



**THE ADEQUACY OF PRENATAL CARE IN PUERTO RICO AND ITS
ASSOCIATION WITH THE NEWBORN PHYSICAL CONDITIONS**

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In the 1920's prenatal care was promulgated as a preventive practice to reduce morbidity and mortality risks of the product of pregnancy and the mother. According to medical experts, prenatal care should be provided early, continuously and in accordance with high quality standards (1). Some common sense norms were suggested to comply with the first two aspects. To be adequate, prenatal care must begin in the first trimester of pregnancy and there must be a prescribed minimum number of visits during the gestational period distributed in a given fashion. In cases of pregnancy complications, additional visits could be necessary. In other words, there must be a continuous surveillance of the development of pregnancy.

These two aspects of prenatal care are relatively easy to evaluate. But the quality and content of the care, as important as the other two, is extremely difficult to quantify. Due to this difficulty, only timing and continuity are the aspects considered in most studies. It seems that the majority of the researchers prefers the trimester of pregnancy in which the care began over the number of prenatal visits as an indicator of adequacy of this care (2,3,4). Their reasoning is based on the fact that the number of visits reported could be concentrated at any interval of the gestational period, especially in the last trimester, reflecting, more than any thing else, poor prenatal care. Although this is true in an unknown number of cases, not less true is that a mother could make a visit during the first trimester of pregnancy making only

this initial one, or a few more, and this cannot be considered adequate care. In a study undertaken in 1980 in Puerto Rico, only 57 percent of those mothers who began care in the first trimester made the prescribed number of visits (5) increasing to 70 percent in 1986 (6).

For these reasons, in the present study these two indicators will be considered as well as the Kessner Index which combines them with the duration of pregnancy (7). It seems that Kessner Index is the most appropriate indicator of adequacy of prenatal care that can be obtained from the live birth certificate.

The practice of prenatal care seems to take impetus after World War II although Island-wide data began to be collected in 1978. Since that year, the month of pregnancy in which the care began and the number of visits made by the mother were new items included in the live birth certificate. In a study utilizing the 1980 data, Vázquez and Vázquez (5) found that 63 percent of the mothers began their prenatal care in the first trimester of pregnancy, making an average of 8.2 prenatal visits per mother and that only 36 percent of them received adequate prenatal care as assessed by the Kessner Index. A great improvement was observed by 1986. The Kessner Index, for example, increased by 13 points during this six-year period equivalent to 36 percent increase (Table 1).

In spite of this improvement, the Island-wide coverage of prenatal care was still considerably poor as compared with that of other countries (e.g. United States), great geographical disparities throughout the Island were observed and the adequacy of this care

varied markedly among subgroups of the population (6). In addition, in Puerto Rico there is no evidence of the health benefits of prenatal care.

Thus, the main objectives of this study are:

1. To assess the degree of adequacy of prenatal care in Puerto Rico, its changes over time and its geographical distribution.
2. To evidence the association between a set of demographic and socioeconomic variables, and adequate prenatal care. In other words, this study is directed to try to uncover some of the possible determinants of adequate prenatal care in Puerto Rico. The demographic independent variables to be considered are: mother's age, parity, and marital arrangement. The socioeconomic factors are: mother's schooling and labor force participation, father's occupation, and type of institution in which the delivery took place.
3. To examine the relationship between adequate prenatal care and the newborn health condition as assessed by his birthweight gestational age and Apgar Score. If the expected positive association between these variables is evidenced, this study will be adding support to the commonly accepted point of view that adequate prenatal care as presently defined has valuable health merits.

METHODS

The information to be analysed in this study was derived from the 1991 live birth certificates using the data file (computer tape)

obtained from the Department of Health of Puerto Rico.

As previously mentioned, three indicators of adequacy of prenatal care will be considered: the number of prenatal visits made by the mother, the trimester of pregnancy in which the care began and the Kessner's Index. Thus, we will be dealing with only two of the components of prenatal care, timing and continuity, for the quality and content of the care cannot be assess from the live birth certificate.

As this is mainly a descriptive study only simple analytic techniques will be considered (proportions, percent distributions, averages, etc.). In addition, multiple regression analyses will be undertaken to evaluate the individual effects of a set of demographic and socioeconomic variables on the adequacy of prenatal care.

RESULTS

According to the data included in live birth certificate, only 1.2 percent of the mothers did not receive prenatal care in 1991, a proportion almost identical to the figure obtained for 1986. Fifty seven percent made 10 prenatal visits or more for an Island-wide average of 9.8 visits per mother. On the other hand, 73 percent began the care in the first trimester of pregnancy and for a 57 percent of the mothers the care received was considered adequate according the Kessner Index (Table 1). These figures represents a remakable improvement since 1980.

TABLE 1

INDICATORS OF THE ADEQUACY OF PRENATAL CARE
PUERTO RICO: 1980, 1986 AND 1991

INDICATOR OF ADEQUACY	1991	1986	1980
Percent began care in the first trimester of pregnancy	73.3	70.0	62.7
Percent receiving adequate prenatal care (Kessner Index)	56.8	49.1	35.9
Percent of mothers with adequate care of those beginning it in the first trimester of pregnancy.	77.4	70.1	57.3
Average number of prenatal visits.	9.1	9.1	8.2
Number of Mothers*	66,081	63,490	70,332

*Excludes "not reported".

Source: José L. Vázquez Calzada and Severo Rivera Acevedo, "Prenatal Care, Infant Birthweight and Infant Mortality in Puerto Rico", Puerto Rico Health Sciences Journal, 8:283-287, 1989.

Geographical Inequalities:

The proportion of adequate prenatal care received by mothers varied considerably between the "municipios" of the Island. The lowest Kessner indexes were recorded among mothers residing in the "municipios" of Salinas (36 percent), Jayuya (37 percent) and Santa Isabel (39 percent). The last two are in the south coast and near to Ponce the most populated "municipio" out of the San Juan Metropolitan Area. On the other hand, the highest figures corresponded to mothers of the "municipios" of Guaynabo (75 percent), Comerío (72 percent) and San Lorenzo (72 percent). Guaynabo is located in the

San Juan Metropolitan Area while the other two belong to the east central part of the Island.

From a regional point of view, mothers of the Health Region of Ponce had the worst performance while those of Bayamón Region had the highest index of adequate care (Table 2). This pattern is somewhat similar to that observed in 1986 although in three out of the six regions there was a shift in their ranks. The region which experienced the lowest increment in the percent of resident mothers receiving adequate prenatal care was the Metropolitan Health Region (San Juan) which as a result, shifted from a second to a fifth position from 1986 to 1991. The greatest increment during this five-years period was observed among mothers of the Region of Ponce (17 points increase). However, still they are in the last position 21 points far away from the leading region and almost 9 points behind the Metropolitan Region which had the second poorest record.

TABLE 2

**PERCENT OF RESIDENT MOTHERS RECEIVING ADEQUATE PRENATAL CARE (KESSNER INDEX) BY HEALTH REGIONS*
PUERTO RICO: 1986 AND 1991**

HEALTH REGION	PERCENT ADEQUATE			NUMBER OF MOTHERS	
	1991	1986	DIFFERENCE	1991	1986
Arecibo	59.5	53.1	6.4	7,652	6,863
Bayamón	65.6	57.3	8.3	10,031	10,630
Caguas	60.0	52.8	7.2	9,336	9,220
Mayagüez	55.6	48.2	7.4	7,966	7,965
Ponce	46.4	29.3	17.1	11,113	11,190
Metropolitan	55.3	54.1	1.2	17,101	16,190

*For the "municipios" included in these regions see Departamento de Salud, Informe Anual de Estadísticas Vitales, 1990.

Source: José L. Vázquez Calzada and Severo Rivera Acevedo, Prenatal Care Infant Birthweight and Infant Mortality in Puerto Rico, Puerto Rico Medical Sciences Journal, 1989; 8:3.

Predictors of Adequacy of Prenatal Care

The adequacy of prenatal care showed a curvilinear relationship with mother's age; the lowest values corresponding to adolescent mothers (Table 3). Mothers 30-34 years of age had the highest percentage of adequate care. On the other hand, mother's parity was negatively associated with adequate care; as parity increased the percentage of adequate care declined steadily. Mother's marital arrangement was also clearly related to adequacy of prenatal care; unwed mothers having the lowest percentage whereas legally married mothers had the highest.

Among the socioeconomic variables considered in this study mother's schooling seems to be the best correlate of adequacy of prenatal care (Table 4). Only sixty-one percent of the mothers with three years of school completed or less, began prenatal care in the first trimester. This proportion increased as schooling increased reaching a high of 84 percent among those with 16 years or more. The same relationship was observed with respect to the Kessner Index.

Mothers in the labor force had much better prenatal care than those out of the labor force (Table 4). In part this is due to socioeconomic differences between the two groups but it is also a fact that a great proportion of women in the labor force have, as fringe benefits, private health services plans which tend to make prenatal care more accessible for them than for those not in the labor force.

TABLE 3

**INDICATORS OF ADEQUACY OF PRENATAL CARE BY SELECTED
DEMOGRAPHIC CHARACTERISTICS OF THE MOTHER
PUERTO RICO, 1991**

CHARACTERISTICS	PERCENT BE- GINNING IN THE FIRST TRIMESTER	MEAN NUMBER OF PRENATAL VISITS	PERCENT WITH ADEQUATE CARE (KESSNER INDEX)	NUMBER OF MOTHERS*
Mother's age, in years				
17 or less	66.2	8.5	43.3	5,415
18-19	65.9	8.6	44.3	6,790
20-24	71.5	9.5	53.6	20,646
25-29	76.6	10.4	62.8	17,928
30-34	78.6	10.7	65.8	9,374
35-39	77.2	10.6	64.1	3,525
40 and over	74.3	10.6	63.4	754
Mother's Parity				
First	77.0	10.5	62.6	25,283
Second	74.6	9.9	58.6	19,747
Third	71.5	9.5	53.2	11,456
Fourth	65.3	8.6	43.7	4,453
Fifth or more	54.8	7.4	32.4	3,531
Mother's Marital Arrangement				
Legally married	79.0	10.7	65.6	39,720
Consensua- lly married	66.2	8.6	43.8	18,610
Unwed mother	57.2	8.1	38.4	5,972
All mothers	73.2	9.8	56.7	64,516

*Excludes "not reported".

Father's occupation is another indicator of the couple's socioeconomic status. As shown in Table 4 there was a clear-cut relationship between father's occupational status and the adequacy of the prenatal care received by the mother. Wives of "white collar" workers had the most adequate care whereas those of farmers and farm laborers had the poorest performance.

Table 4 shows that the type of hospital of delivery was strongly related to the adequacy of prenatal care; those women whose children were born in a private institution having the best prenatal care.

To assess the relative importance of the set of demographic and socioeconomic variables on the adequacy of prenatal care multiple regression analyses were carried on. One of the dependent variables considered was the Kessner Index of adequate care which was coded into a dichotomous variable (1 = adequate care, 0 = not adequate care) and thus, a logistic regression model was utilized (8). In addition, a conventional multiple linear regression was also utilized in which the number of prenatal visits was the dependent variable for prenatal visits seems to be closely related to the demographic and socioeconomic variables previously considered.

The partial correlation coefficients included in Table 5 indicate that the adequacy of prenatal care is strongly associated with the type of hospital where the delivery took place. To a lesser extent adequacy of prenatal care seems to be also a function of mother's age, type of marriage and parity. Nonetheless, the above mentioned independent variables showed a stronger association

TABLE 4

INDICATORS OF ADEQUACY OF PRENATAL CARE BY SELECTED INDICATORS
OF MOTHERS' SOCIOECONOMIC STATUS, PUERTO RICO, 1991

MOTHERS SOCIO- ECONOMIC INDICATOR	PERCENT BEGAN IN FIRST TRIMESTER	MEAN NUMBER OF PRENATAL VISITS	PERCENT WITH ADEQUATE CARE (KESSNER INDEX)	NUMBER OF MOTHERS*
Years of School Completed				
0 - 3	60.9	7.7	36.5	662
4 - 6	65.6	8.1	42.3	2,403
7 - 11	65.4	8.3	42.1	18,396
12	72.7	9.6	55.4	18,133
13 - 15	78.2	10.8	66.1	14,226
16 and over	84.1	12.0	76.9	10,385
Labor Force Participation				
In labor force	83.4	11.1	76.0	17,240
Not In labor force	69.5	9.1	49.7	47,086
Father's Occupation+				
White Collar Services	79.7	11.1	69.0	17,679
Manual	72.7	9.6	54.8	9,021
Agriculture	71.6	9.4	53.4	31,275
	71.4	8.5	44.5	2,671
Place of Delivery				
Private Hospital	81.9	12.0	75.6	24,669
Public Hospital	68.0	8.5	45.2	39,648

*Excludes "Not Reported".

+ "White Collar" include: Professionals, Administrators and Kin-
dred; Clerical and Sales Workers. "Services" include: all type of
service occupations. "Manual" includes: craftsmen and operatives, and
non-agricultural laborers. "Agriculture" includes: farmers and farm
laborers.

with the number of prenatal visits than with the Kessner Index. On the other hand, the results of a regression analysis not included in Table 5 and in which the trimester of pregnancy care began was the dependent variable, showed no important associations with the demographic and socioeconomic independent variables.

TABLE 5

**PARTIAL CORRELATION COEFFICIENTS BETWEEN THE DEPENDENT VARIABLES
"NUMBER OF PRENATAL VISITS" THE "ADEQUACY PRENATAL CARE"
AND THE INDICATED INDEPENDENT VARIABLES
PUERTO RICO, 1991**

PARTIAL CORRELATION COEFFICIENTS

INDEPENDENT VARIABLES	NUMBER OF PRENATAL VISITS	ADEQUACY OF PRENATAL CARE (KESSNER INDEX)*
Type of hospital delivery took place (1 = private, 0 = public).	0.318	0.147
Type of mother's marriage (legal = 1, not legal = 0).	0.118	0.088
Mother's parity	-0.194	-0.123
Mother's years of age.	0.129	0.094
Number of cases	64,249	64,249

*In the case in which the Kessner Index was the dependent variable (1 = adequate care, 0 = not adequate care) a logistic regression model was utilized.

Prenatal Care and the Outcome of Pregnancy

If prenatal care is such an effective preventive practice as it was conceived, it should be expected that adequate care will cope with pregnancy medical risks reducing delivery complications. It should also minimize the proportion of low birthweight and preterm newborns as well as the proportion of depressed babies as assessed by Apgar Score (2).

The 1991 data demonstrated that among mothers who had pregnancy problems there were no important differences in the proportion of mothers who had delivery complications between those who received and those who did not receive adequate prenatal care (Table 6). In fact, the weak association observed is in an opposite direction to what should be expected. This was true independently of the prenatal care indicator considered.

On the other hand, adequate prenatal care apparently did not prevent delivery complications among those mothers who did not have pregnancy problems (Table 6). For this group of women the proportion of delivery complications did not differ significantly between those who did not receive and those who did receive adequate prenatal care. And again, the observed relationship is contrary to what should be expected.

The relationship between type of delivery and adequacy of prenatal care represents another puzzling outcome of this study. As shown in Table 7 the proportion of cesarean childbirths increased as the adequacy of prenatal care increased; the percentage of surgical deliveries being highest among those mothers who made 10

visits or more, began this care in the first trimester of pregnancy and had adequate care as assessed by Kessner Index.

TABLE 6

PERCENT OF MOTHERS WITH AND WITHOUT MEDICAL PREGNANCY RISKS WHO HAD DELIVERY COMPLICATIONS AND PERCENT OF MOTHERS WITH CESAREAN CHILDBIRTHS BY PRENATAL CARE VARIABLES
PUERTO RICO, 1991

PRENATAL CARE VARIABLES	MOTHERS WITH MEDICAL PREG- NANCY RISKS		MOTHERS WITH NO MEDICAL PREGNANCY RISKS		ALL MOTHERS	
	TOTAL	PERCENT WITH DELIVERY COMPLICA- TIONS	TOTAL	PERCENT WITH DELIVERY COMPLICA- TIONS	TOTAL	PERCENT WITH CESAREAN CHILD- BIRTHS
Number of Visits						
0 - 3	696	36.1	2,157	18.0	2,853	14.4
4 - 6	1,369	38.4	7,367	17.8	8,736	20.1
7 - 9	2,127	39.5	13,730	18.3	15,857	25.3
10 and more	6,201	42.8	30,825	23.0	37,026	38.4
Trimester of Pregnancy Care Began						
First	7,513	42.8	39,607	21.7	47,120	33.8
Second	2,240	37.4	12,338	18.7	14,578	26.7
Third	602	34.4	2,034	17.8	2,636	18.7
Kessner Index of Adequacy Care						
Adequate	6,077	44.0	30,422	23.0	36,499	37.7
Interme- diate	3,229	37.5	19,367	18.5	22,596	25.1
Inadequate	1,053	35.6	4,178	16.5	5,231	17.3

Contingency analysis tend to demonstrate that adequate prenatal care has a direct association with the newborn's condition at birth. As shown in Table 7, as the number of visits increased the mean birthweight increased while the proportion of low birthweight's decreased. A similar relationship was observed between birthweight and the Kessner Index of adequacy of care.

With respect to timing, birthweight was higher among those whose mothers began their prenatal before the third trimester. No important differences were observed between the weight of babies whose mothers began care in the first or in the second trimester of pregnancy. Newborns gestational age and their five-minutes Apgar Score showed similar relationships with the indicators of prenatal care (Table 7).

However, multiple correlation analysis indicate that the relationships between the newborn physical condition at birth (birthweight, gestational age and five-minutes Apgar Score) and the indicators of adequacy of prenatal care were surprisingly weak. Of the three indicators only the number of prenatal visits seems to have a moderate predictive power of the conditions of the outcome of pregnancy. These results suggest that some other important variables not included in the birth certificate were left out of the analysis. Or it might be that adequate prenatal care as presently defined has meager health benefits.

TABLE 7

NEWBORN'S BIRTHWEIGHT, GESTATIONAL AGE AND APGAR SCORE
BY PRENATAL CARE INDICATORS
PUERTO RICO, 1991

PRENATAL CARE INDICATOR	BIRTHWEIGHT		GESTATIONAL AGE		APGAR SCORE	
	MEAN	PERCENT LOW BIRTHWEIGHT*	MEAN	PERCENT PRETERM*	MEAN+	PERCENT DEPRESSED*
Number Pre-natal Visits made by Mother						
0 - 3	2,917	21.8	37.5	26.6	8.61	5.5
4 - 6	3,022	16.1	38.0	20.8	8.76	3.5
7 - 9	3,149	9.5	38.6	12.3	8.91	1.1
10 and over	3,231	6.5	38.9	8.8	8.99	0.7
Trimester of Pregnancy Care Began						
First	3,172	9.1	38.6	11.8	8.92	1.3
Second	3,174	9.0	38.7	12.2	8.92	1.4
Third	3,087	12.7	38.5	16.2	8.80	2.6
Kessner Index						
Adequate	3,194	8.3	38.7	11.2	8.95	1.2
Interme- diate	3,153	9.6	38.7	12.0	8.90	1.5
Inadequate	3,062	14.3	38.3	18.7	8.81	2.5

*Low birthweights are those weighting 2,500 grams or less. Preterm are those with a gestational age of 36 weeks or less. Depressed are those with a 0-6 Apgar Score.

+Assuming Apgar Score is a quantitative variable.

CONCLUSIONS

The results of this study indicate that prenatal care in Puerto Rico continued to improve during the 1980's. However, there are still enormous geographical inequalities in terms of adequacy of prenatal care; the "municipios" of the southern coast showing the poorest records. Similarly, there are notable disparities among subgroups of mothers; adolescent, unwed and those of the lowest socioeconomic strata as well as those whose babies were born in public hospitals were receiving the poorest prenatal care. It is noteworthy that the best predictor of adequate prenatal care was the type of hospital in which the delivery took place suggesting that the quality of the care is much better in private settings than in public institutions probably due to differences in their clientele.

The effects of adequate prenatal care on the physical condition at birth of the outcome of pregnancy is not so clear. Although at first glance (contingency analysis) adequate prenatal care seems to be associated with higher birthweight, longest gestational age and higher Apgar scores, multiple correlation analyses indicated that these associations were extremely weak. It was also somewhat surprising to find no evidence that adequate prenatal care has an important role in coping with delivery complications and in minimizing cesarean childbirth, one of the most serious public health problems in Puerto Rico. These enigmatic findings were observed both among mothers delivering in private hospitals as well as for those delivering in private ones.

There are some possible explanations for these intriguing results. It might be that the quality component of prenatal care not included in this study and so difficult to assess were a confounding factor. Or it might be that the definition of adequate prenatal care developed in the past be no longer operational. In fact, there is an increasing concern about the prescribed norms. An expert group, for example, has recommended fewer visits for low-risk mothers with increased emphasis on the first months of pregnancy (9). It has also been pointed out that antenatal care is a multiphasic screening program that has never been evaluated and there is no definite evidence about its benefits as presently defined (10). The month of pregnancy in which the care began as one of the indicators of adequacy needs to be reexamined. In Sweden, for example, 98 percent of the mothers began the care in the first trimester while in Japan the corresponding figure was 50 percent. And both countries have similar infant mortality rates and other newborns health indicators (11).

SUMMARY

This study aims to detect changes occurred in the practice of prenatal care in Puerto Rico during 1980's and its effects on the outcome of pregnancy. The data to be analysed was derived from a 1991 live birth file obtained from the Department of Health of Puerto Rico. Three indicators of the adequacy of prenatal care were considered: trimester of pregnancy in which the care began, the number of visits made by the mother and the Kessner Index.

The results of this study indicated that prenatal care has improved considerably since 1980. Nonetheless, still there are marked geographical disparities throughout the Island and varies considerably among subgroups of mothers. The highest proportions of inadequate care corresponded to adolescent, high parity and unwed mothers as well as to those of the lowest socioeconomic levels and to those delivering in public hospitals.

Through a simple comparative analysis the degree adequacy of prenatal seemed to be a good predictor of its newborn physical condition as assessed by his birthweight, gestational age and Apgar Score. However, multiple regression demonstrated that these relationships were extremely weak. This suggests that other important determinants of the newborn physical condition were left out of the analysis. Or it might be that the definition of adequate prenatal care developed for a time in which maternal and infant mortality were extremely high is no longer operational.

Keywords: Prenatal Care, Birthweight, Gestational Age, Apgar Score, Puerto Rico.

RESUMEN

Este estudio tiene como objetivo el conocer los cambios ocurridos en el cuidado prenatal en Puerto Rico durante la década del ochenta. La información a analizarse se derivó de un archivo de datos de los nacimientos vivos ocurridos en Puerto Rico en 1991 obtenido del Departamento de Salud de Puerto Rico. Tres indicadores de la adecuación del cuidado prenatal fueron utilizados: el trimestre del embarazo en que comenzó el cuidado, el número de visitas prenatales realizadas por la madre y el Índice de Kessner.

Los resultados del estudio indicaron que el cuidado prenatal ha mejorado considerablemente a partir de 1980. Sin embargo, todavía existen marcadas diferencias geográficas a través de la Isla y varía considerablemente entre subgrupos de la población. Las proporciones más altas de cuidado inadecuado correspondieron a madres adolescentes, de alta paridad y solteras, así como a madres de los niveles socioeconómicos más bajos y a las que dieron a luz en un hospital público.

Un simple análisis comparativo demostró que el grado de adecuación del cuidado prenatal era un buen pronosticador del estado físico del recién nacido al utilizar como indicadores de éste, el peso, la edad de gestación y el valor Apgar. Sin embargo, al utilizar un modelo de regresión múltiple se encontró que estas asociaciones eran extremadamente débiles, lo que tiende a indicar que otros factores importantes no pudieron ser considerados en el análisis. O pudiera ser que la definición de cuidado prenatal adecuado adoptada para una

época en que prevalecían altas tasas de mortalidad materna e infantil no fuera aplicable hoy día.

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