	8,106
7-9	25.5	14.0	11.5	14,209
10-12	32.8	18.6	14.2	25,382
13 or more	43.1	28.6	14.5	13,502
Trimester of pregnancy care began				
First	33.0	19.6	13.4	48,754
Second	24.7	14.5	10.2	12,320
Third and no care	20.3	11.9	8.4	2,466
Adequacy of care (Kessner)				
Adequate	31.1	21.6	14.5	38,544
Intermediate	24.3	14.2	10.1	20,395
Inadequate	17.7	10.0	7.7	854

The majority of cesareans are related, as expected, with pregnancy medical risks and delivery complications. In 1994, 45 percent of those mothers for whom pregnancy medical risks were reported in the live birth certificate underwent a surgical delivery and almost two thirds of those having a delivery complication. Although delivery complications were more important correlates of cesarean childbirths than pregnancy medical risks as shown in Table 5, in both cases the cesarean rate increases as the number of these problems increases. The data gathered in live birth certificate, indicate that 20 percent of those mothers who did not have pregnancy risks nor delivery complications had their newborns through a surgical intervention. An examination of this group demonstrates that 66 percent were repeated cesareans whereas one third of them were primary cesareans for which a health problem was not indicated.

Chronic hypertension and uterine bleeding were reported as the most common pregnancy medical risks associated with a cesarean delivery. In 1994, the majority of those mothers for whom those conditions were reported underwent a surgical delivery (Table 6). Other important risks were diabetes and anemia. Among the leading

Table 5. Cesarean Childbirth Rates (In percent) by Number of Pregnancy Medical Risks and Delivery Complications, Puerto Rico: 1994

Number of delivery complications	Number of pregnancy medical risks			
	0	1	2 or more	Total
0	20.0	26.9	38.5	20.8
1	63.5	68.3	78.5	64.7
2 or more	81.5	77.4	83.7	80.8
Total	29.1	43.0	58.5	31.0

delivery complications cephalopelvic disproportion was the most important, reported in 22 percent of the group of mothers who had a cesarean delivery in 1994. According to the birth certificate data, 98 percent of those who had this condition had a surgical delivery (Table 6). Breech presentation and fetal distress were two other extremely important complications associated with a cesarean delivery.

Table 6. Cesarean Childbirth Rates (In percent) Among Mothers for whom the Leading Pregnancy Medical Risks and Delivery Complications were Reported, Puerto Rico: 1994

	Rate	Number of mothers
Pregnacy medical risk*		
Chronic hypertension	61.7	251
Uterine bleeding	59.0	1,144
Diabetes	49.2	594
Anemia	42.9	1,033
Pulmonary disease	24.2	186
Delivery complications**		
Cephalopelvic disproportion	97.3	3,617
Breech presentations	90.7	1,071
Fetal distress	81.8	719
Premature rupture of membranes	31.9	882
Meconium (moderate to heavy)	17.0	1,073

* No other risk

** No other complication

Hospitals and Cesareans. One of the most striking findings of this study is the extraordinary high level of surgical deliveries in private hospitals. In 1994, over 46 percent of all deliveries in private hospitals were cesareans as compared with 20 percent in public institutions (Table 7). In addition, in private hospitals there is a higher proportion of repeated cesareans and extremely low percentage of vaginal births after a cesarean (VBAC). The highest incidence of surgical deliveries in public hospitals corresponded to the University Regional Hospital, a supratertiary institution to where the most complicated cases of the Island are referred. However, the rate of 31 percent is much lower than that of private hospitals (Table 7).

Table 7. Cesarean Childbirth Rates (In percent) Type of Delivery, Puerto Rico: 1994

Type of hospital	All	Primary	Repeated	No. of mothers
Private hospitals	46.5	27.0	19.5	25,549
Public hospitals	20.5	12.5	8.0	39,191
University District Hospital	31.5	18.9	12.6	1,968
Other District Hospital	19.6	12.0	7.6	21,614
Area Hospitals	23.0	14.3	8.7	9,206
San Juan City Hospital	16.9	10.0	6.9	4,149
Other Public Hospitals	23.2	12.6	10.6	724

Another distinctive trait of private hospitals is the enormous variability among them regarding the incidence of cesarean childbirth. In 1994, the rate ranged from a low of 26 to a high of 70 percent. As shown in Table 8 in 13 out of the 31 private hospitals reporting deliveries the cesarean rate surpassed 50 percent and in seven of them it was of 60 percent or more. A similar degree of variability was observed with respect to the proportion of VBAC. In the private hospital with the largest number of deliveries (2,565) the proportion of VBAC was 25 percent as compared with less than two percent in a private hospital with 1,153 deliveries. There were eight private hospitals out of these 31 not reporting a single case of VBAC. One of these had 800 deliveries and another 608. In 1994, data tend to demonstrate that in private hospitals there is an inverse relationship between the cesarean rate and the proportion on of VBAC deliveries (Table 8). It is also clear, that there is no association between the size of the hospitals, in terms of deliveries, and cesarean childbirth indicators.

Table 8. Distribution of Private Hospitals by their Level of Cesarean Childbirth Rates and Mean Percent of VBAC Deliveries, Puerto Rico: 1994

Cesarean child birth rate (in percent)	Numbers of hospitals*	Percent VBAC
Under 35	4	21.1
35 - 44	9	6.3
45 - 49	5	3.9
50 - 59	6	1.5
60 and over	7	1.3
Total	31	5.5

* Eight private hospitals with three or less deliveries were excluded. All 31 hospitals had at least 30 deliveries in 1994.

Another puzzling result of this study is the higher proportion of surgical deliveries in private hospitals associated with mother's pregnancy medical risks and delivery complications as compared with the same conditions in public settings (Table 9). With the exception cephalopelvic disproportion among delivery complications for all other conditions the cesarean rates were considerably higher in private hospitals.

Table 9. Cesarean Childbirth Rates Among Mothers for whom the Leading Medical Pregnancy Risks and Delivery Complications were Reported by Type of Hospital, Puerto Rico: 1994

Condition	Private Hospital		Public Hospital	
	Rate	Mothers	Rate	Mothers
Pregnancy medical risk*				
Uterine bleeding	68.8	589	48.6	555
Anemia	51.3	595	31.5	438
Diabetes	54.6	363	40.7	231
Chronic hypertension	74.0	131	48.3	120
Pulmonary disease	39.4	66	15.8	120
Delivery complication**				
Cephalopelvic disproportion	97.7	2627	96.7	987
Premature rupture of membrane	42.6	378	23.8	504
Meconium	41.9	167	12.3	906
Breech presentation	95.7	535	86.1	536
Fetal distress	87.9	406	73.8	313

* No other risk

**No other complication

Discussion

By 1994, more than three out of ten of all deliveries in Puerto Rico were cesareans and thus, the Island continues to be the leading country of the world in this aspect. However, the data for the last years suggest that its incidence probably has leveled off. Cesarean rates varied considerably throughout the Island and were lower among those groups of mothers with the higher health risks. Adolescents, unwed and mothers of the lowest socioeconomic strata have had the lowest incidence of surgical deliveries since 1989 when these data began to be collected in the live birth certificate. Another unexpected result of this study is the association between cesarean childbirth and prenatal care. The proportion surgical deliveries increases as the number of prenatal

visits made by mothers increases, was highest among mothers who began the care in the first trimester of pregnancy as well among those who had the most adequate care as assessed by the Kessner index. Although prenatal care was not adopted to deal with the cesarean situation, it is to be expected that adequate prenatal care will cope with much of the pregnancy problems which results in a surgical delivery. As expected, the incidence of cesarean were clearly associated with mother's pregnancy medical risks and delivery complications. The most important pregnancy medical risks associated with cesareans were chronic hypertension, uterine bleeding and diabetes. Among the delivery complications cephalopelvic disproportion was the most important. Among 22 percent of those mothers who had a surgical delivery this type of complication was reported. Two other important ones were breech presentation and fetal distress. Those three leading complications were reported in 33 percent of all surgical deliveries. In almost all the cases in which a cephalopelvic disproportion was reported a cesarean was performed and in over 80 percent of those in which a breech presentation or a fetal distress was mentioned.

The incidence of cesarean deliveries in private hospitals is amazing. The rate for mothers delivering in this type of institution was more than twice that reported for those delivering in public hospitals. This in spite of the fact that the clientele of private hospitals is a much low risk population from a health standpoint than that of public institutions. In 1994, for example, only six percent of mothers delivering in private hospitals were adolescents, 18 percent were not legally married (in consensual unions and unwed) and only nine percent had less than high school level. The corresponding figures for those delivering in public hospitals were; 83, 91 and 49 percent. The enormous variability among private hospitals is also surprising. In a small group of these institutions the cesarean rate was of less than 35 percent but in 13 percent of them the figure was over 50 and in five (16 percent) the rate surpassed 60 percent. With respect to VBAC deliveries an opposite relationship was observed. The incidence in private hospitals was extremely low (less than five percent) with considerable variability.

In spite of dealing with a less risky population from a health stand point the proportion of mothers with pregnancy medical and delivery complications, as reported in the live birth certificate was greater from those delivering in private hospitals. According to the information included by the attending physician in this document, 15 percent of those mothers delivering in private hospitals had pregnancy medical risks and 28 percent delivery complications in 1994. The corresponding figures of those delivering in public hospitals were 10 and

19 percent. Almost all the leading pregnancy medical risks and delivery complications were reported to be more frequent among mothers delivering in private hospitals. In the case of cephalopelvic disproportion the main delivery complication, for example, it was reported in 12 percent of mothers delivering in private institutions as compare with only three percent for mothers receiving those services in public hospitals. And a cephalopelvic disproportion was informed in 26 percent of the cases of cesarean performed in private settings.

A partial correlation analysis (logistic) demonstrates that the type of hospital of delivery was the best predictor of a cesarean. This has been true since 1989, when these data began to be collected in the live birth certificate. Only two other variables of all the set of socio-demographic and prenatal care factors considered in this study has some influence over the type of delivery; mother's age and mother's parity. The partial correlation coefficients in a logistic model were: 0.126, 0.114 and 0.093 with type of hospital, mother's age and mother's parity respectively.

The results of this study indicate that the extraordinary high level of surgical deliveries in Puerto Rico cannot be attributed to health reasons which are the unique valid reasons for such a procedure.

Resumen

De acuerdo con la última encuesta sobre los niveles de fecundidad realizada en 1982 en Puerto Rico, la tasa de partos por cesárea fue de 27 por ciento durante el trienio de 1980-82. Desde 1989, en los certificados de nacidos vivos se ha incluido una pregunta sobre el tipo de parto. Estos datos indican que la incidencia de los partos quirúrgicos ha continuado aumentando y en 1994 fue de 31 por ciento. La elevada proporción de cesáreas repetidas

(42%) y como resultado el bajo porcentaje de partos vaginales luego de una cesárea (9%) son factores que contribuyeron al alto nivel de los partos por cesáreas en Puerto Rico. Inexplicablemente las madres de alto riesgo desde el punto de vista de la salud, como las adolescentes, las solteras y las de bajos niveles socioeconómicos tuvieron tasas de cesáreas mucho más bajas que sus contrapartes. De forma similar, las madres que recibieron el mejor cuidado prenatal tuvieron una mayor incidencia de partos quirúrgicos. De otra parte, las tasas de cesáreas en los hospitales privados fueron más del doble de los registrados en hospitales públicos. De hecho, un análisis de correlación múltiple mostró la mayor asociación con el parto por cesárea para el año 1994 fue el tipo de hospital.

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