Objective: To determine whether women who frequently bring their neonates for problem-oriented primary care visits or emergency department visits are at elevated risk of having depressive symptoms.

Design: Analysis of 2 prospective cohort studies of mothers and their infants: (1) a telephone interview study of mothers and infants after birth at an urban teaching hospital (the hospital cohort) and (2) the 1988 National Maternal and Infant Health Survey, a nationally representative sample of women who had live births in 1988.

Participants: A total of 1015 women in the hospital cohort surveyed at 3 and 8 weeks post partum and 6779 women with data from the national survey.

Main Outcome Measure: Depressive symptoms above the Center for Epidemiologic Studies Depression Scale cutoff score of 15.

Results: After controlling for sociodemographic variables and parity, women exhibited high levels of depressive symptoms if their infants had more than 1 problem-oriented primary care visit (hospital cohort: odds ratio, 2.0 [95% confidence interval, 1.1-4.3]; national survey cohort: odds ratio, 2.0 [95% confidence interval, 1.5-3.0]). Women were more likely to have high levels of depressive symptoms if their infants had even 1 emergency department visit (hospital cohort: odds ratio, 3.2 [95% confidence interval, 1.5-6.9]). Frequent well-child visits were not associated with maternal depressive symptoms.

Conclusions: Neonatal health care use patterns predict women at risk for postpartum depression. Recognition of these signature patterns of service use by pediatric health care providers may facilitate early diagnosis and treatment of postpartum depression and improve outcomes for women and their families.

SUBJECTS AND METHODS

The hospital cohort consisted of 1200 mother-infant pairs consecutively delivered between February 15 and May 29, 1993 at a single Boston, Mass, urban teaching hospital with more than 8000 annual births. This prospective cohort study was initially conducted to measure the effects of inpatient postpartum services, particularly postpartum length of stay, on an array of maternal and infant health outcomes. Mothers were identified by hospital information systems on the basis of assignment of diagnosis-related group code 372 (vaginal delivery with complicating diagnoses) or 373 (vaginal delivery without complicating diagnoses). Patients were excluded for the following reasons: (1) residence outside Massachusetts, (2) admission of the infant to the special care nursery for more than 24 hours, (3) birth weight less than 2200 g, (4) gestational age less than 36 weeks, (5) twin or multiple birth, (6) maternal or newborn postpartum length of stay greater than 99 hours, and (7) assignment of any one of a predetermined group of serious maternal or newborn secondary medical diagnoses.

Research assistants interviewed mothers on the telephone, in English or Spanish, at 3 and 8 weeks post partum. They obtained information about health services utilization, health-related behaviors, and health outcomes. Of 1364 eligible patients, 1200 (88.0%) were surveyed at 3 weeks, and 1015 (84.6%) were surveyed again at 8 weeks. Study methods have been previously described in detail.15

The nationally representative sample we analyzed was the 1988 NHIS,14 conducted by the National Center for Health Statistics to identify factors related to poor pregnancy outcome.16-18 The population-based study identified subjects from vital records of births, using stratified systematic sampling techniques with oversampling of black and low-birth-weight infants.19 The sample from 48 states, the District of Columbia, and New York City included 13 417 live births, 4772 fetal deaths, and 8177 infant deaths. Mothers were mailed a 35-page questionnaire, a brochure, and a prepaid return envelope. Nonrespondents received a second questionnaire and then were contacted for a personal interview. Response rates for women with live births, fetal deaths, and infant deaths were 74.2%, 69.3%, and 65.2%, respectively. Methods are described in detail elsewhere.19 For these analyses, we limited the 1988 NHIS data set to live births, excluding patients with 1 or more of the following criteria: gestational age less than 36 weeks (2166 patients [21.8%]), birth weight less than 2200 g (2134 [21.4%]), multiple births (351 [3.5%]), and infants who never came home (307 [3.1%]). The responses to 1 or 2 questions on the depression scale were left blank by 488 (4.9%) of subjects; these subjects were excluded as well, resulting in a sample size of 6749.

In the hospital cohort, the main independent variable was the occurrence of more than 1 problem-oriented newborn primary care visit. Problem-oriented visits were distinguished from well-child visits by survey items asking whether each infant primary care visit was “scheduled and routine or for a problem.” An additional marker of problem-oriented health care use is newborn emergency department visits; subjects were classified as having either any newborn emergency department visits or none. Rates of primary care and emergency department visits were measured during the first 21 days after maternal discharge. Covariates measured included maternal age, race, Hispanic ethnicity, parity, educational level, income, and payer status.

In the NHIS cohort, the main independent variable was also the occurrence of more than 1 problem-oriented newborn primary care visit during the first month of life. Problem-oriented primary care visits were identified by survey questions asking whether the infant was seen “because he or she was sick” or “for well-baby care when the baby was not sick.” Limited data were available regarding infant emergency department visits in the NHIS, and therefore these visits are not included in the analysis. The same covariates were measured, including maternal age, race, Hispanic ethnicity, parity, educational level, income, and payer status.

The same outcome measure was used for both samples. The main dependent variable used for analysis of the hospital and the NHIS data sets was the presence of a high degree of depressive symptoms assessed by means of the Center for Epidemiologic Studies Depression Scale (CES-D). This validated 20-item scale was developed to measure symptoms of clinical depression and is sensitive for detecting major depression, minor depression, and depressive personality.20-22 Subjects using the CES-D are asked to rate symptoms on a scale from 0 to 3, according to how they have felt during the past week. The scale measures symptoms of dysphoria and somatic complaints that tend to be associated with depression and is highly correlated with other clinical rating scales.21 The CES-D score was dichotomized by means of the previously reported standard cutoff score of 15 or higher to identify cases of depressive symptoms.23,24

The Fisher exact test was used to assess the significance of binary associations. Logistic regression modeling adjusted for covariates, all of which were forced into the models (SAS System for Windows Release 6.11; SAS Institute Inc, Cary, NC). For the NHIS data, all bivariate analyses were weighted to be nationally representative. Logistic regressions for the NHIS data accounted for the sampling strategy by means of SUDAAN (Research Triangle Institute, Research Triangle Park, NC). Adjusted odds ratios and confidence intervals (CIs) were calculated with the β coefficients and SEs obtained from the regression analyses.

We expected that depressed women and their infants would exhibit characteristic patterns of health care utilization and that these patterns could be used to identify depression. Specifically, we hypothesized that women who frequently bring their neonates for problem-oriented primary care visits or emergency department visits would be at elevated risk of having depressive symptoms. We tested this hypothesis with data obtained on a
cohort of mother-infant pairs from a single obstetrical hospital and further validated our findings through analysis of a nationally representative sample, the 1988 National Maternal and Infant Health Survey (NMIHS).14

RESULTS

Women in the hospital cohort were generally more affluent and better educated than those in the NMIHS cohort (Table 1). Specifically, a higher percentage of women in the NMIHS cohort had not completed high school (22.7% vs 5.1%; P < .001), had an annual household income of less than $20 000 (41.7% vs 15.4%; P < .001), and had Medicaid insurance or self-paid for health care (55.6% vs 15.1%; P < .001).

HOSPITAL COHORT

In the hospital cohort, 76.2% had no problem visits, 16.3% had 1, and 7.6% of infants had more than 1 problem-oriented primary care visit within 21 days (Figure 1, top). When asked, “What did the doctor say the problem was at the end of the visit?” for each of the problem-oriented primary care visits, mothers responded, “no serious problem” (26.0%), jaundice (20.5%), and fever (9.2%). Of newborns, 5.1% had an emergency department visit. According to maternal report, the emergency department diagnoses were most frequently “no serious problem” (21.9%), jaundice (15.6%), and fever (7.8%). Only 6.6% had no well-child primary care visits within the first 21 days, while 82.5% had 1 well-child visit and 11.0% had more than 1 well-child primary care visit.

Among the mothers in the hospital cohort, 9.2% had depressive symptoms above the CES-D cutoff. Covariates that were significant predictors of high levels of depressive symptoms included maternal age of 21 years or younger (P = .03), maternal educational level below high school (P = .02), self-pay or Medicaid insurance status (P < .001), and black race (P = .002).

The occurrence of more than 1 infant problem-oriented visit was strongly associated with maternal depressive symptoms (Table 2). This effect persisted even after adjustment for maternal age, race, Hispanic ethnicity, parity, educational level, income, and payer status (adjusted odds ratio, 2.0 [95% CI, 1.1-4.3]). As the number of infant problem-oriented primary care visits increased (at least 1, 2, or >2), the proportion of women with depressive symptoms increased as well (P = .03; Figure 2, top). The strongest predictor of depressive symptoms was infant emergency department visits. Women in the hospital cohort whose infants had an emergency department visit were highly likely to show depressive symptoms (adjusted odds ratio, 3.2 [95% CI, 1.5-6.9]). In contrast, having more than 1 well-child visit was not associated with depressive symptoms (adjusted odds ratio, 1.4 [95% CI, 0.7-2.8]).

The positive predictive value of having more than 1 problem-oriented primary care visit was 0.16 (95% CI, 0.11-0.26) and the negative predictive value was 0.91 (95% CI, 0.89-0.93). The positive predictive value for depressive symptoms of an emergency department visit was 0.24

Table 1. Selected Sociodemographic Characteristics of the Women

<table>
<thead>
<tr>
<th>Age, y</th>
<th>Hospital Cohort, % (n = 1015)</th>
<th>NMIHS* Cohort, % (Weighted %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;18</td>
<td>2.3</td>
<td>6.3 (4.4)</td>
</tr>
<tr>
<td>18-21</td>
<td>5.2</td>
<td>20.4 (17.0)</td>
</tr>
<tr>
<td>&gt;21</td>
<td>92.5</td>
<td>73.5 (78.5)</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>75.3</td>
<td>49.3 (80.5)</td>
</tr>
<tr>
<td>Black</td>
<td>10.9</td>
<td>47.2 (14.7)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>12.0</td>
<td>8.7 (12.2)</td>
</tr>
<tr>
<td>Primiparous</td>
<td>46.3</td>
<td>40.8 (41.7)</td>
</tr>
<tr>
<td>Annual household income, $†</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;20 000</td>
<td>15.4</td>
<td>52.6 (41.7)</td>
</tr>
<tr>
<td>20 000-60 000</td>
<td>52.7</td>
<td>40.8 (49.4)</td>
</tr>
<tr>
<td>&gt;60 000</td>
<td>31.9</td>
<td>6.6 (9.0)</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than high school</td>
<td>5.1</td>
<td>22.7 (18.1)</td>
</tr>
<tr>
<td>High school graduate</td>
<td>12.4</td>
<td>42.9 (41.6)</td>
</tr>
<tr>
<td>Some college</td>
<td>17.3</td>
<td>20.8 (23.1)</td>
</tr>
<tr>
<td>Completed college</td>
<td>65.2</td>
<td>13.6 (17.2)</td>
</tr>
<tr>
<td>Insurance status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private</td>
<td>84.9</td>
<td>33.6 (38.5)</td>
</tr>
<tr>
<td>Medicaid or government</td>
<td>13.0</td>
<td>35.1 (23.5)</td>
</tr>
<tr>
<td>Uninsured or self-pay</td>
<td>2.1</td>
<td>26.6 (33.1)</td>
</tr>
<tr>
<td>Other (Indian, military)</td>
<td>0.0</td>
<td>4.7 (4.9)</td>
</tr>
</tbody>
</table>

*1988 National Maternal and Infant Health Survey (NMIHS), National Center for Health Statistics.
† Income data were missing for 7.7% of the women.

Figure 1. Number of problem-oriented and well-child primary care visits: hospital cohort (top) and national survey (bottom).
The effect of having more than 1 infant problem-oriented primary care visit on depressive symptoms was of similar magnitude to the effect in the hospital cohort; after adjustment for covariates, the adjusted odds ratio for depressive symptoms above the CES-D cutoff in the NMIHS cohort was 2.0 (95% CI, 1.5-3.0). The number of problem-oriented infant visits within the first month was positively associated with increasing rates of depressive symptoms (P < .001; Figure 2, bottom). Having more than 1 infant problem visit in each of the second, third, fourth, and fifth months of life also predicted high levels of depressive symptoms, with odds ratios (95% CIs) of 1.5 (1.1-2.0), 1.5 (1.1-2.0), 1.3 (1.0-1.7), and 1.5 (1.5-2.0), respectively.

As in the hospital cohort, having more than 1 well-child visit was not associated with increased levels of depressive symptoms (adjusted odds ratio, 1.1 [95% CI, 0.8-1.5]). In the NMIHS cohort, where there was a higher rate of depressive symptoms, the positive predictive value of having more than 1 primary care visit for an infant problem was 0.36 (95% CI, 0.30-0.41). The negative predictive value was 0.78 (95% CI, 0.77-0.79).

**COMMENT**

These data demonstrate a clear relationship between patterns of infant health care visits and maternal emotional state. An infant having more than 1 problem-oriented primary care visit or any emergency department visits in the first month of life signals a mother at greater risk of being or becoming depressed. There was a “dose-response” effect, with more problem-oriented visits being associated with higher rates of depressive symptoms. Furthermore, problem-oriented primary care visits occurring in the second through the fifth months of life were also significantly associated with maternal depressive symptoms, a consistency that strengthens confidence in the association. Well-child visits, however, which are generally scheduled by the pediatrician and not initiated by the mother, were not associated with maternal depressive symptoms in either cohort.

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**Table 2. Odds of Maternal Depressive Symptoms***

<table>
<thead>
<tr>
<th>Infant Visits</th>
<th>Odds Ratio (95% CI)</th>
<th>P</th>
<th>Adjusted Odds Ratio (95% CI)</th>
<th>P</th>
<th>Positive Predictive Value (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hospital Cohort</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;1 Problem visit</td>
<td>1.9 (1.1-3.8)</td>
<td>.04</td>
<td>2.0 (1.1-4.3)</td>
<td>.05</td>
<td>0.16 (0.12-0.26)</td>
</tr>
<tr>
<td>≥1 Emergency department visit</td>
<td>3.3 (1.7-6.7)</td>
<td>&lt;.001</td>
<td>3.2 (1.5-6.9)</td>
<td>&lt;.001</td>
<td>0.24 (0.17-0.38)</td>
</tr>
<tr>
<td>&gt;1 Well-child visit</td>
<td>1.3 (0.7-2.4)</td>
<td>.46</td>
<td>1.4 (0.7-2.8)</td>
<td>.32</td>
<td>NA</td>
</tr>
<tr>
<td><strong>NMIHS Cohort</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;1 Problem visit</td>
<td>1.9 (1.5-2.6)</td>
<td>&lt;.001</td>
<td>2.0 (1.5-3.0)</td>
<td>&lt;.001</td>
<td>0.35 (0.31-0.40)</td>
</tr>
<tr>
<td>&gt;1 Well-child visit</td>
<td>0.8 (0.7-1.1)</td>
<td>.35</td>
<td>1.1 (0.83-1.49)</td>
<td>.47</td>
<td>NA</td>
</tr>
</tbody>
</table>

*As measured by a score of 16 or more on the Center for Epidemiologic Studies Depression Scale. CI indicates confidence interval; NA, not applicable.
† Adjusting for parity, age, race, Hispanic ethnicity, education, income, and insurance status.
‡ 1988 National Maternal and Infant Health Survey (NMIHS), National Center for Health Statistics.

**Figure 2. Frequency of problem-oriented primary care visits: hospital cohort (top) and national survey (bottom). CES-D indicates Center for Epidemiologic Studies Depression Scale.**

(95% CI, 0.17-0.39) and the negative predictive value was 0.92 (95% CI, 0.90-0.93).

**NMIHS COHORT**

In the NMIHS cohort (Figure 1, bottom) almost one quarter of infants (23.4%) had no primary care follow-up in the first month of life; this proportion was significantly higher than the number without follow-up in hospital cohort (P < .001). The percentage of NMIHS newborns who had more than 1 problem primary care visit (6.6%) was similar to that in the hospital cohort (P = .23). Almost one quarter of women had levels of depressive symptoms above the CES-D cutoff (23.4%; P < .001), a much higher rate than in the hospital cohort.

Covariates that were significant predictors of high levels of depressive symptoms included maternal age of 21 years or younger (P < .001), maternal educational level below high school (P < .001), family income less than $20,000 (P < .01), self-pay or Medicaid insurance status (P < .001), black race (P < .001), non-Hispanic ethnicity (P < .001), and parity of more than 1 (P = .02).
Women who are depressed may bring their infants to medical attention more often than other women for several reasons. Depression may color a mother’s assessment of infant cues and well-being. In addition, depressed women may, on some level, recognize their own need to seek help. It is generally accepted that adult patients may offer a chief complaint that does not directly reveal the underlying reason for the health care visit. Some women may find contacting the health system on behalf of their infant less threatening or stigmatizing than seeking help for their own needs directly.

Depression has been shown to increase health care use. Healthy adult patients with perceived poor health and depressive symptoms have increased use of health care services. Elderly patients with depression have higher overall costs of medical services even after adjusting for illness severity. Also, previous work has established a direct relationship between use of maternal and child health services. Depression drives use of health services and, further, use of maternal and child health services are related. Our data establish the linkage between utilization of maternal health and child health services; maternal depression appears to be one determining factor of patterns of infant health care visits.

Conversely, some women may become depressed because their infants are ill. Mothers of sicker children have higher rates of depression and anxiety than the general population. Most of the infants in this study, even those with emergency department or problem-oriented primary care visits, had only minor problems. In the hospital cohort, the majority of infants with more than 1 problem-oriented primary care visit or emergency visit did not have serious or chronic illnesses. According to maternal report, the most common diagnosis at the emergency department visits was “no serious problem,” and only 17% of neonates were admitted at these visits. Of the admitted infants, the median length of hospital stay was 3 days, with a range of 1 to 14 days, and the majority of these hospitalizations were for jaundice and dehydration, which are acute, treatable conditions that should have resolved by the time the CES-D was administered. Even so, seemingly minor illnesses may result in changed maternal perception of the infant’s well-being and lower a mother’s self-esteem.

The relation between infant health care use and maternal depressive symptoms is robust and demonstrated here in 2 patient populations with different risk status. Some differences between the 2 populations are worth noting. The NMIHS cohort overall had younger mothers and lower socioeconomic status as measured by income, maternal educational level, and insurance status. Given that these factors are all significantly associated with high CES-D scores, it is not surprising that the rate of depressive symptoms was significantly higher in the NMIHS cohort. Also, the rate of primary care follow-up was higher in the hospital cohort, which is not surprising given the high rate of primary care attachment in the Boston area.

Our study has some limitations. We were able to study only the association of infant visits with maternal depressive symptoms; the relationship between use of maternal health services and depressive symptoms could not be established. In the hospital cohort, few women had primary care visits within the first 21 days post partum, and only 1.9% had emergency department visits of their own. The 1988 NMIHS survey did not collect detailed data on maternal use of postpartum health services. Also, all use of health services was measured by maternal report. Previous work, however, does establish the accuracy of self-reported medical history and specifically accuracy of maternal report of pediatric health care utilization. Nonetheless, our results should be confirmed by other methods, such as chart review, physician survey, and secondary analyses of health insurance claims. Also, future work should validate these findings with other measures of depression, as the CES-D is a screening tool rather than a diagnostic tool so that some specificity is sacrificed. Depression may be an even more prevalent problem than suggested by our data, since exclusion criteria such as low birth weight and prematurity may have lowered the rate of depression in the sample. Also, we expect that nonrespondents to the surveys may have had a higher rate of depression. Despite these caveats, the predictive value of use of infant health services for maternal depressive symptoms is robust and demonstrated here in these 2 populations of mother-infant dyads at different baseline risks of depression.

CONCLUSIONS

Women whose infants have frequent problem-oriented primary care visits or emergency department visits are more likely to subsequently have depressive symptoms. Regardless of whether depressive symptoms are the basis or the result of these infant outpatient visit patterns, mothers and infants with these patterns need close monitoring. Neonatal health care use, classically treated as an outcome in health services research models, may be a valuable predictor of women at risk for postpartum depression. The pediatrician who finds a mother bringing in her infant for frequent visits to the emergency department or to the office should closely examine the motivation for the visits, and consider screening for depressive symptoms. Specific evaluation of mothers by health care providers who recognize these signature patterns of service use may reduce unnecessary health care use and facilitate early diagnosis and treatment of postpartum depression, improving outcomes for women and their families.

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