Prediction of Resource Use During Acute Pediatric Illnesses

Paul McCarthy, MD; Theodore Walls, PhD; Dominic Cicchetti, PhD; Linda Mayes, MD; John Rizzo, PhD; Jorge Lopez-Benitez, MD; Sadek Salloum, MD; Michael Baron, MD; Howard Fink, MD; Robert Anderson, MD; Todd Little, PhD; Robert LaCamera, MD; Kimberly Freudigman, PhD

Background: Significant resources are used for acute illnesses in children. Identifying predictors of resource use can focus interventions to reduce this use.

Objective: To determine the relative effects of maternal, infant, social milieu, and demographic characteristics, the mother-child interaction, and perception of illness severity on the use of resources during acute illnesses in children.

Design: At the 2-week and 6-, 15-, and 24-month well-child care visits of a cohort of mother-infant dyads, the mother–well-child interaction was assessed by using the Biringen Emotional Availability Scales, and data were gathered regarding maternal depression and sense of competence, infant temperament, maternal social support, the home environment, and demographic characteristics. At each of the cohort’s 1983 ill-child care visits during 30 months of follow-up, the mother–ill-child interaction was assessed by using the Emotional Availability Scales, and mothers and pediatricians independently assessed illness severity using the Acute Illness Observation Scales. Resources used during the illnesses—over-the-counter and prescription medications, tests, hospitalizations, follow-up visits, and the emergency department—were assessed.

Setting: A hospital primary care center and an urban and a suburban private practice.

Patients: Between February 1, 1995, and March 30, 1998, a consecutive sample of 380 dyads were asked to enroll at the 2-week well-child care visit; 316 (83.2%) consented, and complete data were available for analysis of 243 dyads.

Main Outcome Measures: A path analytic framework using a structural equation model assessed the presence and strength of predictive relationships between demographic, maternal, infant, and social milieu data, the Biringen Emotional Availability Scales, and the Acute Illness Observation Scales and the main outcome measure, resource use.

Results: Three variables predicted greater mean resource use during each acute illness episode: a less optimal mother-child interaction (β = −.53), lower scores for parenting sense of competence (β = −.26), and greater perception of illness severity by mothers (β = .33). By using the coefficient of determination ($R^2$), these 3 predictors account for 55% of the reliable variance in resource use during acute illnesses.

Conclusion: The quality of the mother-child interaction, maternal sense of competence, and maternal assessment of severity of the illness are major predictors of resource use during acute pediatric illnesses, and should be important foci of interventions to reduce resource use.

Arch Pediatr Adolesc Med. 2003;157:990-996
in combination, thus informing more precise design of interventions to reduce resource use during acute childhood illnesses.

METHODS

STUDY POPULATION AND DESIGN

Patients were enrolled at a medical center primary care center, the urban private practice of 2 of us (R.A. and R.L.), and the suburban private practice of 2 of us (M.B. and H.F.). These sites were chosen to ensure that the study participants represented a broad range of sociodemographic characteristics. Previous experience indicated, for example, that mothers in the primary care center vs those in a suburban practice would be younger, less likely to have college degrees, and more likely to be receiving federal assistance. Study participants gave informed written consent, and the study protocol was approved by the Human Investigation Committee of the Yale University School of Medicine.

MOTHER-CHILD INTERACTION

At the 2-week and 6-, 15-, and 24-month well-child care visits, pediatricians or nurse practitioners scored 3 domains (maternal sensitivity, maternal hostility, and child responsivity) of the Biringen Emotional Availability Scales (EASs), a measure of the mother-child interaction. Scale scoring was performed after a 2-minute observation period (during which the mother played with the child), after obtaining the medical history and performing the physical examination. This was the well EAS score. Completion of the EASs took 2 to 3 minutes. Pediatricians and nurse practitioners were trained to score the EASs reliably. The convergent validity of EAS scoring was demonstrated by obtaining videotapes of the well-child care visit in a 20% subsample (videotaped cohort) and scoring these videotapes by the method of Bornstein and colleagues by an observer blind to the EAS score.

MATERNAL, INFANT, AND SOCIAL MILIEU CHARACTERISTICS

Within 2 weeks of the well-child care visit, a child developmentalist (K.F.), blinded to EAS data, visited the home and scored the Home Observation for Measurement of the Environment (HOME) Scale of Caldwell and Bradley and the Supplemental HOME for Impoverished Families (SHIF). Mothers completed the Beck Depression Inventory, the Parenting Social Support Index, the Rothbart Infant Temperament Questionnaire, the Parenting Sense of Competence Scale, and a revised version of the Life Events Questionnaire of Abidin. Demographic data were also recorded. A research associate gathered and collated these latter data, completed by the mothers; therefore, the investigators and other study personnel were unaware of these results. Pediatricians were also unaware of HOME Scale and SHIF data gathered by the child developmentalist.

CLINICAL JUDGMENT AND RESOURCE USE

During acute illness-related visits to the pediatrician during 30 months of follow-up for mother-infant dyads, the mother and the pediatrician (or nurse practitioner) observed the child for 2 minutes and then independently scored the Acute Illness Observation Scales (AIOSs). The AIOSs are composed of 6 items that assess by observation an ill child’s degree of toxicity; adequate levels of reliability and validity of the AIOSs have been demonstrated. After the observation period, attainment of the medical history, and the physical examination, the pediatrician scored the 3 domains of the AIOSs: this was the ill EAS score. Over-the-counter and prescription medications given, tests ordered, hospital admissions, follow-up appointments made, and use of the ED were recorded on a standardized form. Mothers were provided a teaching videotape of the AIOSs. For the videotaped cohort of mothers and infants, ill-child care visits were videotaped and analyzed by the method of Bornstein and colleagues. Data about medications given, tests ordered, hospitalizations, follow-up appointments made, and use of the ED were gathered 2 weeks after the ill-child care visits by review of standardized forms, telephone logs, patient medical records, and hospital medical records. All study personnel, with the exception of one of us (P.M.), were blinded to study hypotheses.

SPECIFIC HYPOTHESES

We adopted 3 hypotheses about the data for path analysis. These 3 hypotheses can be traced in Figure 1 by visualizing 1-way arrows from elements within columns 1 and 2 to 3 (hypothesis 1), columns 1 and 2 to 3 to 5 (hypothesis 2), and column 3 to 4 to 5 (hypothesis 3).

Hypothesis 1 indicates that adverse demographic, maternal, infant, and social milieu characteristics (columns 1 and 2) would predict a less optimal mother-child interaction (column 3).

Hypothesis 2 indicates that the prediction by adverse demographic, maternal, infant, and social milieu characteristics (columns 1 and 2) of greater resource use (column 5) would be mediated by a less optimal mother-child interaction (column 3) independent of illness severity assessment (column 4).

Hypothesis 3 indicates that the prediction by a less optimal mother-child interaction (column 3) of greater resource use (column 5) would be mediated by higher pediatrician and mother illness severity assessments (column 4) (after accounting for adverse demographic, maternal, infant, and social milieu characteristics [columns 1 and 2]).

DATA ANALYSIS

A path analytic model was developed to assess the presence and strength of relations among the 3 major categories of predictors of resource use previously discussed: demographic, maternal, infant, and social milieu characteristics; mother-child interaction; and clinical judgment. The strength of the relations was determined using the $\beta$ coefficient. This analysis was conducted using structural equation modeling in a software program (LISREL [linear structural relations]). A socioeconomic status (SES) marker construct was created from the following variables: father in the home, educational level of mothers, whether receiving Medicaid, maternal employment, maternal age, and location of clinical practice. Also, a 2-factor solution was identified for the Rothbart measure; one dimension reflected distress/fear characteristics (eg, “how often did the baby cry or show distress?”) and the other reflected extroverted child characteristics (eg, “during a peekaboo game, how often did the baby smile?”). These 2 factors were entered into the model separately. The Parenting Sense of Competence Scale score was available for only one time of measurement and was used to create a single-indicator factor. Similarly, ethnicity (1 indicates white; and 0, all others) and sex were retained in the model as single-indicator factors. An EAS factor for each mother-infant dyad was created based on parcels of scale totals from 3 items on the instrument assessed at 3 data collection points (6, 15, and 24 months) at well- and at all ill-child care visits for that dyad. Finally, a marker for the outcome variable, resource use, called the resource-to-value index (RTVI), was de-
veloped for each acute illness episode based on the following equation, where for every resource used during acute illnesses from study enrollment at birth through the end of the study at the age of 30 months, an RTVI was calculated. This was the main dependent variable considered in this study and was a new measure created by us based on standard econometric practices for calculating unit costs with weighted averages.

\[
RTVI = \text{Hospitalization} (1.000) + \text{ED Use} (0.235) + \text{Tests} (0.052) + \text{Follow-up Visits} (0.067) + \text{Prescriptions} (0.010) + \text{Over-the-Counter Medications} (0.010)
\]

The proportional weights were calculated based on 1998 fee schedules from Yale–New Haven Children’s Hospital and Yale Preferred Health. A value of 1 was assigned to the highest cost resource (hospitalization, $1490), and the proportional weights compared with the cost of hospitalization for each resource were developed as follows: hospitalization, $1490/$1490 = 1.000; ED use, $350/$1490 = 0.235; tests, $77/$1490 = 0.052; follow-up visits, $101/$1490 = 0.067; prescriptions, $15/$1490 = 0.010; and over-the-counter medications, $15/$1490 = 0.010.

Therefore, if a child incurred 1 hospitalization, 1 test, and 1 prescription during an illness, the final RTVI score would be calculated as follows: 1.000 + 0.052 + 0.010 = 1.062. This figure was calculated for each illness-related visit for each child. The final value used in our model was the average resources used per visit, as reflected in column 5 of Figure 1.

Finally, we developed a measurement model and a structural model using structural equation modeling techniques developed in a software program (LISREL\textsuperscript{23}); this is a software package used to analyze matrices of variable associations. We assessed model fit using standard measures of practical fit (the nonnormed fit index,\textsuperscript{24} the comparative fit index,\textsuperscript{25} and the root-mean-square error of approximation\textsuperscript{26}), and examined any follow-up tests as either nested-model comparisons (ie, as \(\chi^2\) difference tests) or as maximum likelihood tests of the significance of a parameter from 0. Modification indexes, residuals, and other tolerance statistics were scrutinized to ensure that meaningful estimates were not inadvertently excluded from the model.

\[\beta\] Coefficients were used to estimate the amount of variance in the outcome variable, resource use, that was explained or predicted by the predictor variables studied. \(\beta\) Coefficients in a structural model are correlations, but are adjusted for other correlations (paths) in the model.

### RESULTS

#### STUDY POPULATION

The study began enrolling mothers on February 1, 1995, and was complete on March 30, 1998. For the total study sample, 380 mothers were asked to participate and 316 (83.2%) enrolled; these proportions were similar at the 3 sites. Numbers enrolled at each study site were as follows: primary care center, 151; urban private practice, 111; and suburban private practice, 54. For the present analyses, there were complete data available for 243 mother-infant dyads for whom resource use data were available. The mean maternal age was 27.8 years for the sample. Categorical sample demographic characteristics of interest across the 3 sites are shown in Table 1, and indicate a spectrum of sociodemographic characteristics.

There were 2444 illness episodes in the cohort. The mean number of ill-child care visits for each patient enrolled was quite similar across the 3 sites: primary care center, 6.4; urban private practice, 5.5; and suburban private practice, 6.3. There were 50 children with serious illnesses, defined in previous studies\textsuperscript{8,9,22} as patients with significant positive laboratory test results, such as a positive urine or blood culture or a chest radiograph positive for disease. Complete data regarding maternal, infant, social milieu, and demographic characteristics, EASs, and maternal and pediatrician AIOs were available for

---

©2003 American Medical Association. All rights reserved.
the mother-infant dyad for 1983 illness episodes. Table 2 outlines the number of resources used across ill-child care visits by specific resource.

**PATH ANALYSES RESULTS**

The final model (Figure 2) achieved adequate fit (root-mean-square error of approximation, 0.039 [range, 0.031-0.047]; nonnormed fit index, 0.92; and comparative fit index, 0.93). Based on extrapolation of $\beta$ coefficients, the total variance accounted for in resource use was 55%. Of this figure, 48% was unique variance attributable to each of the following paths: 14% of the variance in RTVI was accounted for by the mothers’ assessment of illness severity (AIOS score), 23% by the quality of the mother-child interaction (EAS score), and 11% by the Parenting Sense of Competence Scale score. The remaining 7% was common among the 3 predictors.

Supplementary analyses assessed whether when the same model was estimated for the private practice ($n=132$) and primary care clinic ($n=111$) groups separately (excluding the group variable from the SES factor), the same paths were still significant and adequate fit was retained. This supplementary analysis indicated that because of the removal of the group variable in SES, paths from demographic variables to maternal and infant characteristics decreased substantially (average $\beta$ change, −.10); this demonstrates that inclusion of the variable in the SES factor was an appropriate decision in our model with all groups combined and that the primary relations of interest among mother-child interaction and severity ratings retained most of their prediction on per-visit resource use (RTVI) when estimated for either group.

The path analysis is outlined in Figure 2. The demographic variables of ethnicity and SES did affect several maternal, infant, and social milieu variables. Most notable were the effects of higher SES on infant characteristics (extroversion and distress/fear), as measured by the Rothbart, $\beta$ of .32 and −.32, respectively, and on a more optimal home environment, as measured by the SHIF and the HOME Scale ($\beta=.39$). White ethnicity had a limited effect on a more optimal home environment ($\beta=.13$) and greater social support ($\beta=−.19$).

For determinants of the mother-child interaction, higher SES and, to a lesser extent, ethnicity had direct effects on a more optimal mother-child interaction ($\beta=.85$ and $\beta=−.18$, respectively); these effects were not mediated by maternal, infant, and social milieu characteristics.

Furthermore, a less optimal mother-child interaction predicted greater per-visit resource use (RTVI) ($\beta=−.53$); this was a direct effect not mediated by perception of illness severity, ie, AIOS scores. In addition, mother’s perception of greater illness severity (AIOS score) predicted increased per-visit resource use (RTVI) ($\beta=.33$), and this perception mediated the effect of depressive symptoms on increased resource use ($\beta=.21$). Socioeconomic status affected mother’s illness severity score: the lower the SES, the higher the perception of illness ($\beta=.34$).

Mother’s perceived parental competence (Parenting Sense of Competence Scale score), although not documented to have a direct effect on the mother-child interaction, did directly effect per-visit resource use; the less the perceived competence, the greater the per-visit resource use ($\beta=−.26$). No other maternal, infant, or social milieu characteristics directly predicted resource use.

As reported previously, whether an illness was serious, as seen in 50 illness episodes, explained only a small amount of the variance in such variables as mother’s illness severity assessment (1%) and test ordering (1%); similarly, inclusion of whether an illness was serious in our path analysis did not alter study results.

Of the per-visit resource use, 55% was explained by 3 variables: a less optimal mother-child interaction, greater perception of illness severity by mothers, and lower maternal perceived competence. The mean cost of resource use per visit was $98.30; the 3 variables explain

---

**Table 1. Demographic Characteristics of Primary Care Center, Urban Private Practice, and Suburban Private Practice Patients**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Whole Sample</th>
<th>Primary Care Center Patients</th>
<th>Urban Private Practice Patients</th>
<th>Suburban Private Practice Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal age, y</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>27.8</td>
<td>24.2</td>
<td>31.2</td>
<td>30.3</td>
</tr>
<tr>
<td>SD</td>
<td>6.9</td>
<td>6.4</td>
<td>5.8</td>
<td>6.0</td>
</tr>
<tr>
<td>Medicaid health insurance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>123</td>
<td>100</td>
<td>17</td>
<td>6</td>
</tr>
<tr>
<td>No</td>
<td>106</td>
<td>4</td>
<td>65</td>
<td>37</td>
</tr>
<tr>
<td>Educational level</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did not complete high school</td>
<td>52</td>
<td>38</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td>Completed high school</td>
<td>83</td>
<td>62</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>Some college</td>
<td>38</td>
<td>4</td>
<td>34</td>
<td>0</td>
</tr>
<tr>
<td>College</td>
<td>57</td>
<td>1</td>
<td>37</td>
<td>19</td>
</tr>
<tr>
<td>Maternal employment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>120</td>
<td>25</td>
<td>65</td>
<td>30</td>
</tr>
<tr>
<td>No</td>
<td>109</td>
<td>79</td>
<td>17</td>
<td>13</td>
</tr>
<tr>
<td>Father at home</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>145</td>
<td>40</td>
<td>69</td>
<td>36</td>
</tr>
<tr>
<td>No</td>
<td>84</td>
<td>64</td>
<td>13</td>
<td>7</td>
</tr>
<tr>
<td>Parity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primiparous</td>
<td>83</td>
<td>43</td>
<td>23</td>
<td>17</td>
</tr>
<tr>
<td>Multiparous</td>
<td>136</td>
<td>63</td>
<td>49</td>
<td>24</td>
</tr>
</tbody>
</table>

*Data are given as number of patients in each group unless otherwise indicated. The total number of patients with data varied by characteristic.

---

**Table 2. Resources Used and Associated Costs Across Ill-Child Care Visits**

<table>
<thead>
<tr>
<th>Resource Used</th>
<th>Total No. of Ill-Child Care Visits Analyzed</th>
<th>No. of Visits at Which ≥1 Resource Was Used</th>
<th>Cost of the Resource, $*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency department</td>
<td>1983</td>
<td>168</td>
<td>58 800</td>
</tr>
<tr>
<td>Medications</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prescription</td>
<td>1983</td>
<td>1053</td>
<td>15 795</td>
</tr>
<tr>
<td>Over-the-counter</td>
<td>1983</td>
<td>658</td>
<td>9870</td>
</tr>
<tr>
<td>Tests</td>
<td>1982</td>
<td>356</td>
<td>27 412</td>
</tr>
<tr>
<td>Follow-up visits</td>
<td>1976</td>
<td>320</td>
<td>32 320</td>
</tr>
<tr>
<td>Hospitalizations</td>
<td>1983</td>
<td>34</td>
<td>50 660</td>
</tr>
</tbody>
</table>

*The total cost was $194 857. See the “Data Analysis” subsection of the “Methods” section for the basis of cost data.
55%, or $54.06 per visit, of this cost, or $107,171 of the total cost of resources, $194,857 (Table 2). The direction of effects documented in this path analysis was in the direction hypothesized: adverse influences (eg, lower SES and less optimal maternal, infant, and social milieu characteristics) predicted a less optimal mother-child interaction, greater perception of illness severity, and greater resource use.

**COMMENT**

These results document that a less optimal mother-child interaction, greater perception of illness severity by mothers, and lower maternal perceived competence are major determinants of increased resource use during acute pediatric illness. Therefore, these determinants are reasonable foci for interventions to reduce resource use. These determinants also serve to mediate the effects of several factors (low SES, depressive symptoms, and non-white ethnicity) on resource use.

A less optimal mother-child interaction had the greatest influence on resource use independent of the overt assessment of illness severity, as measured in the AIOSs. What is the mechanism by which the quality of the mother-child interaction predicts resource use and what implications does this have for interventions focused on clinical judgment to reduce resource use? In regard to understanding the mechanism, it is reasonable to think that if the mother-child interaction is less optimal, then the child will be in a less optimal interactive state and, thus, be perceived as more ill. To further clarify the issue, consider that only 1 in 50 acute illnesses in children is serious and that most acute illnesses do not have any abnormal findings from the medical history and physical examination to suggest a serious illness. Thus, observation of the child’s state of well-being is paramount. Previous work has demonstrated that observational assessment of a child’s state of well-being relies most on the child’s response to stimuli. The mother-child interaction provides a rich source of data about response to stimuli on which to make assessments of well-being. For example, in the method of Bornstein and colleagues of assessing the mother-child interaction, there are 5 modes of infant behavior and 7 modes of maternal behavior that reflect the quality of the interaction. The AIOSs, although based predominantly on stimulus-response and interaction data, assess only 4 domains of the interaction. The mother-child interaction, because it encompasses many domains not traditionally thought of as a source of information about illness severity, thus has the potential to expand the database for clinical judgments and to improve resource use.

An unexpected finding in the study was the lack of a relationship between assessment of illness severity by pediatricians and resource use; a relationship between mothers’ assessment of illness severity and resource use was documented. This issue was examined further by studying the bivariate association of pediatricians’ and mothers’ severity assessment to RTVI. Both associations were significant (\( r = .15 \) [\( P < .01 \)] and \( r = .25 \) [\( P < .001 \)], respectively), but the mothers’ assessment to a greater degree. The stronger association of mother’s severity assessment to resource use is reflected in the path analysis (Figure 2), and is consistent with a previous report that parental expectation of resources being provided was a predictor of actual provision of resources. Our results indicate that mother’s severity assessment may be part of the database that leads the parental expectation that resources will be provided.

---

**Figure 2.** Resource use path diagram (all numbers are \( \beta \) coefficients). The asterisk indicates see Table 1; the dagger, see Table 2 and the “Data Analysis” subsection of the “Methods” section.
Study data also indicate that lower maternal perceived competence, as assessed at well-child care visits (and depression, as mediated by mothers' assessment of illness severity), is a predictor of increased resource use during acute illnesses. Maternal depression was the only personal variable that affected mothers' severity assessment. Maternal depression is gaining increasing recognition as a determinant of the health status of children.\textsuperscript{26} That adverse influences, such as lower maternal perceived competence and depression, influence resource use may provide an explanatory model for findings recently reported by the Children's Sentinel Nutrition Assessment Project, a consortium of 6 pediatric centers.\textsuperscript{28} In the 2718 children 36 months or younger who were studied, children exposed to termination or reduction of welfare benefits were more likely to be hospitalized (odds ratio, 1.8; 95% confidence interval, 1.1-3.0) at the time of their visit to an ED than if such a reduction did not occur. Loss or reduction of welfare benefits affects resources available to families and could affect adversely maternal sense of competence, maternal depression, and, as a stressor, the mother-child interaction; these adverse effects, as the present report demonstrates, may result in increased resource use during illnesses. Thus, paradoxically, reduction of welfare benefits may lead to greater expenditures in other areas of the social safety net.

**IMPLICATIONS**

What implications do these considerations have regarding interventions to reduce resource use? Clinical judgment should be one focus of interventions. While data about the child's state of well-being based on the mother-child interaction are available to mothers and pediatricians, study results indicate that such data are not integrated into formal judgments about illness severity, ie, the AIOS score does not mediate mother-child interaction data as resources are being used (Figure 2). Previous work\textsuperscript{22} has noted common ground between the domains used to assess the mother-child interaction and the domains on which clinical assessment of severity of illness are based: crying, response of that crying to parent comforting, and providing stimuli to maintain a child in an optimal functional state. There is the potential to increase that common ground by increasing the awareness of those who provide health care to children—physicians in practice, fellows and residents in training, and nurses—about these issues, and then translating that awareness to teaching parents about the mother-child interaction and how data from the interaction can potentially affect perception of illness and resource use. This teaching can be done at well-child care visits and ill-child care visits because, as previously demonstrated,\textsuperscript{7} the mother—well-child and the mother—ill-child interaction are highly intercorrelated ($r=0.65$). Teaching interventions can improve the specificity of parents' clinical judgments,\textsuperscript{8} however, to our knowledge, no teaching program has integrated teaching about clinical judgment, the mother–child interaction, and their interrelation.

Interventions that provide support to parents, especially support during illness episodes, might affect positively parents' sense of competence and reduce the sense of isolation associated with depressive symptoms. Consistent with this, a previous report by Olds et al\textsuperscript{9} demonstrated a decreased number of ED visits due to injuries and ingestions for children aged 12 to 50 months whose low-income teenaged mothers had received home visits starting prenatally before 30 weeks of gestational age and continuing until the child was aged 2 years. Similarly, Nelson et al\textsuperscript{10} demonstrated that providing simple telephone support to mothers who had brought their child to an ED for acute illnesses reduced the subsequent inappropriate use of follow-up visits to the ED by half. It is reasonable to speculate that the interventions described by Olds et al and Nelson et al that focused on enhancing support mechanisms for mothers may have affected resource use through the mechanisms described herein.

**STUDY LIMITATIONS**

Appropriateness of resource use was not measured in this study. However, as noted previously, 98% of acute illnesses are nonserious and there is great variation in resource use for these nonserious illnesses. This variation in resource use is predicted by such factors as a less optimal mother-child interaction and lower maternal perceived competence rather than whether an illness is serious or not. Study data identify an opportunity to improve appropriate resource use and reduce inappropriate use by focusing on factors that predict variation in resource use for nonserious illnesses. The issue of appropriateness of resource use is the subject of ongoing research by us.

The SES variable, although composed of 6 factors, did not include data about income or household size. It is possible that our available demographic covariates were insufficient to reflect important differences in mothers. However, because there were multiple indicators of SES, it is reasonable to believe that some of the variance that would be attributable to other markers, such as income or household size, would be collinear with markers that were available in our study.

In conclusion, the quality of the mother-child interaction, maternal sense of competence, and maternal assessment of severity of the illness are major predictors of resource use during acute pediatric illnesses, and should be important foci of interventions to reduce resource use. Awareness of and teaching about the mother-child interaction and its relation to clinical judgment could be integrated into the education of those who provide health care to children and, therefore, into the discussion of acute illness with parents as part of health care.

Accepted for publication May 16, 2003.

This study was supported by grant RO1HD 26575-01 from the National Institute of Child Health and Human Development, Bethesda, Md (Dr McCarthy).

We thank Donald Showalter for his assistance in the statistical analyses; and the pediatricians and nurse practitioners who examined patients at the study sites (Angela Crowley, PNP; Mary Ann Davidson, PNP; Janet Geiger, MD; Liesel Gould, MD; Karen Haddad, PNP; Margaret Ikeda, MD; Melinda Mahabee-Gittens, MD; Cynthia Mann, MD; Deborah Navedo, PNP; and Carter Stifson, MD).
Use of health resources is a major societal concern. Significant resources, such as medications, the ED, hospitalizations, and follow-up visits, are used during acute illness. To our knowledge, no studies have defined the major determinants of this use.

Our results indicate that the major determinants of resource use are the quality of the mother-child interaction, maternal perception of illness severity, and maternal sense of competence. The strongest predictor is the mother-child interaction: the less optimal the interaction, the greater the resource use. Awareness of and teaching about the mother-child interaction and its relation to clinical judgment to those who provide health care to children and to parents at well- and ill-child care visits hold promise to improve clinical judgment and to reduce the use of resources during acute illnesses in children.

Corresponding author and reprints: Paul L. McCarthy, MD, Department of Pediatrics, Yale University School of Medicine, 333 Cedar St, New Haven, CT 06520 (e-mail: Paul.McCarthy@yale.edu).

REFERENCES


