

# The perinatal and economic impact of prenatal care in a low-socioeconomic population

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Reductions in publicly funded prenatal care programs in 1981 to 1984 resulted in an increase in unregistered patient deliveries from 7.8% to 14.9% of births at University of California San Diego Medical Center. To assess the economic and perinatal impact of the increasing number of deliveries of women without prenatal care, 100 consecutive patients with fewer than three prenatal visits were studied. Each "no care" patient was matched by age, parity, and week of delivery with a control patient who received care in a state-funded perinatal project (Comprehensive Perinatal Program). Maternal antenatal risk factors were equally distributed between the two groups when maternal age, parity, history of substance abuse, prior preterm delivery, hypertension, and abortion were compared. Maternal obstetric outcomes were similar, including cesarean section rate and incidence of postpartum fever and hemorrhage. However, neonates delivered of women receiving no care experienced significantly greater morbidity than the neonates of women in the Comprehensive Perinatal Program, including an increased incidence of premature rupture of the membranes and preterm delivery (13% versus 2%,  $p < 0.05$ ), low birth weight (21% versus 6%  $< 2500$  gm,  $p < 0.002$ ), and intensive care unit admissions (24% versus 10%,  $p < 0.005$ ). When the total inpatient hospital charges were tabulated for each mother-baby pair, the cost of perinatal care for the group receiving no care (\$5168 per pair) was significantly higher than the cost for patients in the Comprehensive Perinatal Program (\$2974 per pair,  $p < 0.001$ ) including an antenatal charge of \$600 in the Comprehensive Perinatal Program. The excess cost for delivery of 400 women receiving no care per year in the study hospital was \$877,600. These results suggest that extension of prenatal care programs to medically indigent women is likely to result in a net reduction in perinatal morbidity and health care expenditures. (AM J OBSTET GYNECOL 1986;154:29-33.)

**Key words:** Prenatal care, prematurity, midwifery

The association between lack of prenatal care and increased maternal and fetal morbidity has been recognized for almost half a century. Eastman<sup>1</sup> observed, in 1947, that the prematurity rate was 24% among patients at The Johns Hopkins Hospital who received no prenatal care but only 8% among women with three or more prenatal visits. This finding was confirmed by several subsequent investigators<sup>2-7</sup> but disputed by others.<sup>8-10</sup> Perhaps because of the controversy regarding the cost-effectiveness of antenatal care, the concept of "guaranteed access" to prenatal services has not been universally embraced.<sup>11</sup> Moreover, participation in antenatal programs varies widely among subpopulations.<sup>12, 13</sup> In California, from 1978 to 1982, 10.4% of all deliveries were of women who received no prenatal care, unknown care, or third-trimester care only.<sup>14</sup>

At the University of California San Diego Medical Center, "no care" deliveries present a special problem. Situated near the United States-Mexico border, the hospital acts as a primary care center for a large number of women of Mexican descent. A small fraction of patients receive care from private physicians or Health Maintenance Organizations (12%), and a somewhat larger proportion of patients qualifying for state-funded medical care (Medi-Cal) receive prenatal care in the UCSD Clinics (22%). However, the remaining patients are indigent and ineligible for the usual sources of publicly funded medical care, principally because of their status as undocumented aliens (66% of all patients delivered). The only low-cost prenatal service available to these patients is the Comprehensive Perinatal Program, a state-funded, nurse-midwife-staffed program that operates within a consortium of 10 community clinics throughout San Diego County.

However, enrollment in the Comprehensive Perinatal Program is limited to 100 patients per month. Because the potential Comprehensive Perinatal Program subscribership is more than 200 patients per month, an extensive waiting list for enrollment has resulted. Patients unable to enroll in the Comprehensive

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Table I. Maternal antenatal data

Factor	No care (Mean $\pm$ SD) (%)	Care (Mean $\pm$ SD) (%)
Total Deliveries	100	100
Mean age	23.8 $\pm$ 2.3	24.8 $\pm$ 5.0
<18 yr	10	5
>35 yr	3	3
Nulliparity	39	33
Obstetric history		
Hypertension	2	2
Substance abuse	10	3
Prior preterm delivery	2	4
Pregnancy loss or abortion	24	30
Foreign citizenship	75	96
Eligible for Medi-Cal	28	26
Pregnancy duration		
Mean (wk)	39.4 $\pm$ 4.0	40.1 $\pm$ 1.0*
Preterm (%)	13	2*
Prenatal visits		
Mean No.	1 $\pm$ 1	12 $\pm$ 3*
First visit (wk)	39.5 $\pm$ 1.2	14.0 $\pm$ 3.6*

\*p &lt; 0.01.

Perinatal Program continue their pregnancies without prenatal care and frequently present to UCSD Medical Center for delivery. During the 3 years preceding the present study, the number of "no care" deliveries at UCSD increased almost fourfold. This study was undertaken to assess the perinatal and economic impact of the rising numbers of "no care" deliveries by comparing in detail the outcomes of women who received prenatal care in the Comprehensive Perinatal Program with outcomes in those who did not ("no care").

### Methods

**Patient selection.** One hundred consecutive deliveries at UCSD Medical Center of women who received no prenatal care during pregnancy were identified. Patients who received prenatal care at another institution or who were seen in an emergency room on more than two occasions during pregnancy were excluded. For comparison, each "no care" patient was matched by week of delivery with a patient who received prenatal care in the Comprehensive Perinatal Program. To ensure that the Comprehensive Perinatal Program group received adequate prenatal care, patients whose first prenatal visit occurred after 20 weeks were excluded from the study.

**Prenatal care.** Prenatal care in the Comprehensive Perinatal Program was provided by certified nurse-midwives in a network of 10 outlying community clinics. The Comprehensive Perinatal Program clinics provide a comprehensive program of perinatal care and education that includes obstetric care, nutritional assessment and support, social service, and home-outreach services. With the exception of insulin-requiring diabetics, no patients were transferred from the Compre-

hensive Perinatal Program because of antenatal medical or obstetric complications. Patients with complications were presented by the midwife to staff physicians regularly available for consultation at the clinic site. Additionally, the case records of patients with complications were reviewed weekly at a high-risk conference by a panel consisting of a perinatologist, the nurse-midwife staff, program dietitians, social workers, and clinic managers. Antepartum testing and sonography services were provided to Comprehensive Perinatal Program patients at no additional cost. Patients were asked to reimburse the clinic a single "packaged" fee (\$300 to \$675, on a sliding scale depending on ability to pay) for prenatal and delivery-postpartum care.

**Intrapartum management.** After admission to the delivery unit, "no care" patients were managed by the obstetric house staff and faculty. Comprehensive Perinatal Program patients were usually managed and delivered by certified nurse-midwives from the Comprehensive Perinatal Program. Labors complicated by maternal medical conditions, fetal distress, prematurity, or dystocia were managed in conjunction with the obstetric staff. However, Comprehensive Perinatal Program patients managed or delivered by obstetric staff were considered to be in the Comprehensive Perinatal Program group for the purposes of the study.

**Data collection and analysis.** The maternal and newborn medical records of the 100 Comprehensive Perinatal Program and "no care" pairs were reviewed. Antenatal, postpartum, and newborn outcome data were abstracted and coded for analysis. In cases in which the duration of gestation at delivery was unclear, the Dubowitz evaluation of the newborn infant was used to corroborate the obstetric history. The total charges billed to each mother and baby during the course of their hospital stay were obtained from the hospital's billing unit. The  $\chi^2$  and Student's t tests were used to evaluate the significance of differences between the two groups.

### Results

Selected antenatal maternal risk factors for the "no care" and Comprehensive Perinatal Program patients are listed in Table I. Mean maternal age was similar in both groups, as was the relative proportion of women under the age of 18 or over 35. Nulliparous patients were relatively evenly distributed between the study populations, as were patients with histories of previous preterm delivery, pregnancy loss, elective abortion, hypertension, and substance abuse. The remaining demographic variables (United States citizenship and eligibility for publicly funded medical care) were similar as well.

Table I also compares the number of prenatal visits to a clinic or emergency room as well as the mean week

Table II. Neonatal complications

Complication	No care (Mean $\pm$ SD) (%)	Care (Mean $\pm$ SD) (%)	p Value
Premature rupture of membranes	13	2	0.006
Meconium	19	25	NS
Ominous fetal heart rate tracing	10	5	NS
Prematurity (<37 wk)	13	2	0.006
Birth weight			
Mean (gm)	3087 $\pm$ 256	3385 $\pm$ 476	0.01
<2500 gm (No.)	21	6	0.004
5 min Apgar score <7	8	2	0.07
Hospital stay >3 days	24	12	0.05
Perinatal death	4	1	0.11

of pregnancy in which the first visit occurred. The Comprehensive Perinatal Program patients had a mean of 12 prenatal visits (versus  $1 \pm 1$  for the "no care" population) beginning in the fourteenth gestational week (versus the thirty-ninth week among the "no care" patients). This was the only antepartum risk factor that was significantly different between the two groups ( $p < 0.01$ ).

Intrapartum and postpartum management of patients was similar in that the frequency of oxytocin, epidural anesthesia, and antibiotic usage intrapartum was comparable. A trend to higher cesarean delivery rates was evident in the Comprehensive Perinatal Program group (14% versus 9%), but the incidence of instrument-assisted delivery was almost identical (22% versus 20%, Comprehensive Perinatal Program and "no care" groups, respectively,  $p = \text{NS}$ ). Maternal postpartum morbidity as a whole (18% in both groups) and when analyzed by individual complications was relatively similar. An exception was postpartum transfusion for severe anemia (hematocrit <28% in seven "no care" women versus one Comprehensive Perinatal Program patient;  $p < 0.05$ ). The mean hospital stay of "no care" patients was approximately 1 day longer than that of the Comprehensive Perinatal Program group (3.6 versus 2.4 days,  $p < 0.01$ ).

In contrast to the comparable maternal outcomes, the fetal and newborn complications (Table II) were distinctly dissimilar. The differences in the incidence of meconium-stained amniotic fluid and ominous fetal heart rate tracings were not significant, but "no care" patients were much more likely than Comprehensive Perinatal Program patients to be admitted with premature rupture of the membranes and premature labor (13% versus 2%,  $p < 0.01$ ). The higher frequency of preterm delivery among the "no care" patients is reflected in the increased incidence of low birth weight (<2500 gm in 21% of "no care" patients and 6% of Comprehensive Perinatal Program patients;  $p < 0.005$ ) and prolonged newborn hospital stay (>3 days in 24%

Table III. Hospital charges

	No care (Mean $\pm$ SD) (%)	Care (Mean $\pm$ SD) (%)
Maternal charges *	\$1722 $\pm$ 35	\$1663 $\pm$ 38
Neonatal charges *	\$3487 $\pm$ 599	\$ 697 $\pm$ 48
Total charges	\$5168	\$2374

\* $p < 0.001$ .

Table IV. Costs and projected savings

Excess cost per no care delivery	\$2794
Cost of Comprehensive Perinatal Program professional services	600
Projected savings with prenatal care (per patient delivered)	\$2194
Projected savings with prenatal care (400 patients per year)	\$877,600

of "no care" patients and 12% of Comprehensive Perinatal Program patients;  $p < 0.05$ ). Infants of "no care" women also experienced a somewhat increased risk of a low 5-minute Apgar score (<7 in 8% of "no care" patients and 2% of Comprehensive Perinatal Program patients;  $p = 0.07$ ).

Four perinatal deaths, all occurring before admission, were detected in the "no care" group. Three patients presented with uncontrolled hypertension, vaginal bleeding, and fetal death. Abruptio placentae was diagnosed in these patients at delivery. The fourth patient was admitted with chorioamnionitis and fetal death. In the Comprehensive Perinatal Program group, a single intrapartum death occurred. This patient was instructed to ambulate in early labor after auscultation of normal fetal heart tones. One hour later, thick meconium staining and fetal death were documented. The autopsy results were inconclusive. The difference in fetal death rates between these groups was not statistically significant.

The hospital charges generated by the care of each mother and baby were tabulated for the period from admission in labor until discharge (Table III). The difference in maternal hospital charges between the "no care" group and Comprehensive Perinatal Program patients was small (mean difference = \$59,  $p < 0.001$ ). On the other hand, mean neonatal charges were strikingly higher in the "no care" group (\$3487 in "no care" group versus \$697 in Comprehensive Perinatal Program patients;  $p < 0.001$ ). When the mean of total charges accrued in providing intrapartum and postpartum care to each mother-baby pair was assessed, the typical "no care" patient bill was \$5168 compared with \$2347 for a Comprehensive Perinatal Program delivery. The average cost per delivery was \$2821 ( $p < 0.001$ ).

Table V. Preterm deliveries: No care and Comprehensive Perinatal Program patients

Patients	Year 1 (N = 757)		Year 2 (N = 1048)		Year 3* (N = 1410)	
	n	%	n	%	n	%
Comprehensive Perinatal Program	16/534	3.0	29/711	4.1	49/1034	4.7
No care	32/223	14.3†	35/337	10.4†	38/376	10.1†

\*Study year.

†p &lt; 0.001.

**Cost analysis.** During the study period, the cost of providing comprehensive perinatal care in the Comprehensive Perinatal Program was \$600 per patient. This cost included antenatal professional fees (routine visits, performance and interpretation of nonstress tests and sonography) and intrapartum and postpartum professional services provided by the Comprehensive Perinatal Program midwives and/or obstetric staff. Adding the \$600 care cost to the overall charges for a Comprehensive Perinatal Program delivery results in a total Comprehensive Perinatal Program obstetric expense of \$3000 per case. When this expense is compared with the \$5168 cost for a "no care" delivery, the net excess expenditure per "no care" patient was approximately \$2100. At the rate of 400 "no care" deliveries per year in the study institution, the annual excess cost of delivering these patients was \$877,600 (Table IV).

#### Comment

This study assessed the perinatal and economic impact of prenatal care on maternal and neonatal outcome in a cohort of indigent women. In this population, provision of prenatal care did not appear to reduce appreciably the incidence of maternal complications or morbidity associated with labor and delivery. However, infants delivered of "no care" women experienced significantly greater perinatal morbidity and mortality, primarily associated with increased prematurity. The preterm (<37 weeks) delivery rate was 13% among the "no care" patients versus 2% in the Comprehensive Perinatal Program. The hospital charges resulting from the care of these infants exceeded by severalfold the cost of providing prenatal care to their mothers.

The preterm delivery rate of 13% in the "no care" group is consistent with the results reported in other studies. Tokuhata et al.<sup>3</sup> studied birth certificate data of 185,000 deliveries and found a 23.6% prematurity rate among women without prenatal care compared with 6.9% among those with care. Similar results were obtained by Bruce et al.<sup>4</sup> (22.9% versus 9.5% prematurity), as well as Klein<sup>5</sup> (33.1% versus 9.1%), Ryan et al.<sup>6</sup> (15.8% versus 9.9%), and Greenberg<sup>7</sup> (2.5 times

reported a threefold increase in perinatal mortality among women who, for religious reasons, avoided prenatal care and practiced home birth when compared with women managed by physicians in a hospital setting. However, these studies were not well controlled for obstetric risk factors such as race, substance abuse, previously poor obstetric outcome, and social stratum. Moreover, patients in the "no care" groups were often sociologically and demographically distinct from the groups receiving prenatal care. Indeed, the "no care" women often refused or avoided prenatal care because of drug addiction, alcoholism, or transitory lifestyle.<sup>3-5</sup> In the present study, however, the reason for lack of care was, in general, lack of availability of antenatal services. Thus the populations compared in this study appear to be drawn from a relatively homogeneous pool of medically indigent women.

The finding of only 2% prematurity in the Comprehensive Perinatal Program group (compared to the 6% to 8% rate observed in most centers) was striking. The unusually low rate in the Comprehensive Perinatal Program could be due to (1) a population with an intrinsically low risk of preterm delivery, (2) a bias in ascertainment of the Comprehensive Perinatal Program population by exclusion of patients who registered for prenatal care after 20 weeks, or (3) a type I statistical error.

To clarify these issues, the preterm delivery rate in the entire Comprehensive Perinatal Program (including patients initiating care at all gestational ages) was evaluated during the year in which the study was conducted as well as the two preceding years. The preterm delivery rate was also assessed in the "no care" population. This analysis (Table V) demonstrated that the preterm delivery rate for "no care" patients was significantly higher than that of the Comprehensive Perinatal Program patients in all 3 years studied (mean rate of 3% in Comprehensive Perinatal Program group versus 12% in "no care" patients; p < 0.001). Further, the Comprehensive Perinatal Program patients regularly achieved a low prematurity rate even when late-registering patients were included (approximately 65% of Comprehensive Perinatal Program patients register af-

outcome of the cohort of patients examined in detail in the study protocol is unrepresentative of the population as a whole. When the strength of the difference between preterm delivery rates of the two groups ( $p = 0.006$ ) is considered, it is also not likely that a type I error could have occurred.

There were no demonstrable differences in obstetric and demographic risk factors between the "no care" and the Comprehensive Perinatal Program group. Detailed comparisons indicate that the Comprehensive Perinatal Program and "no care" patients were indigent, predominantly Hispanic women with relatively limited access to prenatal care. Indeed, at the time of delivery, many of the "no care" patients were on a waiting list to enter the Comprehensive Perinatal Program. The limitation in Comprehensive Perinatal Program enrollment to 100 patients per month and ineligibility of the remaining patients for other publicly funded prenatal care programs resulted in an "overflow" of approximately 100 women per month into the "no care" pool. These patients continued to request and receive delivery and postpartum services despite their lack of prenatal care.

A final question may be raised as to whether limiting the study group to patients who initiated care before 20 weeks exaggerated the differences in gestational length and neonatal morbidity between the two groups. This approach was taken deliberately in order to assess the specific effect of comprehensive prenatal care on outcome. Thus it was considered essential to ensure the Comprehensive Perinatal Program group received full prenatal care and to exclude patients who may have been seen only for a few visits.

A new finding in this study was the markedly higher financial cost of delivering patients without prenatal care when compared with that of the patients given care. Detailed analysis of patient charts and hospital billing records in this study demonstrated that the cost of care of premature "no care" newborn infants far exceeds the cost of comprehensive maternal antenatal care. Even if the cost of professional services in the Comprehensive Perinatal Program (\$600) is relatively low, the cost differential of \$2168 per "no care" delivery would provide significant net savings even if more costly physician care (estimated cost \$750 to \$1200) were extended to the "no care" patients.

The implications of these results for economic and health policies are numerous. In the population studied

here, expansion of prenatal care programs to include presently ineligible women would likely engender significant savings in delivery and nursery costs as well as result in decreased infant morbidity and mortality. Because labor, delivery, and newborn care is ultimately provided to these indigent women regardless of their antenatal care status, investment in prenatal surveillance would seem to be a more cost-effective approach. Furthermore, the expected decrease in newborn care expenditures does not consider the enormous potential savings in aftercare (special education, follow-on medical support) frequently required in the first years of a premature infant's life or the "hidden costs" of preterm birth, that is, the considerable psychological stresses on the families involved.

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**Perinatal Needs Assessment Worksheet for Calender Year 1987**

Center Name:  
Address:

BCRR Number:

Telephone Number:

	By Center Providers	By Contract Providers on-site	By Contract Providers off-site
1. Number of Prenatal Users	_____	_____	_____
2. Number of Deliveries	_____	_____	_____

The following numbers do not relate to the source of care.

- 3. Number of Female Users, ages 15-44 \_\_\_\_\_
- 4. Number of Low Birth Weight Infants (under 2500 grams) \_\_\_\_\_
- 5. Number Very Low Birth Weight Infants (under 1500 grams) \_\_\_\_\_
- 6. Number of Teen Pregnancies:  
age 14 and under : \_\_\_\_\_  
age 15 to 17 : \_\_\_\_\_
- 7. Number 1st trimester enrollees (13 wks or less) \_\_\_\_\_
- 8. Number 3rd trimester enrollees (27wks or more) \_\_\_\_\_
- 9. Number of Infant Deaths  
Neonatal (27 days or less) \_\_\_\_\_  
Postneonatal (28 - 365 days) \_\_\_\_\_
- 10. Number of Fetal deaths (or Stillbirths) \_\_\_\_\_

Signature of person preparing report:  
Printed Name of person preparing report: