Health Care and Hospitalizations of Young Children Born to Cocaine-Using Women

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Objectives: To examine the health care and hospitalizations of young children (birth to age 2 years) born to cocaine-using women and to assess the extent to which premature births account for differences between these children and comparison children.

Design: A retrospective cohort design using a repeat-matching method: comparison children were matched to subjects with exposure to cocaine on 6 sociodemographic variables, first, without attention to gestational age and then using the gestational age as an additional matching variable.

Setting: City hospitals and primary care clinics.

Subjects: Children of women giving birth at a single hospital.

Main Outcome Measures: Hospital admissions and indexes of health care use for children from birth to age 2 years.

Results: Of the 139 subjects with exposure to cocaine, 23% were born prematurely compared with only 6% in the first comparison (P < .001). At birth, children with exposure to cocaine remained in the hospital longer (P < .01), but this difference was explained by the increased prevalence of prematurity. By age 2 years, these children had significantly fewer visits for health care maintenance (P < .001), were less likely to have completed immunizations (P < .05), and spent more days in the hospital than comparison children. These differences were not related to prematurity, but were explained by differences in sociodemographic characteristics.

Conclusion: Although prematurity is the major reason for lengthier hospital stays at birth of children with exposure to cocaine, adverse social factors contribute most to inadequate preventive health care and increased stays in the hospital in subsequent years.

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SINCE the epidemic of cocaine abuse escalated in the early 1980s, studies have demonstrated a disturbingly high prevalence of use among pregnant women, particularly in poor, disadvantaged populations. Although there continue to be many questions regarding the extent and nature of the deleterious effects of in utero cocaine exposure, investigators also have demonstrated that, following birth, infants who have had exposure to cocaine stay in the hospital longer and their increased rate of prematurity is a major factor contributing to these costly hospital stays.3,4 At present, however, little information exists concerning the health care of these children after the neonatal period, and, to our knowledge, no studies have examined whether children with cocaine exposure continue to have increased rates of hospitalization beyond the newborn period. In addition, when considering interventions aimed at preventing the consequences of maternal drug use on children, it is important to know to what extent any differences in the health of these children or their use of health care might be due solely to the increased rate of prematurity as opposed to the social-environmental factors that are associated with drug use.

The purpose of this study, therefore, was to examine the use of outpatient health care services and hospitaliza-
SUBJECTS AND METHODS

OVERVIEW OF STUDY DESIGN

This was a retrospective cohort study. The index children were born to cocaine-using women, and the children used for comparison were born to women who had no evidence of drug use during pregnancy. To determine the extent to which outcomes were related to prematurity, a repeat-matching method was used. Comparison children were first matched to cocaine-exposed children on sociodemographic variables without regard to whether the subjects were born prematurely; in a second round of matching, the gestational age was also used as a matching variable. Thus, for a child with exposure to cocaine who was born prematurely, the first comparison child was replaced by a second one who also was premature. If subjects already matched on gestational age, then the original comparison subject was retained for the second comparison.

The differences in outcomes between the cocaine-exposed and comparison groups in the first comparison (ie, excluding gestational age as a matching variable) provide a measure of the total effects of cocaine exposure, including both the effects of prematurity and the socioenvironmental factors relating to cocaine use. In contrast, any differences between subjects with cocaine exposure and comparison subjects when matched on gestational age provide an estimate of the effects of the socioenvironmental factors but exclude the effects of prematurity.

SELECTION OF SUBJECTS

Potential subjects were identified from a review of the medical records of all women who gave birth at Yale-New Haven Hospital, New Haven, Conn, between August 1, 1989, and September 30, 1990. Subjects were included if they lived in either New Haven or 1 of 2 adjacent towns, the woman either had received prenatal care at the Women’s Center of the hospital or had received no prenatal care, and the child received pediatric care at the same hospital or at 1 of 4 clinics located within New Haven—2 at community health centers, 1 at a health maintenance organization, and 1 at the only other hospital in the greater New Haven area. Subjects were excluded if the mother was younger than 18 years at the time of delivery, there was methadone or heroin use during pregnancy, there was a fetal death or an infant died within 48 hours of birth, the child was a nonsingleton birth, or the child was placed directly into foster care or for adoption immediately after birth.

Subjects with exposure to cocaine and comparison subjects were identified through a review of hospital medical records and the results of urine toxicologic tests. Cocaine-exposed children were those for whom there was evidence that the mother used cocaine during pregnancy, based on either interview data noted in the medical record or a urine screening test positive for cocaine. Possible comparison subjects were children whose mothers had no history of cocaine use during pregnancy according to at least 2 separate notations in the mother’s medical record. Subjects were excluded if there were unconfirmed suspicions of maternal drug use or the documentation that drugs had not been used was inadequate.

For the first comparison, subjects were matched to those with cocaine exposure using the following criteria: date of birth within 6 months, race, method of payment of hospitalization, the mother’s parity (primiparous or not), the mother’s age at delivery (18 years, 19-24 years, or ≥25 years), and the timing of the first prenatal visit (before or after 28 weeks’ gestation). For the second comparison, controlling for prematurity, the subject was also matched on gestational age—at least 37 weeks or less than 37 weeks. If less than 37 weeks’ gestation, subjects also were matched by whether the birth weight was greater than 1500 g.

DATA COLLECTION

The medical records of both the mothers and infants were reviewed. Data regarding sociodemographic characteristics: prenatal care; the use of drugs, alcohol, and cigarettes during pregnancy; and data related to the delivery were abstracted from the mothers’ records. There was considered to be a concern about housing whenever there was a notation in the medical record that related to overcrowding, a lack of safety, or the temporary nature of a subject’s home. Data regarding the hospitalization of children in the newborn

RESULTS

Of 1214 obstetrical records reviewed, 1140 women were eligible for the study. Of these, 173 (15.2%) had evidence of cocaine use and 526 (46.1%) were eligible for the comparison group. For the remaining 441, information was inadequate for the subjects to be assigned to the index or comparison groups. Of the 173 women who had used cocaine, 139 of their infants were included in the study. The remaining infants were excluded for the following reasons: 26 did not receive their pediatric care from the monitored health care sites, 7 were discharged to foster care and spent no time with their biological mothers, and 1 record could not be located.

For each of the children with exposure to cocaine, a comparison child was chosen using the 6 matching criteria described earlier (first comparison). Of the children with cocaine exposure, 32 (23%) were born pre-
period and during the subsequent 2 years were obtained from the children’s records at both Yale-New Haven Hospital and the 1 other hospital in the area.

Newborn Hospitalization

Data abstracted from each child’s medical record included information related to the birth, gestational age, birth weight, and whether the child was admitted to the newborn intensive care unit (NICU), the length of stay in the unit, and the total length of hospital admission. A determination was made as to whether each day in the hospital was medically necessary. For this assessment, we allowed as medically necessary a 2-day hospital stay for healthy infants born at full term by normal, vaginal delivery and 4 days for infants born by cesarean section. For infants born prematurely, the days in the hospital that were considered medically necessary were first determined using existing hospital policy guidelines for defining limits when an infant might be ready for discharge from the newborn nursery (eg, weight >1850 g and postconceptual age at least 33 weeks). Days in the hospital beyond these limits were categorized on a 4-point scale according to the reasons for the infant’s remaining in the hospital: purely medical, mainly medical or some psychosocial, mainly psychosocial or some medical, and purely psychosocial.

Hospital Admissions From Birth to Age 2 Years

For each hospital admission, the medical records were reviewed to determine whether there were notations about the mother’s history of drug use either in the predelivery record (in the emergency department) or in the hospital admission notes. A determination was made as to whether the hospital admission was medically indicated. In addition, the pediatric appropriateness evaluation protocol was used to identify days for which it was not medically justifiable that a child be in the hospital. This protocol takes into account the level of care and monitoring provided for a patient, investigations done, and treatments administered. Whenever the pediatric appropriateness evaluation protocol did not completely apply and there was uncertainty regarding the medical necessity for being in the hospital, the records for that day in the hospital were reviewed independently by 2 of us (B.W.C.F. and J.M.L.) who were unaware of the subject’s group status. If disagreements occurred, a consensus decision was reached. The reason for admission and final diagnoses for each admission were noted. Data on charges for hospital admissions were obtained from the hospital billing department.

Outpatient Health Care

To obtain data on outpatient care, we reviewed medical records at the 2 hospitals and 3 other large clinics in the city that provide pediatric services to this group of children. The site of each medical visit was noted, and the types of visits were categorized as either health care maintenance (ie, well-child care), acute care, specialty care, or a return visit. Notations were made of laboratory investigations for screening for anemia and lead toxicity and all immunizations given at each of the sites. For the purposes of this research, immunization was considered complete at 12 months of age if the child had received at least 3 doses of diphtheria toxoid, tetanus toxoid, and pertussis vaccine, adsorbed, and 3 doses of live oral poliovirus vaccine and at 24 months of age if the child had received an additional dose each of diphtheria toxoid, tetanus toxoid, and pertussis vaccine, adsorbed, and poliovirus vaccine and the combined vaccine for measles, mumps, and rubella viruses. If the records of medical care did not continue for the full 24 months, the records were reviewed in depth to determine if there was an explanation, such as the child’s moving out of the area.

DATA ANALYSIS

The χ² statistic was used to assess differences between groups in categorical variables, and the Student t test was used for differences in continuous data. To assess for the potential that other factors contributed to outcomes, multiple independent variables were entered into logistic regression models to assess their contributions to dichotomous outcomes, and linear models were used to determine contributions to the length of hospital stays.0,11

SOCIODEMOGRAPHIC CHARACTERISTICS OF SAMPLE

The sociodemographic characteristics of the sample are shown in Table 1. Subjects were predominantly African American, multiparous, and receiving Medicaid. It was not always possible to identify a comparison subject who was born prematurely and also matched on the other matching characteristics (second comparison).
comparison children were not significantly different (P = .42). For subjects with cocaine exposure, 13.9% of the days in the hospital were judged to be for reasons that were not medically necessary (ie, mainly or purely psychosocial). This proportion was significantly greater for the cocaine-exposed group than in either of the comparison groups and accounted for an average excess of 1.06 days per cocaine-exposed child.

The mean length of stay in the NICU was significantly different only in the first comparison (4.4 days for cocaine-exposed children vs 1.2 days for comparison children; P < .05) and was not significantly different when the gestational age was included as a matching variable (P = .70). In both comparisons, a significantly greater proportion of the children who had exposure to cocaine had brief admissions to the NICU (≤ 24 hours).

To assess whether possible confounding variables might explain differences in the duration of hospital stays between cocaine-exposed and comparison children, analyses of linear models were performed. We entered into the models those independent variables for which there were significant differences between cocaine-exposed and comparison groups: gestational age; maternal age; inadequate prenatal care; concerns about housing, alcohol and tobacco use in pregnancy; and mode of delivery. For both comparisons, prematurity remained the only variable significantly associated with a longer hospital stay (P < .001).

The mean hospital charges were significantly greater for subjects with exposure to cocaine in the first comparison, amounting to an excess of $3,811 per child. The charges were not significantly different in the second comparison when prematurity was included as a matching variable.

### OUTPATIENT HEALTH CARE USE AND HEALTH PROBLEMS IN THE FIRST 2 YEARS OF LIFE

To assess the comparability of follow-up in the study groups, we first examined medical records to determine whether subjects remained in the area and continued to receive their health care at study sites. As can be seen in Table 3, the rates of follow-up were similar among the 3 groups. In comparing subjects who completed follow-up with those who were unavailable for follow-up, there were no significant differences in any of the baseline sociodemographic variables. The mean number of health care visits for cocaine-exposed and comparison children during the first 2 years of life are shown in Table 4. In both the first and second comparisons, the cocaine-exposed subjects had significantly fewer health care maintenance visits (about 1 less visit per child) than did comparison subjects, but differences between groups in the number of visits for acute care or the total number of health care visits (including specialty visits and return visits) were not significant. Similarly, differences between groups in the number of visits to the emergency

### Table 1. Sociodemographic Characteristics of Cocaine-Exposed Children and Comparison Subjects

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Cocaine-Exposed Children (n=139)</th>
<th>First Comparison (n=139)</th>
<th>Second Comparison Matched for Prematurity (n=139)</th>
<th>Matched</th>
<th>Nonmatched</th>
</tr>
</thead>
<tbody>
<tr>
<td>African American race</td>
<td>82</td>
<td>81</td>
<td>78</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medicaid</td>
<td>97</td>
<td>94</td>
<td>96</td>
<td></td>
<td></td>
</tr>
<tr>
<td>First-born child</td>
<td>12</td>
<td>12</td>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maternal age ≥25</td>
<td>70</td>
<td>56‡</td>
<td>51§</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Late prenatal care</td>
<td>41</td>
<td>25§</td>
<td>26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Birth by cesarean section</td>
<td>4</td>
<td>9‡</td>
<td>9†</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Birth weight &lt; 2500 g</td>
<td>30</td>
<td>7†</td>
<td>22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol use</td>
<td>44</td>
<td>13§</td>
<td>15§</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tobacco use</td>
<td>70</td>
<td>33§</td>
<td>34</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concern about housing</td>
<td>34</td>
<td>10†</td>
<td>10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Data are given as percentages.
†The significant values in comparison with cocaine-exposed children were as follows: † indicates P < .05; §, P < .005; ‡, P < .01; and ¶, P < .001.

### Table 2. Newborn Hospital Stays for Cocaine-Exposed Children and Comparison Subjects

<table>
<thead>
<tr>
<th>Hospital Stay</th>
<th>Cocaine-Exposed Children (n=139)</th>
<th>First Comparison (n=139)</th>
<th>Second Comparison Matched for Prematurity (n=139)</th>
<th>Comparison Subjects†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days in Hospital</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1059</td>
<td>543</td>
<td>889</td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>7.6 (14.7)</td>
<td>3.9 (7.2)†</td>
<td>6.4 (10.4)</td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>1-84</td>
<td>1-80</td>
<td>1-80</td>
<td></td>
</tr>
<tr>
<td>Proportion not medically necessary, %</td>
<td>13.9</td>
<td>2.4</td>
<td>2.8</td>
<td></td>
</tr>
<tr>
<td>Days in Newborn Intensive Care Unit (NICU)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>609</td>
<td>173</td>
<td>551</td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>4.4 (14.9)</td>
<td>1.2 (7.3)†</td>
<td>4.0 (11.0)</td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>0-81</td>
<td>0-80</td>
<td>0-80</td>
<td></td>
</tr>
<tr>
<td>Proportion of subjects staying in NICU, %</td>
<td>≤ 24 h</td>
<td>29.5</td>
<td>11.5†</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt; 24 h</td>
<td>16.5</td>
<td>8.6†</td>
<td></td>
</tr>
<tr>
<td>Mean hospital charges, $</td>
<td>6194</td>
<td>2383†</td>
<td>5256</td>
<td></td>
</tr>
</tbody>
</table>

*The significant values in comparison with cocaine-exposed subjects were as follows: † indicates P < .01; ‡, P < .05.
dependent variables for which there were significant differences between groups at baseline. In the logistic regression analysis for the first comparison, the cocaine-exposed group continued to be significantly more likely to be incompletely immunized (adjusted odds ratio [OR], 2.37; 95% confidence interval [CI], 1.26-4.44). The only other variable that was significantly associated with a lack of immunizations was poor maternal prenatal care (OR, 1.79; 95% CI, 1.01-3.16). In the second comparison, however, differences were no longer significant. For group status, the OR was 1.79 (95% CI, 0.98-3.25), and for poor prenatal care, the OR was 1.72 (95% CI, 0.98-3.00).

There were no significant differences between groups in the types of illnesses for which children were seen. By age 2 years, 75% of the children with exposure to cocaine had been seen for a viral illness or upper respiratory tract infection, 71% for otitis media, 40% for a diaper rash, and 37% for an injury. The proportions receiving these diagnoses among the comparison subjects were similar.

**HOSPITALIZATIONS IN THE FIRST 2 YEARS OF LIFE**

Table 5 shows a summary of hospital admissions for cocaine-exposed and comparison subjects up to age 2 years (excluding hospitalizations at the time of birth). Of the subjects with exposure to cocaine, 32 (23%) were admitted to the hospital for a total of 48 admissions. Fewer hospital admissions occurred among the comparison subjects, and the difference was statistically significant when matched for prematurity. Of the 48 hospital admissions of cocaine-exposed children, 21 (44%) occurred before 3 months of age, whereas comparison subjects had less than half of this number of hospital admissions by this age (10 and 9 admissions in the first and second comparisons, respectively). The diagnoses that resulted in hospital admissions were similar in the 3 groups. The most frequent diagnoses were:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Cocaine-Exposed Children (n=139)</th>
<th>First Comparison Matched for Prematurity (n=139)</th>
<th>Second Comparison Matched for Prematurity (n=139)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total admissions, No.</td>
<td>Days in hospital, No.</td>
<td>Mean per subject (SD)</td>
</tr>
<tr>
<td></td>
<td>48</td>
<td>265</td>
<td>1.91 (5.86)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>135</td>
<td>0.97 (4.12)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>93</td>
<td>0.67 (2.43)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Range</td>
<td>1-18</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1-41</td>
<td>1-14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Length of stay, %</td>
<td></td>
</tr>
<tr>
<td></td>
<td>≤3 d</td>
<td>32.7</td>
<td>4.3‡</td>
</tr>
<tr>
<td></td>
<td>4-7 d</td>
<td>46.9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>≥8 d</td>
<td>20.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Proportion not medically necessary, %</td>
<td>19.2</td>
<td>9.6†</td>
</tr>
<tr>
<td></td>
<td>Mean hospital charges per subject (for all 139 subjects), $</td>
<td>2020</td>
<td>914</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>709‡</td>
</tr>
</tbody>
</table>

*The significant values in comparison with cocaine-exposed subjects were as follows: † indicates P < .05; ‡, P < .01; §, P < .005; and ††, P < .001.
were respiratory conditions, including bronchiolitis and asthma (27% in the cocaine-exposed group).

The mean number of days spent in the hospital for all 139 cocaine-exposed children (1.91 days per child) was greater than that for the comparison children, but this difference was statistically significant only in the second comparison when gestational age was included as a matching variable. Similarly, the mean charges resulting from hospitalization were significantly increased for cocaine-exposed subjects only in the second comparison. This finding that there was a greater difference between groups when they were matched by gestational age is explained by the fact that 1 comparison subject who was included only in the first comparison stayed in the hospital for 41 days, more than twice the length of stay of any other subject (maximum stay, 18 days). Because this 1 outlier led to a counterintuitive result, we examined its effect by repeating the analyses excluding this subject and its matched-comparison subjects. With these subjects excluded, the differences between groups were not significant in the first comparison for both the mean number of days spent in the hospital (1.92 vs 0.64 days; \( P = .02 \)) and the mean hospital charges per subject ($2035 vs $692; \( P = .05 \)).

For the cocaine-exposed children, 67% of the admissions lasted at least 4 days, whereas for the comparison children, only about half of the admissions lasted 4 days or more. For the cocaine-exposed subjects, 19% of the days in the hospital were judged on the pediatric appropriateness evaluation protocol to be medically unnecessary, which is significantly higher than for the comparison children.

Of the 48 hospital admissions of subjects with cocaine exposure, 3 (6%) were considered to be not medically necessary. Only 2 (4%) of the preadmission records and 22 (46%) of the postadmission records mentioned a mother’s history of drug use. In only 2 records was there a notation documenting that drug use was ongoing.

When logistic regression analyses were used to examine the possible relationship between sociodemographic factors and hospitalizations, in the first comparison there was no longer a significant difference between groups, but associations between hospital admissions and sociodemographic variables were significant: concern about housing (OR, 3.85; 95% CI, 1.73-8.56), maternal smoking (OR, 2.39; 95% CI, 1.17-4.86), and poor prenatal care (OR, 2.29; 95% CI, 1.09-4.83). In the second comparison in which prematurity was included as a matching variable, only concern about housing continued to be significantly associated with hospital admissions (OR, 3.86; 95% CI, 1.74-8.56). When the relationship between sociodemographic characteristics and the duration of hospital stay was examined, maternal age was the only variable that had a significant association \( (P < .05) \)—children of mothers aged 25 years or older tended to stay in the hospital longer.

**COMMENT**

**NEWBORN HOSPITALIZATIONS**

As has been shown in previous studies of children born to cocaine-using mothers, our study demonstrates that these children spend a prolonged period in the hospital in the neonatal period. In our study, the average length of stay was almost twice as long as that of a comparison group of infants matched on sociodemographic variables. Almost a quarter of the cocaine-exposed infants were born prematurely, however, and the results of this study illustrate the degree to which prematurity accounts for the increased duration of hospital stays. By using a unique method in which case-patients are first compared with control subjects who are matched on sociodemographic variables without attention to gestational age and then compared again with gestational age included as a matching variable, we have demonstrated that the effect of cocaine use during pregnancy on prolonging the hospital stays of newborn infants is almost entirely due to the association between cocaine use and premature delivery. These results were supported by those of the multivariate analyses, which showed that significant differences in sociodemographic variables between cocaine-exposed children and suitable comparison children, only prematurity contributed significantly to the duration of a hospital stay.

Our study is different in an important way from prior studies that examined the duration of newborn hospitalizations of cocaine-exposed infants because children who did not go home with their mothers but were placed in foster or adoptive families were excluded from the study. These infants were excluded because we wished to study only infants who were in the care of their mothers, or who at least started in the care of their mothers, for the 2-year follow-up period. This approach, however, potentially excludes a group of children, referred to elsewhere as “boarder babies,” who in other studies have been shown to remain in the hospital for extensive periods and account for a substantial proportion of hospital days. In fact, in our study, only 7 infants were excluded for this reason, but these children stayed in the hospital for a mean of 43 days. Including these infants in the cohort would have resulted in a mean hospital stay of 9.3 days, which is within the range of 7.8 days to 22.5 days reported in other studies.

Despite that only 13.9% of hospital days for the cocaine-exposed group were judged to be medically inappropriate, this was still significantly greater than in the comparison groups. Although these hospital days amount to an average of only 1 additional day per subject, this “medically unnecessary” day explains the difference in the total duration of hospitalization between the cocaine-exposed and comparison infants when matched on prematurity.

In addition to prolonged stays in the NICU, more cocaine-exposed children spent short periods in the intensive care unit, which, because of the additional services required, adds to hospital costs. The difference between groups in the number of perinatal complications was not significant (data not shown), suggesting that these short stays in the NICU may have been because the medical staff were aware of the mother’s history of drug use and were, therefore, taking extra precautions in caring for the child.
ROUTINE HEALTH CARE

These results demonstrate that for the children of cocaine-using mothers, there is decreased attention to routine health care, as shown by the decreased number of health care visits and the delay in immunizations. For both groups, the attention to preventive health care and immunizations was unsatisfactory, as has been documented for young children nationwide. The findings of this study, however, identify a group of children who are at particularly high risk for inadequate medical care. As seen in other studies, inadequate prenatal care in this population was a marker for the incomplete immunization of children, but maternal cocaine use itself also is a risk factor for inadequate immunizations, or at least a marker for behaviors and other socioeconomic factors that interfere with a child’s receiving appropriate health care.

HOSPITAL ADMISSIONS

Our results show for the first time that children born to cocaine-using mothers also spend more time in the hospital after the newborn period. This difference is not great, however, and accounts for an average of only about 1 extra day per child during the first 2 years of life. Unlike the newborn hospital stays, the increase in later hospitalizations was not related to prematurity.

It is unclear from this study why the infants with exposure to cocaine tended to be admitted more frequently, although the results do support the fact that this was not due to an increased rate of prematurity or an increased prevalence of infection among the cocaine-exposed children. Furthermore, the lack of notations about drug use in emergency department records would suggest that physicians’ knowledge about drug exposure was not a contributing factor, although physicians may have been aware of more subtle information related to the care and health of the children. As has been seen in other studies of children living in poverty, our results suggest that other sociodemographic factors such as inadequate housing contribute to differences in the rates of hospitalization. It is noteworthy also that in the first comparison, the increased rate of cigarette smoking among the cocaine-using mothers was 1 of the variables that explained differences in hospitalizations between the 2 groups. This likely relates to the fact that respiratory conditions such as bronchiolitis and asthma were the most frequent reasons for admissions to the hospital.

Although hospital admissions were nearly always considered to be medically necessary, once admitted, the cocaine-exposed children tended to stay in the hospital longer, and about a fifth of the days in the hospital appeared to be primarily for social reasons.

HOSPITAL CHARGES

When the charges from hospitalizations at birth are combined with those during the subsequent 2 years, the hospital charges for cocaine-exposed children during the study were $4917 per child greater than the charges for comparison children when prematurity was not included as a matching variable. When the increase in medical care costs between 1990 and the end of 1996 are adjusted for, these excess charges are equivalent to about $6965 per child in 1996. The greater part of these excess charges is a result of prolonged hospital stays at the time of birth; however, in this study population, almost a quarter of the total excess charges related to later hospitalizations.

STUDY LIMITATIONS

A possible limitation of our study is that information about cocaine use was obtained from reviewing medical records, rather than through a universal screening of all eligible women. Because of this, it is possible that drug-using women might inadvertently have been included in the comparison group, in which case, differences between groups might have been minimized. Alternatively, if cocaine-using women were selectively identified because of characteristics that are associated with poorer outcomes (eg, inadequate prenatal care or concerns about housing), then the differences between cocaine-exposed and comparison subjects might have been overestimated. In our study, however, 15% of the eligible women were found to be using cocaine, a rate that is similar to the results of a prospective study that included universal screening conducted in the same prenatal clinic a year later. The results of this latter study showed that 16% of the women were using cocaine, so if a detection bias did occur in the present study, its effect was likely minimal.

A second possible limitation is that the data on health care visits could be incompletely ascertained if children received health care elsewhere. We attempted to guard against this by obtaining data from all the clinics in the city that routinely provide health care to children receiving Medicaid. In addition, we reviewed all records kept in the clinics, including immunization records, and if there was an indication that an immunization had been given elsewhere or that a visit had taken place at another site, data were also collected from this other site. Only a small proportion (3%) of all the identified health maintenance visits, however, were at other sites.

A third limitation is our inability to know whether women with cocaine-exposed children continued to use cocaine; for only 2 hospital admissions was there mention of continuing drug use in the medical record. Obviously, this might be an important consideration when outcomes beyond the newborn period are assessed. On the basis of the experience of clinicians working with women who have used cocaine during pregnancy, most of the women likely continued to use cocaine during the follow-up period.

A fourth limitation of the study is that we did not have information on whether the families enrolled in the study were receiving services that possibly could have resulted in the differences between groups being less striking than if no services existed. We do know that some of the children in the cocaine-exposed group spent time with other caregivers, which might also have diminished differences between the groups.
CONCLUSIONS

This study has demonstrated that the children of mothers who use cocaine during pregnancy not only have prolonged hospital stays following birth, but continue to receive inadequate attention to health care and stay in the hospital longer during the early years of life. Although the increased length of hospital stays at birth is predominantly related to the increased rates of prematurity associated with cocaine use, the greater number of later hospitalizations is related to socioenvironmental factors such as inadequate housing and not to prematurity. Thus, these later effects are likely due to the behaviors and environmental circumstances that are associated with cocaine use and not an effect of the drug itself. Interventions aimed at improving outcomes for cocaine-using women and their children will have little benefit in decreasing lengthy hospital stays in the newborn period, unless such interventions are able to prevent premature births. On the other hand, because the lack of attention to the routine health care of these children and the increased number of hospitalizations during the early years of life are not related to prematurity, interventions to address such outcomes for these children may have a beneficial and cost-saving effect, whether or not prematurity can be prevented. Future studies are needed to assess whether interventions do improve the health care of such children and, if so, what types of interventions are most cost-effective in helping these children and their parents.

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