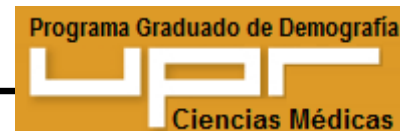


ORIGINAL CONTRIBUTIONS

Prenatal Care, Infant Birthweight and Infant Mortality in Puerto Rico

JOSE L. VAZQUEZ CALZADA, PhD*; SEVERO RIVERA ACEVEDO, MA**



ABSTRACT. This study purports to analyze selected demographic and socio-economic correlated of prenatal care in Puerto Rico. Also, the relationship between prenatal care and infant birthweight and mortality is examined.

The data was obtained from the 1986 live birth and death certificates. Three indicators of adequacy of prenatal care were utilized in the analysis: number of prenatal care visits, trimester in which this care began and the "Kessner Index".

The findings of the study revealed that prenatal care in Puerto Rico has improved both in terms of early care and in continuity, since 1980.

Great geographical differences in adequacy of prenatal care were observed throughout the Island. Prenatal care varies considerably among different population subgroups. Inadequate prenatal care was more frequent among adolescent, unwed and high parity mothers as well as among those of the lowest socio-economic strata.

Furthermore, these groups had the highest proportion of low birthweight babies and their offsprings, the highest mortality rates. The statistical evidence obtained from this study suggests that this is in part due to the inadequate prenatal care received by these mothers. (*Key Words: Prenatal Care, Low birthweight, Infant Mortality*)

PUERTO Rico compares favorably with the leading countries of the world in terms of its level of general mortality and life expectancy. However, this is not the case with respect to infant mortality. At present, its rate of 15 infant deaths per 1,000 live births is 2.5 times the figures recorded in countries like Finland, Japan and Sweden, and 41 percent higher than the rate of the United States (1). These differences are due to the high mortality risks during the neonatal period (less than 28 days of life). In 1985, neonatal mortality in Puerto Rico was 63 percent higher than in the United States but late infant mortality (28 days of life or more) was somewhat lower (1, 2). In fact, late infant mortality in the Island compares with the figures reported for Finland, Japan and Sweden but neonatal mortality is almost three times higher.

One of the reasons for such a situation is the high proportion of low birthweight babies born to Puerto Rican

mothers. During the last 25 years the proportion of live births weighing 2500 grams (5.5 pounds) or less has fluctuated between 9 and 10 percent, and there is no evidence of a declining trend (3, 2). In contrast, the proportion reported in 1985 for Norway, Sweden, Netherlands and Finland was four percent and 5.5 percent for United States white mothers (1).

In the developed countries low birth seems to be the major cause of neonatal mortality. In the United States, for example, two-thirds of all neonatal deaths corresponded to infants born weighing 2500 grams or less (5), while in Puerto Rico it amounted to 73 percent in 1985 (4). The neonatal mortality rate for Puerto Rican low birthweight infants was 82 per 1,000 live births in 1986 as compared with a rate of three for those weighing more than 2500 grams (4).

According to medical experts, only prenatal care which is provided early, continuously and in accordance with high quality standards can result in truly significant improvements in infant birthweight and mortality (6). There is substantial evidence that this kind of care can reduce considerably the two major contributors to low birthweight: pre-term birth and intrauterine growth retardation.

The practice of prenatal care appears to have taken impetus in Puerto Rico after World War II although Island-

Address request for reprints to Dr. José L. Vázquez Calzada, Department of Social Sciences, Faculty of Biosocial Sciences and Graduate School of Public Health, University of Puerto Rico Medical Sciences Campus, GPO Box 5067, San Juan, PR 00936.

* Professor, Department of Social Sciences, Faculty of Biosocial Sciences and Graduate School of Public Health, University of Puerto Rico, Medical Sciences Campus.

** Associate Professor, Department of Social Sciences, Faculty of Biosocial Sciences and Graduate School of Public Health, University of Puerto Rico, Medical Sciences Campus.

wide statistics began to be collected in 1978. Since that year, questions about the number of prenatal visits made by the mother and the month of pregnancy in which the care began have been included in the birth certificate.

Although misreporting errors are always present in this type of information, no gross bias were detected in the analysis of the 1980 data (7). Since then, the "non response" error has been reduced from four percent to almost zero (0.3 percent in 1986) and the quality of the data has improved considerably. It is evident that the quality and content of the care received cannot be assessed utilizing the information obtained from the birth certificate but it provides good measures for the analysis of the coverage and distribution of these services. In addition, some indicators of the adequacy of timing and continuity, two of the three components of prenatal care, can be derived from them.

The main objective of this study is to analyze the coverage, distribution and adequacy of prenatal care in 1986 and some of the changes that have occurred since 1980, the first year for which a comparable study was undertaken. Furthermore, the relationship between prenatal care and infant birthweight and mortality will be examined.

METHOD

The information to be analyzed in this study was derived from the 1986 live birth and death certificates utilizing the data files (computer tapes) which were obtained from the Department of Health of Puerto Rico.

Three indicators of adequacy of prenatal care are utilized: the number of prenatal visits, the trimester in which this care began and the "Kessner Index" (1). This index combines the trimester in which care began, the number of visits and the weeks of gestation to determine the adequacy of prenatal care from the standpoint of its timing and continuity. Under Kessner's criteria, prenatal care is considered adequate only if it began in the first trimester of pregnancy and if for a given duration of pregnancy there is a corresponding number of visits. It is always inadequate if it began in the last trimester. Thus, the "Kessner Index" results in three categories: adequate, intermediate and inadequate prenatal care (See Appendix A). This index seems to be the best indicator of the adequacy of prenatal care that can be derived from the data included in the birth certificate for it takes into account both timing and continuity.

RESULTS

According to the 1986 data only 1.3 percent of Puerto Rico mothers did not receive prenatal care. This figure is almost identical to the one reported for the United States (6). With respect to the number of prenatal visits, 57 percent of the mothers made 9 or more with an average of

9.1. On the other hand, 70 percent of them began prenatal care during the first trimester of pregnancy and 49 percent received adequate care as assessed by the "Kessner Index". These figures represent a great improvement since 1980 as shown on Table 1. This improvement is best evidenced by the "Kessner Index" which increased over 13 points from 1980 to 1986, while the increment in the percentage who began prenatal care in the first trimester was of only 7 points.

TABLE 1

Indicators of Adequate Prenatal Care Puerto Rico, 1980 and 1986		
Indicators	1986	1980
Percent of mothers who began prenatal care in first trimester of pregnancy	70.0	62.7
Percent of mothers who received adequate prenatal care ("Kessner Index")	49.1	35.9*
Percent of those who began care in first trimester and received adequate prenatal care ("Kessner Index")	70.1	57.3*
Average number of prenatal visits	9.1	8.2
Number of mothers	63,490	70,332

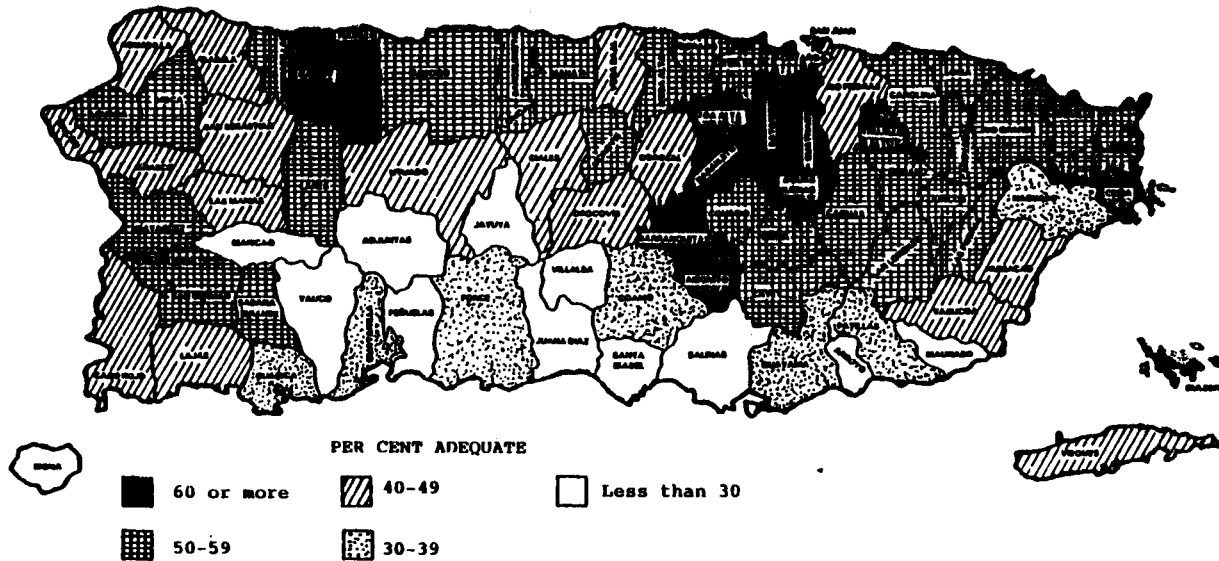
* Not from the original study. Obtained by the authors from the 1980 data file (computer tape).

Regional Differences

The adequacy of prenatal care varies considerably throughout the Island. In 1986, the "municipio" of Guaynabo, to the west of San Juan the capital, had the highest "Kessner Index" of adequate care with 76 percent as compared with 22 percent for Juana Díaz, a "municipio" adjacent to Ponce in the southern coast. As shown in Figure 1, all the "municipios" of the southern coast exhibited very low rates of adequate care. A similar situation was found for most of the "municipios" of the west central part of the Island. On the other hand, twelve "municipios" had figures higher than 60 percent. Seven of them form a cluster to the southwest of San Juan, in which some of the mountainous area of the Island are included.

In San Juan prenatal care is not in accordance with its prominent socioeconomic position. The "Kessner Index" for mothers residing in San Juan amounted to 47 percent, a figure which was below the Island's average (49 percent). The available data demonstrated that the situation was substantially worse in the part which corresponds to the old San Juan "municipio". Only 38 percent of the mothers living in this area received adequate prenatal care as compared with 51 percent for those residents in the old Río Piedras "municipio".

Figure 1



PERCENT OF ADEQUATE CARE RECEIVED (KESSNER INDEX) BY MOTHER'S MUNICIPIO OF RESIDENCE
PUERTO RICO: 1986

When the data were analyzed according to the regional classification system utilized by the Department of Health of Puerto Rico to administer the health services offered to the population, great disparities were observed between regions (Table 2). The Region of Ponce had the worst record of prenatal care. Only 29 percent of the mothers residing in this group of "municipios" received adequate care as compared with 57 percent in the Region of Bayamón which had the highest rate. The situation of the Region of Ponce is striking when compared with all others. The "Kessner Index" of adequate care for this region was 28 percent points lower than the index of the leading Region of Bayamón while the gap between the Region of Mayagüez, which had the second poorest record, and the Region of Bayamón was of only 9 points. In other words, the Region of Ponce was far behind all other regions in terms of adequate prenatal care.

Correlates of prenatal care

As in the 1980 study, urban mothers had more adequate prenatal care than their rural counterparts (Table 3). Although both groups had similar proportions of early care (first trimester care), 75 percent of urban mothers who began their care in the first trimester made the necessary visits for their care to be considered adequate as compared with 65 percent for rural mothers.

Age of mother was closely associated with the level of adequacy of prenatal services; the poorest record corresponding to adolescent mothers (under 20 years of age). As compared with all other age groups, they began the care later, made less visits and had the lowest index of

TABLE 2

Percent of Mothers Receiving Adequate Prenatal Care According to the Health Region of Residence Puerto Rico, 1986

Health Region of Mother's Residence*	"Kessner Index" of Adequate Care (Percent)	Number of Mothers
Arecibo Region	53.1	6,863
Bayamón Region	57.3	10,630
Caguas Region	52.8	9,220
Mayagüez Region	48.2	7,965
Ponce Region	29.3	11,587
Metropolitan Region	54.1	16,190

* For the "municipios" included in these regions see, "Departamento de Salud de Puerto Rico, 1987, Informe Anual de Estadísticas Vitales, 1985, Table 2.

adequate care. Prenatal care improves as age increases up to the group 30-34 years and then declines somewhat among mothers 35 years of age and older.

The type of marital arrangement is another important demographic variable associated with prenatal care. As shown in Table 3, legally married mothers had the highest percentage of early care, the highest average number of visits and the highest "Kessner Index" of adequate care.

TABLE 3

Indicators of Prenatal Care by Selected Demographic Characteristics of the Mother, Puerto Rico, 1986				
Characteristic of the Mother	Percent Began Care in First Trimester of Pregnancy	Average Number of Prenatal Visits	"Kessner Index" of Adequate Care (%)	Number of Mothers*
Zone of Residence				
Urban	69.7	9.4	52.3	32,182
Rural	70.4	8.7	45.7	30,952
Age in years				
Under 18	61.4	7.7	34.6	4,481
18-19	62.0	7.9	35.5	6,355
20-24	67.8	8.7	45.0	21,418
25-29	74.2	9.7	56.3	17,450
30-34	76.0	9.9	59.1	9,188
35 and over	71.9	9.6	54.2	4,259
Marital Arrangement				
Legally Married	74.9	9.7	55.9	44,430
In consensual union	60.8	7.8	34.2	14,157
Unwed mothers	51.6	7.3	28.7	4,543
Parity				
1	73.4	9.5	53.5	23,393
2	72.2	9.3	52.1	18,971
3	69.3	8.9	47.5	11,957
4	61.7	8.1	38.4	4,716
5 or more	52.9	7.1	26.9	4,099
Total	70.0	9.1	49.1	63,490

* Excludes "not reported" in each characteristic.

The poorest performance corresponded to unwed mothers while those in consensual unions had intermediate figures but more closely resembled the unwed than the legally married group.

Adequacy of prenatal care was found to be negatively associated with parity; primiperae having the best record (Table 3). All three indicators utilized in this study declined steadily as parity increased. These relationships hold true for all age groups.

As expected, socioeconomic status emerged as an important determinant of adequate prenatal care. The percentage of mothers who had early care, their average numbers of visits and the index of adequate care, increased as schooling increased (Table 4). The differences, however, were not so noteworthy among mothers with less than 12 years of school completed but became greater when the high school level was surpassed.

A similar relationship was observed when husband's occupation was utilized as a socioeconomic indicator (Table 4). The wives or partners of professionals, administrators and kindred workers had the highest percentage of adequate care while those of laborers had the lowest performance.

TABLE 4

Indicators of Prenatal Care by Selected Socioeconomic Characteristics of the Mother, Puerto Rico, 1986				
Characteristic of the Mother	Percent Began Care in First Trimester of Pregnancy	Average Number of Prenatal Visits	"Kessner Index" of Adequate Care (%)	Number of Mothers*
Years of school completed				
0-6	60.3	7.3	31.3	4,423
7-11	62.2	7.8	35.1	18,989
12	70.7	9.1	49.4	18,721
13-15	75.4	10.1	60.1	11,828
16 or more	82.6	11.1	71.7	9,184
Husband or Partner Occupation				
Professionals, administrators and kindred	79.3	10.8	67.4	10,739
Clerical and sales workers	73.0	9.6	54.2	6,947
Craftmen and operatives	69.4	9.0	48.3	23,022
Service workers	68.6	8.8	46.1	8,299
Farmers and farm Administrators	71.7	8.4	43.4	767
Laborers (including farm)	64.2	7.3	35.2	10,807
Labor Force Participation				
In labor force	82.2	11.2	72.0	15,607
Not in labor force	66.0	8.4	41.6	47,538

* Excludes "not reported" in each characteristic.

Mother's labor force participation seems to be one of the most important correlates of prenatal care (Table 4). With respect to the "Kessner Index" working mothers differ by more than 30 percent points from those mothers out of the labor force.

The data obtained from the birth certificate indicate that mothers delivering in private hospitals had more adequate prenatal care than those whose delivery occurred in public health facilities (Table 5). The "Kessner Index" amounted to 72 percent for the first group as compared with only 37 percent for the second group.

TABLE 5

Indicators of Prenatal Care by Type of Hospital
in Which the Delivery Took Place,
Puerto Rico, 1986

Indicator	Public Hospital	Private Hospital
Percent of mothers who began care in first trimester of pregnancy	64.3	80.9
"Kessner Index" of Adequate Care (percent)	36.7	72.3
Average number of Prenatal Visits	7.9	11.3
Number of Mothers*	41,240	22,034

* Excludes "not reported".

Prenatal Care and Infant Birthweight

In the study in which the 1980 data for Puerto Rico was examined infant birthweight was directly related with the number of prenatal visits made by the mother but no association was found with respect to early care (7). Similar relationships were observed in the analysis of the 1986 data; the number of visits and the "Kessner Index" of adequacy were clearly related to birthweight but early care did not behave as expected. As shown in Table 6, birthweight figures did not differ between children born to mothers who began their care in the first or in the second trimester of pregnancy. However, marked differences were observed between those born to mothers who began these services during the second and the third trimester.

Prenatal Care and Infant Mortality

The 1986 data showed, as in the 1980 study, that there was a clear inverse association between mortality and the number of visits made by the mother (Table 7). With respect to the trimester of pregnancy in which the care began and the "Kessner Index" of adequacy of care the relationships were not clear-cut. As expected, infant and neonatal mortality were higher among children born to mothers who began prenatal care in the third trimester as well as among those who received inadequate care. However, infant and neonatal mortality showed a contradictory relationship when first and second trimesters in which care began were compared. A similar situation was observed between the "Kessner Index" and neonatal mortality. Nevertheless, it should be emphasized that there are considerable differences in infant and neonatal mortality when first and third trimesters are compared as well as between adequate and inadequate care.

TABLE 6

Average Infant Birthweight and Percent Weighing 2500 Grams
or Less by Indicators of Prenatal Care
Puerto Rico, 1986

Indicator	Average Weight (in grams)	Percent Weighing 2500 grams or Less	Number of Live Births*
Number of Prenatal Visits made by Mothers			
0	2,873	21.0	812
1-3	2,945	18.5	2,544
4-6	3,078	13.4	11,211
7-9	3,172	8.9	17,683
10 or more	3,258	6.1	30,985
Trimester of Pregnancy in which Care Began			
First	3,192	8.7	44,202
Second	3,181	8.7	15,977
Third and no care	3,083	12.3	2,927
"Kessner Index"			
Adequate care	3,225	7.6	30,964
Intermediate care	3,166	9.2	25,546
Inadequate care	3,059	13.6	6,544

* Excludes "not reported" in each indicator.

TABLE 7

Infant and Neonatal Mortality by
Indicators of Prenatal Care,
Puerto Rico, 1986

Indicator	Infant Mortality	Neonatal Mortality	Number of Live Births*
Number of Prenatal Visits Made by Mother			
0	74.6	48.9	818
1-3	42.9	35.5	2,538
4-6	22.6	18.5	11,206
7-9	10.9	8.0	17,687
10 or more	7.8	5.7	31,011
Trimester of Pregnancy in which care began			
First	13.0	10.2	44,222
Second	11.8	8.9	15,985
third and no care	28.5	17.7	2,933
"Kessner Index"			
Adequate care	11.9	9.5	30,963
Intermediate care	12.4	9.3	25,544
Inadequate care	23.8	16.8	6,528

* Excludes "not reported" in each indicator.

DISCUSSION

Prenatal care has improved considerably in Puerto Rico since 1980, but still remains far behind the level achieved in countries like the United States. Less than half of Puerto Rican mothers received adequate prenatal care as compared with 68 percent of the United States (1). And, if the quality and content were to be considered, one could speculate that less than one-third of the Island's mothers are receiving truly adequate prenatal care.

The great disparities in the distribution of these services throughout the Island is astonishing. From a "municipio" standpoint, the "Kessner Index" of adequate care varied from a high of 76 percent to a low of 22 percent. These striking differences and the extremely low level of adequate care in the health Region of Ponce as well as in San Juan, the capital, point out the need for immediate action from the corresponding health agencies.

Marked differences were also observed between groups of mothers. Inadequate prenatal care was more frequent among adolescent, unwed and high parity mothers as well as among those of the lowest socioeconomic strata. Probably as a result, these groups also had the highest proportion of low birthweight babies and their children, the highest mortality rates.

The fact disclosed on this study that working mothers have such an excellent record of prenatal care makes labor force participation one of the best predictors of the adequacy of these services. This is undoubtedly the result of their greatest access to health insurance plans as generally obtained at their jobs as fringe benefits.

Although inadequacy of prenatal care in the United States is associated with the same group of demographic and socioeconomic variables as in Puerto Rico, their main problem has to do with the accessibility of these services by the so called minority groups. Blacks and the great majority of the Hispanic groups are far behind from the level of adequate care achieved by the white population; Puerto Ricans having the poorest record (1).

In Puerto Rico the main problems that have to be solved are: the extremely uneven distribution of prenatal care across the Island, the great difference in the adequacy of these services between private and public offerings, and the poor access to public prenatal health services of the high risk groups of mothers (adolescent, not legally married, high parity and low socioeconomic status mothers). As evidenced by statistics reported by the Department of health of Puerto Rico these high risk groups have almost no access to private health services (2). For all this, there is an urgent need for a better allocation of government resources to improve the coverage and quality of prenatal care, and to develop more effective educational programs related to these services.

RESUMEN

El objetivo de este estudio es el examinar los factores demográficos y socioeconómicos asociados con el cuidado prenatal en Puerto Rico. Además, se analizará la relación entre el cuidado prenatal, el peso del recién nacido y la mortalidad infantil. Los datos fueron obtenidos de los certificados de nacimiento y defunción de 1986. Tres indicadores del grado de adecuación del cuidado prenatal fueron utilizados: el número de visitas prenatales, el trimestre del embarazo en que comenzó el cuidado prenatal y el "Índice de Kessner". Los hallazgos del estudio demuestran que el cuidado prenatal en Puerto Rico ha mejorado significativamente desde 1980. Se observaron grandes diferencias en relación a lo adecuado del cuidado

prenatal a través de la Isla, así como variaciones muy marcadas entre subgrupos de la población. Madres adolescentes, no casadas, de alta paridad y de niveles socioeconómicos muy bajos recibieron el cuidado prenatal más inadecuado. Estos grupos de madres también tuvieron las más elevadas proporciones de recién nacidos de bajo peso, y sus infantes las más altas tasas de mortalidad. La evidencia estadística derivada de este estudio tiende a indicar que la alta proporción de niños de bajo peso entre estas madres y la elevada mortalidad infantil de sus hijos se deben en parte al cuidado prenatal inadecuado recibido.

REFERENCES

1. Hughes D, et al. The Health of America's Children, Children's Defense Fund, 1988, Washington, DC.
2. Departamento de Salud de Puerto Rico. Informe Anual de Estadísticas Vitales, 1985. 1987.
3. Rivera de Morales N. "Tendencias de la Natalidad y Diferenciales de la Fecundidad en Puerto Rico: Año 1988-1972". Escuela Graduada de Salud Pública, Recinto de Ciencias Médicas, Universidad de Puerto Rico" ("mimeografiado").
4. Figures obtained by the authors from the data files (computer tapes) of birth and death certificates of the Department of Health of Puerto Rico.
5. Brown SS. Can Low Birth Weight be Prevented. Family Planning Perspectives 1985; 17: 3.
6. Sigh S, Torres A, Forrest JD. The Need for Prenatal Care in the United States: Evidence from the 1980 National Natality Survey. Family Planning Perspectives 1985; 17: 3.
7. Vázquez Calzada JL, Vázquez Correa M. "El Cuidado Prenatal en Puerto Rico". Revista de Salud Pública de Puerto Rico 1983; 3-4.

APPENDIX A

David Kessner's Criteria of Adequacy of Prenatal Care

Adequate Care:

Care Began in First Trimester and for the indicated weeks of gestation there were the indicated number of visits.

Weeks of Gestation	Number of Prenatal Visits
17	2 or more
18-21	3 or more
22-25	4 or more
26-29	5 or more
30-31	6 or more
32-33	7 or more
34-35	8 or more
36 or more	9 or more

Gosta
2

Inadequate Care:

Care began in Third Trimester or for the indicated weeks of gestation there were the indicated number of visits.

Weeks of Gestation	Number of Prenatal Visits
17-21	0
22-29	1 or fewer
30-31	2 or fewer
32-33	3 or fewer
34 or more	4 or fewer

Gosta
1

Intermediate Care:

All other combinations

Source:

Dana Hughes, et al., 1988. *The Health of America's Children*. Children's Defense Fund, Washington, DC, Technical Notes.