

Maternal Depressive Symptoms and Children's Receipt of Health Care in the First 3 Years of Life

Cynthia S. Minkovitz, MD, MPP*; Donna Strobino, PhD*; Dan Scharfstein, ScD‡; William Hou, MS*; Tess Miller, DrPH*; Kamila B. Mistry, MPH*; and Karen Swartz, MD§

ABSTRACT. *Background.* Maternal depression is widely recognized to negatively influence mother-child interactions and children's behavior and development, but little is known about its relation to children's receipt of health care.

Objective. To determine if maternal depressive symptoms reported at 2 to 4 and 30 to 33 months postpartum are associated with children's receipt of acute and preventive health care services in the first 30 months.

Design. Cohort study of data collected prospectively as part of the National Evaluation of Healthy Steps for Young Children (HS). Data sources included medical records abstracted for the first 32 months, enrollment questionnaires, and parent interviews when children were 2 to 4 and 30 to 33 months old. Acute care use included hospitalizations and emergency department visits. Preventive care included well-child visits and vaccinations. Maternal depressive symptoms were assessed by using the Center for Epidemiologic Studies-Depression Scale. Generalized linear models (logistic regression for dichotomous outcomes and Poisson regression for count outcomes) were used to estimate the effect of maternal depressive symptoms on children's receipt of care. The models were adjusted for baseline demographic characteristics, child health status, participation in HS, and site of enrollment.

Results. Of the 5565 families enrolled in HS, 88% completed 2- to 4-month parent interviews, 67% completed 30- to 33-month parent interviews, and 96% had medical records abstracted. The percentages of mothers reporting depressive symptoms were 17.8% at 2 to 4 months, 15.5% at 30 to 33 months, and 6.4% at both. Children whose mothers had depressive symptoms at 2 to 4 months had increased use of acute care reported at 30 to 33 months including emergency department visits in the past year (odds ratio [OR]: 1.44; confidence interval [CI]: 1.17, 1.76). These children also had decreased receipt

of preventive services including age-appropriate well-child visits (eg, at 12 months [OR: 0.80; CI: 0.67, 0.95]) and up-to-date vaccinations at 24 months for 4 doses of diphtheria, tetanus, pertussis, 3 doses of polio vaccine, and 1 dose of measles-mumps-rubella (OR: 0.79; CI: 0.68, 0.93). There was no association of maternal depressive symptoms at 30 to 33 months with children's preceding use of care.

Conclusions. Maternal depressive symptoms in early infancy contribute to unfavorable patterns of health care seeking for children. Increased provider training for recognizing maternal depressive symptoms in office settings, more effective systems of referral, and development of partnerships between adult and pediatric providers could contribute to enhanced receipt of care among young children. *Pediatrics* 2005;115:306-314; *maternal depression, acute care, preventive services.*

ABBREVIATIONS. ED, emergency department; HS, Healthy Steps for Young Children; UTD, up-to-date; DTP, diphtheria, tetanus, pertussis; MMR, measles-mumps-rubella; CES-D, Center for Epidemiologic Studies-Depression Scale; OR, odds ratio; CI, confidence interval.

Maternal depression has been shown to negatively affect the behavior and development of children, parenting practices, and mother-child interactions in the first 3 years of life. Depressed mothers talk less to their infants, express fewer positive facial emotions, and show less positive physical affection.¹ They also report poorer prevention practices including decreased use of car seats,^{2,3} electrical plug covers,² and smoke detectors.⁴ Other less favorable parenting practices among mothers with depressive symptoms include decreased odds of using the back-to-sleep position and increased odds of using corporal punishment.⁴ Maternal depression also is associated with emotional unavailability and less secure attachments, and maternal insensitivity partially mediates the effect of depressive symptoms on children's negative cognitive and social outcomes.⁵ Reflecting both biological and environmental risk, children of depressed mothers also are at increased risk for the development of psychiatric diagnoses.^{6,7}

Despite these well-known associations and the recognition that parents, particularly mothers, remain the primary decision-makers for their children's health,⁸ little is known about the effect of maternal depression on parents' health care seeking for their children. Regarding acute care, Mandl et al⁹ reported

From the Departments of *Population and Family Health Sciences and †Biostatistics, Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland; and ‡Department of Psychiatry, Johns Hopkins School of Medicine, Baltimore, Maryland.

Accepted for publication Jul 9, 2004.

doi:10.1542/peds.2004-0341

This work was presented at the Pediatric Academic Societies' Meeting; May 6, 2003; Baltimore, Maryland.

No conflict of interest declared.

Dr Miller's current address is: Center for Primary Care, Prevention, and Clinical Partnerships, Agency for Healthcare Research and Quality, Rockville, MD 20850.

Address correspondence to Cynthia S. Minkovitz, MD, MPP, Department of Population and Family Health Sciences, Johns Hopkins Bloomberg School of Public Health, 615 N Wolfe St, Baltimore, MD 21205. E-mail: cminkovi@jhsph.edu

PEDIATRICS (ISSN 0031 4005). Copyright © 2005 by the American Academy of Pediatrics.

higher proportions of infants with ≥ 2 problem-oriented visits in the first 5 months of life and higher proportions with emergency department (ED) visits in the first month of life among infants of mothers with depressive symptoms compared with those whose mothers did not have symptoms. Maternal depressive symptoms have also been shown to be associated with increased ED use among urban children with asthma in 2 US cities^{10,11} but not among US urban preschool children.¹² Although Kahn et al¹³ found no association between maternal depressive symptoms and hospitalizations in the first 3 years of life for a national sample of US children, Chung et al⁴ reported increased odds of hospitalizations among children whose mothers had depressive symptoms in a community-based survey of low-income women.

No associations have been reported between maternal depressive symptoms and children's receipt of preventive care. Mandl et al⁹ found no relation of multiple well-child visits with levels of depressive symptoms. Similarly, maternal depression has not been associated with total visits (acute and preventive) in studies of 5- to 11-year-olds enrolled in a health maintenance organization¹⁴ or among Australian children 4 to 9 years old.¹⁵ Watson and Kemper¹² also found no relation between maternal depressive symptoms and children's immunization status among low-income children. However, to date, there have been no systematic studies examining associations of maternal depressive symptoms with a broad array of acute and preventive services for a diverse group of young children for whom the recommended schedule of well-child visits is greatest.¹⁶

Given the high lifetime prevalence of depression among women (21%)¹⁷ and increased reporting of depressive symptoms by mothers of child-bearing age,¹⁸ associations between maternal mental health and children's receipt of care may be particularly important in the first 3 years of life when children are expected to have frequent health-maintenance visits. The objective of this study was to examine whether maternal depressive symptoms, reported when children were 2 to 4 and 30 to 33 months old, are associated with children's receipt of health care services.

We hypothesized that maternal depressive symptoms are associated with decreased use of preventive services and increased receipt of acute care. Specifically, we hypothesized that mothers who reported depressive symptoms are more likely to seek care for their children in the ED, have children who are hospitalized, and also to have undervaccinated children. These expected relations consider that mothers with depressive symptoms may have a greater propensity to seek care for acute illnesses due to decreased ability to interpret symptoms, heightened levels of worry about their child, decreased comfort in their own ability to manage illness, or increased psychosocial concerns that are not the stated reason for the visit. They may be less likely to seek preventive care for their children because of difficulties keeping visit appointments or with advance planning for scheduled visits.

Study Design

This cohort study relies on data collected prospectively as part of the Healthy Steps for Young Children (HS). HS incorporates child development specialists and enhanced developmental services into pediatric practices serving families of young children. Fifteen HS sites across the country participated in this prospective clinical trial; 6 featured a randomized design, and 9 used a quasi-experimental design. Enrollment began in September 1996 at 1 site, followed by staggered initiation at subsequent sites and enrollment completion in November 1998. Children were followed from birth to 3 years.¹⁹⁻²¹

Data Sources

Four data sources were used for the analyses reported here and included a self-administered enrollment questionnaire, 2- to 4-month parent telephone interview, 30- to 33-month parent telephone interview, and medical records. Questionnaires and computer-assisted telephone interviews were conducted in English and Spanish.

The enrollment questionnaire provided demographic characteristics including mother's age and race/ethnicity and the child's gender and birth weight. Additional demographic characteristics were obtained from the 2- to 4-month interview about marital status, maternal education, employment, parity, household income, home ownership, and child's insurance. In the 2- to 4-month and 30- to 33-month interviews, respondents were asked about utilization of acute care services, their child's health status, and the presence of depressive symptoms. Of the 5565 families enrolled in the evaluation, 4896 (response rate: 88%) completed the 2- to 4-month interview, and 3737 (response rate: 67%) completed the 30- to 33-month parent interview. Mothers were the primary respondents.

Children's medical records were abstracted from birth to 32 months of age for 96% of children whose mothers completed the 2- to 4-month interview. Trained staff completed chart reviews on all children with ≥ 1 office visits. Abstracted data included date and type of office visit and vaccinations. Five percent of medical records were selected randomly and reabstracted, and a high percent agreement was noted ($\geq 87\%$ for visit type, $\geq 96\%$ for visit date, $\geq 99\%$ for vaccine type, and $\geq 98\%$ for vaccine date).

Dependent Variables

Variables for our analysis were selected based on a modified behavioral model of health services utilization²² to examine associations between maternal mental health and service use of the child, controlling for factors known to be associated with children's receipt of health care services. Dependent variables included several measures of health care utilization, and independent variables included predisposing, enabling, and need factors.

The dependent variables were measures of children's utilization of preventive and acute health care services. Dichotomous variables created to describe preventive care measures were age-appropriate well-child visits at 2, 6, 12, 15, 18, and 24 months, age-appropriate vaccinations, and up-to-date (UTD) vaccination status. Both well-child visits and vaccinations were considered age appropriate if they occurred during the recommended age intervals.¹⁶ Children were considered UTD if they had received 4 doses of diphtheria, tetanus, pertussis (DTP), 3 doses of polio vaccine, and 1 dose of measles-mumps-rubella (MMR) by 2 years of age. Definitions of age-appropriate and UTD immunizations were based on *Red Book* recommendations of the American Academy of Pediatrics and were calculated based on dates of birth and immunization.²³ Doses received at less than the minimum interval between doses were not counted (Table 1).

Dichotomous variables also were used to describe utilization of acute care services with regard to ED visits (including urgent care center use) and hospitalizations since birth as reported in the 2- to 4-month parent interview. ED visits and hospitalizations since birth and during the preceding 12 months were reported in the 30- to 33-month parent interview. Respondents in the 30- to 33-month interview also reported on their child's injuries and related ED visits in the past year. Medical records data were used to define the number of sick visits through 32 months of age.

TABLE 1. Definitions for Preventive Services

Type of Preventive Services	Definition
Age-appropriate well-child visits	
2 mo	Visit between 42 d (1.5 mo) and 92 d (3 mo), inclusive
6 mo	Visit between 152 d (5 mo) and 213 d (7 mo), inclusive
12 mo	Visit between 336 d (11 mo) and 426 d (14 mo), inclusive
15 mo	Visit between 427 d (14 mo) and 518 d (17 mo), inclusive
18 mo	Visit between 519 d (17 mo) and 608 d (20 mo), inclusive
24 mo	Visit between 701 d (23 mo) and 851 d (28 mo) inclusive
UTD vaccination at 24 mo (4 DTP, 3 Polio, 1 MMR)	DTP 1 given on or after 42 d (6 wk) and DTP2 given at least 28 d after DTP1; and DTP3 given at least 28 d after DTP2; and DTP4 given at least 184 d (6 mo) after DTP3 and between 365 d (12 mo) and 24 mo of age, inclusive; and OPV/IPV1 given on or after 42 d (6 wk); and OPV/IPV2 given at least 28 d after OPV/IPV1; and OPV/IPV3 given at least 28 d after OPV/IPV2 and between 184 d (6 mo) and 24 mo of age, inclusive; and MMR given between 365 d (12 mo) and 24 mo of age, inclusive
Age-appropriate vaccinations	
DTP1	DTP1 given between 42 d (6 wk) and 92 d (3 mo), inclusive; and
DTP3	DTP1 given on or after 42 d (6 wk); and DTP2 given at least 28 d after DTP 1; and DTP3 given at least 28 d after DTP 2 and before 213 d (7 mo) of age, inclusive
MMR1	MMR given between 365 d (12 mo) and 488 d (16 mo), inclusive

OPV indicates oral poliovirus vaccine; IPV, inactivated poliovirus vaccine.

Independent Variables

The presence of maternal depressive symptoms, as assessed by a modified 14-item version of the 20-item Center for Epidemiologic Studies-Depression Scale²⁴ (CES-D) was identified as a new predisposing variable in the conceptual model. Consistent with clinical presentation, the presence of symptoms at a single time point was reported regardless of whether symptoms were present at the earlier or later time point. Correlation of the reduced-item version with the full 20-item scale exceeded 0.95 in a sample of high-risk pregnant women.²⁵ The α coefficient for the 14-item CES-D in HS sample was .85 at 2 to 4 months and .87 at 30 to 33 months, similar to that for general population studies.²⁴ For the modified scale, the response categories remained the same as the 20-item scale, with scores ≥ 11 indicating the presence of maternal depressive symptoms; this value corresponds with the cutoff of 16 for the 20-item scale. The CES-D has a 95% sensitivity for diagnosing major depressive disorder, although the positive predictive value is low (0.28) due to modest specificity (0.70), as is typical of most screening tests.²⁶

Additional predisposing factors related to health care utilization included the characteristics of the mother (age at child's birth, race, ethnicity, marital status, education, employment status, and whether first-time parent), father (employment status), and child (gender). Parenting experience distinguished first-time from second-time (or greater) parents.

Enabling factors referred to family resources and included household income, home-ownership status, and child's insurance status. Household income was grouped into 3 categories: low (<\$20 000), middle (\$20 000–\$49 999), and high (\geq \$50 000). A dichotomous variable was created to describe a child's health insurance status, indicating whether the child was covered by public insurance.

The 2 need-for-health-care variables in the conceptual model included low birth weight (<2500 g) and the child's health status. The child's general health status was reported by the mother as poor, fair, good, or excellent. A dichotomous variable was created that grouped poor, fair, and good versus excellent health, because only 2.3% of children were reported to be in fair-poor health.

Statistical Analysis

The sample used to examine the association between maternal depressive symptoms at 2 to 4 months and children's receipt of health care services for the first 3 years of life included children whose mothers completed a 2- to 4-month interview with CES-D scores. Of the 4896 respondents with interviews, 17 were excluded for lack of CES-D data, and 5 were not mothers. We first examined the distribution of predisposing, enabling, and need characteris-

tics of these families. We then compared receipt of health care services between children whose mothers did and did not have depressive symptoms using χ^2 statistics for categorical variables and *t* statistics for the count outcome (eg, number of sick visits). Children with missing medical records ($n = 138$) were excluded from analyses of preventive services and sick visits.

Generalized linear models (logistic regression for dichotomous outcomes and Poisson regression for the count outcome) were used to estimate the effect of depressive symptoms at 2 to 4 months on receipt of care.²⁷ The models were adjusted for baseline demographic characteristics, child's health status, participation in HS, and site of enrollment. The results for dichotomous outcomes are presented as odds ratios (ORs; ratio of the odds of the outcome for children whose mothers did and did not have depressive symptoms). All estimates are presented with 95% confidence intervals (CIs). Separate models were constructed for each type of health care service.

To determine how the timing of maternal depressive symptoms influenced the receipt of care, we examined the associations of maternal depressive symptoms at 2 time points: 2 to 4 months and 30 to 33 months. The longitudinal sample used for this analysis included children whose mothers' completed interviews at both 2 to 4 months and 30 to 33 months ($n = 3357$ for preventive care from medical records data and $n = 3412$ for hospitalizations and ED visits from 30- to 33-month interview data). Of the 3482 mothers who completed both 2- to 4-month and 30- to 33-month interviews, 68 were excluded for lack of CES-D data at 1 time point (7 at 2 to 4 months only and 61 at 30 to 33 months only), and 2 were excluded for lack of CES-D data at both points. Children with missing medical records ($n = 55$) were excluded from analyses of preventive services.

Logistic regression models included timing of depressive symptoms (at 2 to 4 months and 30 to 33 months) and adjusted for predisposing, enabling, and need factors. An interaction term (the product of depressive symptoms at 2 to 4 months with depressive symptoms at 30 to 33 months) was used to test for the effects of depressive symptoms at both time points. Models with interaction terms permitted assessment of the effects of depressive symptoms at 2 to 4 months only, 30 to 33 months only, both time points, and neither time point. Using a Wald test, no interactions were found. Accordingly, reported models do not include interaction terms. Therefore, we report effects of depressive symptoms at 2 to 4 months (regardless of later symptoms) and 30 to 33 months (regardless of earlier symptoms).

Women who reported depressive symptoms at 2 to 4 months were less likely to complete the 30 to 33 month interview (63.3% vs 71.4%). Because missing data were more severe in the longitudinal

TABLE 2. Selected Parent and Family Characteristics by Mother's Depressive Status at 2 to 4 Months and 30 to 33 Months

	2-4 mo						30-33 mo					
	Total (N = 4874)		No Depressive Symptoms (N = 4007)		Depressive Symptoms (N = 867)		Total (N = 3419)		No Depressive Symptoms (N = 2889)		Depressive Symptoms (N = 530)	
	N	%	N	%	N	%	N	%	N	%	N	%
Predisposing Characteristics												
Mother's age at child's birth*†												
<20 y	646	13.3	474	11.9	172	19.9	382	11.2	295	10.2	87	16.4
20-29 y	2460	50.5	2005	50.1	455	52.5	1679	49.2	1406	48.8	273	51.5
≥30 y	1760	36.2	1521	38.0	239	27.6	1353	39.6	1183	41.0	170	32.1
Mother's race*†												
White	2856	59.4	2443	61.8	413	48.3	2103	62.4	1827	64.1	276	53.0
Black	1158	24.1	873	22.1	285	33.3	775	23.0	615	21.6	160	30.7
Asian or Native American	206	4.3	175	4.4	31	3.6	129	3.8	116	4.1	13	2.5
Other	588	12.2	462	11.7	126	14.7	366	10.9	294	10.3	72	13.8
Mother Hispanic‡	930	19.8	740	19.2	190	22.6	599	18.2	491	21.2	108	17.7
Mother's Marital Status*†												
Married, living with biological father	3027	64.4	2634	68.4	393	47.0	2240	68.2	1961	70.7	279	54.9
Not married, living with biological father	627	13.4	478	12.4	149	17.8	382	11.6	301	10.9	81	15.9
Married, not living w/bio father or not married, not living w/biological father	1033	22.0	739	19.2	294	35.2	661	20.1	513	18.5	148	29.1
Mother's education*†												
<High school graduate	781	16.1	562	14.1	219	25.3	467	13.7	352	12.2	115	21.8
High school graduate	1276	26.3	1009	25.3	267	30.9	866	25.4	708	24.6	158	30.0
Some college or vocational school	1424	29.3	1197	30.0	227	26.2	991	29.1	846	29.4	145	27.5
College graduate or beyond	1376	28.3	1224	30.7	152	17.6	1083	31.8	974	33.8	109	20.7
Mother employed	1754	36.0	1466	36.6	288	33.2	1238	36.2	1061	36.7	177	33.4
First-time mother	2370	48.7	1946	48.6	424	48.9	1655	48.4	1396	48.3	259	48.9
Father employed*†	4183	85.9	3483	86.9	700	80.7	2981	87.2	2543	88.0	438	82.6
Child's gender: male	2434	49.9	1982	49.5	452	52.1	1695	49.6	1427	49.4	268	50.6
Enabling characteristics												
Household income*†												
Low	1607	33.0	1163	29.0	444	51.2	1004	29.4	779	27.0	225	42.5
Middle	1695	34.8	1421	35.5	274	31.6	1217	35.6	1017	35.2	200	37.7
High	1572	32.2	1423	35.5	149	17.2	1198	35.0	1093	37.8	105	19.8
Own home*†	2529	52.0	2161	54.0	368	42.5	1930	56.5	1674	57.9	256	48.3
Child's insurance*†												
Public	1968	40.5	1474	36.9	494	57.0	1247	36.6	974	33.8	273	51.5
Private	2693	55.4	2363	59.1	330	38.1	2039	59.8	1804	62.6	235	44.3
Self-pay	204	4.2	161	4.0	43	5.0	126	3.7	104	3.6	22	4.2
Need characteristics												
Low birth weight§ (<2500 g)	309	6.5	233	5.9	76	9.0	218	6.5	177	6.2	41	7.9
Child's health status*†												
Excellent	3773	77.4	3173	79.2	600	69.2	2670	78.1	2298	79.5	372	70.2
Good	990	20.3	756	18.9	234	27.0	678	19.8	535	18.5	143	27.0
Fair	105	2.2	74	1.9	31	3.6	67	2.0	54	1.9	13	2.5
Poor	6	0.1	4	0.1	2	0.2	4	0.1	2	0.1	2	0.4

* $P < .001$ at 2-4 months.

† $P < .001$ at 30-33 months.

‡ $P < .05$ at 2-4 months.

§ $P < .01$ at 2-4 months.

analyses, we performed a sensitivity analysis by using the inverse weighting approach of Robins et al²⁸ to determine the impact of missing data for depressive symptoms. This approach requires estimation of a logistic regression model for the probability of missing-outcome or depressive-symptom data given the baseline covariates described above and auxiliary information (number of observed well-child visits, number of observed sick-child visits, and UTD at 24 months). In this analysis, each observed mother counted for herself and other mothers “like her” who had missing data. After controlling for the covariates in the latter regression model, this approach assumes that missingness is unrelated to use of care and depressive symptoms. For this method, we calculated bootstrapped percentile CIs.²⁹ Statistical procedures were performed by using SAS 8.2 (SAS Institute, Cary, NC) and R 1.6.1 (R Foundation for Statistical Computing, Vienna, Austria) for inverse weighted analyses.³⁰

Institutional review board approval was obtained for this study from the Johns Hopkins Bloomberg School of Public Health Committee on Human Research. Informed consent was obtained at the time of enrollment and reviewed before each interview.

RESULTS

The percentages of respondents with depressive symptoms were 17.8% at 2 to 4 months and 15.5% at 30 to 33 months. Among mothers who responded to both interviews, 9.7% had depressive symptoms at 2 to 4 months only, 9.1% at 30 to 33 months only, 6.4% at both times, and 74.9% at neither.

As expected, mothers with depressive symptoms at 2 to 4 months were disproportionately young (<20 years), nonwhite, Hispanic, not married or living with the biological father, and had less than a high school education (Table 2). They had lower household incomes and greater percentages of children who were publicly insured and not in excellent health. Mothers who reported depressive symptoms at 30 to 33 months had similar characteristics.

A smaller percentage of children whose mothers had depressive symptoms completed each age-appropriate well-child visit or received each age-appropriate vaccination than children whose mothers did not have symptoms. The percentage of children who were UTD at 24 months was also lower for mothers with symptoms (Table 3). Overall levels of timely receipt of care declined as children aged; although nearly all children completed timely 2-month visits (88.1%) and received DTP1 (91.4%), only 54% overall had timely 24-month visits and 74.5% received the first dose of the age-appropriate MMR. At both the 2- to 4-month and 30- to 33-month interviews, a greater percentage of mothers with depressive symptoms reported that their children had ED visits and hospitalizations.

In adjusted analyses, children whose mothers had depressive symptoms at 2 to 4 months had 0.74 to 0.81 reduced odds of receiving age-appropriate well-child visits (Table 4). This result was significant for visits between 6 and 24 months. The trend was consistent but not significant at 2 months, a time when overall receipt of timely care is particularly high. The association of maternal depressive symptoms and vaccinations also was significant for UTD at 24 months and receipt of age-appropriate MMR. Children whose mothers had depressive symptoms at 2 to 4 months also tended to have reduced odds of receiving the first and third doses of DTP, but these relations were not significant.

The influence of maternal depressive symptoms on receipt of acute care persisted for ED visits in the past year and tended to continue for hospitalizations,

TABLE 3. Children’s Receipt of Pediatric Services and Mother’s Depressive Status at 2 to 4 Months

	Total (N = 4874)		No Depressive Symptoms (N = 4007)		Depressive Symptoms (N = 867)	
	N	%	N	%	N	%
Preventive care*						
Age-appropriate well-child visits						
2 mo†	4170	88.05	3466	88.81	704	84.50
6 mo‡	3596	75.93	3019	77.35	577	69.27
12 mo‡	3334	70.40	2801	71.77	533	63.99
15 mo‡	2452	51.77	2085	53.42	367	44.06
18 mo‡	2313	48.84	1958	50.17	355	42.62
24 mo†	2546	53.76	2140	54.83	406	48.74
UTD vaccination at 24 mo‡ (4 DTP, 3 Polio, 1 MMR)	2866	60.52	2416	61.90	450	54.02
Age-appropriate vaccinations						
DTP1§	4327	91.36	3583	91.80	744	89.32
DTP3‡	3339	70.50	2810	72.00	529	63.51
MMR1‡	3528	74.49	2954	75.69	574	68.91
Acute care						
ED visits						
Since birth‡ (2–4 mo)	827	17.00	640	16.00	187	21.64
In past year‡ (30–33 mo)	1158	35.60	927	33.81	231	45.21
In past year due to injury (30–33 mo)	342	9.78	276	9.42	66	11.66
Injuries in past year (30–33)	475	14.24	386	13.75	89	16.82
Hospitalization						
Since birth‡ (2–4 mo)	303	6.23	225	5.62	78	9.03
Since birth† (30–33 mo)	599	17.95	478	17.02	121	22.87
In past year§ (30–33 mo)	198	5.94	155	5.52	43	8.13

* Denominator for preventive care services is 4736 due to missing medical records (n = 138).

† P < .01.

‡ P < .001

§ P < .05.

TABLE 4. Children's Receipt of Preventive and Acute Health Services

Services Received	Depressive Symptoms at 2–4 mo, Adjusted OR (95% CI)*
Preventive care†	
Age-appropriate well-child visits	
2 mo	0.90 (0.72, 1.14)
6 mo‡	0.80 (0.67, 0.95)
12 mo§	0.80 (0.67, 0.95)
15 mo	0.74 (0.62, 0.88)
18 mo‡	0.81 (0.68, 0.95)
24 mo‡	0.81 (0.69, 0.95)
UTD vaccination at 24 mo§ (4 DTP, 3 Polio, 1 MMR)	0.79 (0.68, 0.93)
Age-appropriate vaccinations	
DTP1	0.96 (0.74, 1.25)
DTP3	0.85 (0.71, 1.01)
MMR1‡	0.80 (0.68, 0.96)
Acute care	
ED visits	
Since birth (2–4 mo)	1.10 (0.90, 1.34)
In past year (30–33 mo)	1.44 (1.17, 1.76)
In past year due to injury‡ (30–33 mo)	0.74 (0.55, 0.99)
Injuries in past year‡ (30–33)	1.35 (1.03, 1.76)
Hospitalization	
Since birth (2–4 mo)	1.26 (0.95, 1.68)
Since birth (30–33 mo)	1.20 (0.94, 1.53)
In past year (30–33 mo)	1.31 (0.90, 1.90)

* Adjusted for mother's age at child's birth, mother's race, mother's ethnicity, missing ethnicity, mother's marital status at 2 to 4 months, mother's education at 2 to 4 months, mother's employment status at 2 to 4 months, parity, father's employment status at 2 to 4 months, child's gender, household income at 2 to 4 months, home ownership at 2 to 4 months, child's insurance status at 2 to 4 months, missing insurance at 2 to 4 months, birth weight, child's health status at 2 to 4 months, intervention status, enrollment site, and missing covariates.

† The denominator for acute care services is 4874, whereas for preventive care services it is 4736 due to missing medical records ($n = 138$).

‡ $P < .05$.

§ $P < .01$.

|| $P < .001$.

as reported at 30 to 33 months. Mothers who had depressive symptoms had increased odds of reporting that their children sustained injuries in the past year but also had decreased odds of their children using the ED specifically for injury in the year preceding the 30- to 33-month interview. Children whose mothers had depressive symptoms at 2 to 4 months relative to children whose mothers did not have symptoms had fewer sick visits through 32 months of life (mean: 6.15 vs 6.65; $P = .04$). In adjusted analyses, however, there was no significant association between depressive symptoms at 2 to 4 months and the number of sick visits.

We examined whether the timing of maternal depressive symptoms influenced receipt of care among the subset of respondents who completed both the 2- to 4-month and 30- to 33-month interviews. The association of maternal depressive symptoms with receipt of well-child visits and vaccinations was observed only when symptoms were reported in early infancy and not when they were reported at 30 to 33 months (Table 5). The magnitude and direction of the estimated ORs for early symptoms were similar to results obtained when later symptoms were not considered in the analysis. Similarly, only early maternal depressive symptoms at 2 to 4 months and not at 30 to 33 months were associated with receipt of acute care (Table 6). Specifically, children whose mothers had depressive symptoms at 2 to 4 months had increased odds of having an ED visit between 1.5 and

2.5 years of age (OR: 1.38; CI: 1.12, 1.71). Similar results were found when we reanalyzed the data by using the inverse weighting approach.

DISCUSSION

Our findings show that maternal mental health is associated with young children's receipt of care across a broad array of health care services. In support of our hypotheses, children whose mothers reported depressive symptoms at 2 to 4 months had decreased odds of receiving age-appropriate health-maintenance visits and vaccinations and increased odds of overall ED use in the first 3 years of life. They also tended to have increased odds of hospitalizations, although results were not significant in adjusted analyses.

The relation between maternal mental health and children's receipt of care was observed for depressive symptoms at 2 to 4 but not at 30 to 33 months. It is possible that patterns of health care seeking are established early in children's lives, thus heightening the importance of early influences. Past studies have indicated that timely receipt of the first DTP1 is predictive of timely receipt of immunizations in the first 2 years of life.³¹ It is possible that chronicity of symptoms may be more critical to maternal sensitivity⁵ and parenting practices other than health care seeking for their children.

The observed use of acute care services in our sample was comparable for hospitalizations and

TABLE 5. Children's Receipt of Preventive Health Services and Maternal Depressive Symptoms at 2 to 4 and 30 to 33 Months ($n = 3357$)

	Well-Child Visits, Adjusted OR (95% CI)*						Vaccinations, Adjusted OR (95% CI)*			
	2 mo	6 mo	12 mo	15 mo	18 mo	24 mo	UTD at 24 mo	DTP 1	DTP 3	MMR 1
Depressive symptoms										
2-4 mo	0.97 (0.71, 1.33)	0.72† (0.57, 0.91)	0.74† (0.59, 0.93)	0.70† (0.56, 0.87)	0.77† (0.62, 0.95)	0.70† (0.56, 0.87)	0.72† (0.59, 0.89)	0.89 (0.62, 1.27)	0.73+ (0.59, 0.92)	0.73\$ (0.58, 0.93)
30-33 mo	0.94 (0.68, 1.30)	0.95 (0.74, 1.21)	1.05 (0.83, 1.33)	1.03 (0.82, 1.28)	0.98 (0.79, 1.22)	1.12 (0.90, 1.39)	1.24 (1.00, 1.54)	1.24 (0.84, 1.81)	0.93 (0.74, 1.18)	1.12 (0.87, 1.43)

* Adjusted for mother's age at child's birth, mother's race, mother's ethnicity, missing ethnicity, mother's marital status at 2 to 4 months, mother's education at 2 to 4 months, mother's employment status at 2 to 4 months, parity, father's employment status at 2 to 4 months, child's gender, household income at 2 to 4 months, home ownership at 2 to 4 months, child's insurance status at 2 to 4 months, missing insurance at 2 to 4 months, birth weight, child's health status at 2 to 4 months, intervention status, enrollment site, and missing covariates.

† $P < .01$.

‡ $P < .001$.

\$ $P < .05$.

TABLE 6. Children's Receipt of Acute Health Services and Maternal Depressive Symptoms at 2 to 4 and 30 to 33 Months, ($n = 3412$)

	ED Past Year (30-33)	ED Since Birth (2-4)	ED Past Year Due to Injury (30-33)	Injuries in Past Year (30-33)	Hospitalization Since Birth (2-4)	Hospitalization Since Birth (30-33)	Hospitalization Past Year (30-33)
	Depressive symptoms						
2-4 mo, adjusted OR (95% CI)*	1.38† (1.12, 1.71)	1.22 (0.94, 1.58)	0.75 (0.55, 1.02)	1.27 (0.96, 1.67)	1.25 (0.85, 1.83)	1.18 (0.92, 1.52)	1.18 (0.80, 1.74)
30-33 mo, adjusted OR (95% CI)*	1.18 (0.95, 1.45)	1.03 (0.79, 1.35)	0.88 (0.64, 1.21)	1.23 (0.93, 1.63)	0.89 (0.59, 1.34)	1.08 (0.84, 1.40)	1.43 (0.98, 2.09)

* Adjusted models control for mother's age at child's birth, mother's race, mother's ethnicity, missing ethnicity, mother's marital status at 2 to 4 months, mother's education at 2 to 4 months, mother's employment status at 2 to 4 months, parity, father's employment status at 2 to 4 months, child's gender, household income at 2 to 4 months, home ownership at 2 to 4 months, child's insurance status at 2 to 4 months, missing insurance at 2 to 4 months, birth weight, child's health status at 2 to 4 months, intervention status, enrollment site, and missing covariates.

† $P < .01$.

higher for ED use relative to nationally derived estimates. As assessed at 30 to 33 months in our study, 5.9% of children were hospitalized and 35.6% of children had ED use in the preceding year. Nationally, 5.1% of children 0 to 4 years old were hospitalized in 1998.³² US estimates for annual ED use range from 16.8% for children 0 to 4 years old³² to 24.9% for children <6 years old.³³ In our study, questions about ED use specifically included use of urgent care centers and may have contributed to increased reporting of use. We are unaware of national data reporting age-appropriate receipt of health-maintenance visits. Our estimate of 61% of children being UTD for 4 doses of DPT, 3 doses of polio vaccine, and 1 dose of MMR is less than levels reported in the National Immunization Survey (78.6%)³⁴ and likely reflects our exclusion of vaccine doses received at less than minimum intervals.

In this study we focus on depressive symptoms rather than clinical diagnosis, as has been done in prior studies examining relations between maternal mental health and children's receipt of care. In addition, current depressive symptomatology rather than lifetime history and diagnoses has been associated with children's school and social functioning, as measured by both mothers' and teachers' ratings of child behavior.³⁵ Moreover, we believe that pediatricians are more likely to detect symptoms rather than render clinical diagnoses for adults, giving the measure of symptomatology more immediate practice and policy relevance.

Denominators for age-appropriate visits and vaccinations in our study included all children and were not restricted to active patients with recent visits, as is done for clinical performance measurements. However, restricted denominators for those with recent visits yielded comparable results. We chose to use full denominators, because depressive symptoms are associated with receipt of visits.

We believe that the study findings are generalizable. Although not a nationally representative sample, HS participants are economically and ethnically diverse and had no incentives for complying with well-child care. When compared with national birth data, mothers in the HS sample were of comparable maternal age and somewhat better educated (26.6% vs 22.8% college graduates). HS mothers were more likely to be black (24.4% vs 15.4%), Hispanic (20.2% vs 18.3%), single (35.8% vs 32.4%), and having their first child (46.4% vs 40.8%). A smaller percentage of HS participants were low birth weight (6.6% vs 7.8%), as might be expected from eligibility criteria, which included completion of an office visit within 28 days of life.²⁰

Several limitations of our study warrant comment. Our assessment of acute care use (ED, hospitalizations) was limited to children whose mothers completed the 30- to 33-month interview. Women with depressive symptoms at 2 to 4 months were less likely than their healthy peers to complete the 30- to 33-month interview (63.3% vs 71.4%). We were unable to determine if hospitalizations were preventable, because diagnoses were provided from parent report and not medical records. Finally, unmeasured

provider, child, and system factors may influence mother's health care-seeking decisions for their children.

Our findings reinforce the need to incorporate a family focus in delivering care to children.³⁶ The US Preventive Services Task Force recommends screening adults for depression in primary care settings that have systems to assure appropriate diagnosis, treatment, and follow-up.³⁷ However, a recent American Academy of Pediatrics periodic survey reported that only 57% of pediatricians believe it is their responsibility to recognize maternal depression, and most rely on unstructured approaches.³⁸ Moreover, at an inner-city, general pediatric clinic, Heneghan et al³⁹ reported that pediatricians recognized only 29% of the mothers with high levels of depressive symptoms.

Our findings suggest that early screening for maternal depressive symptoms, if accompanied by appropriate anticipatory guidance and referrals, could contribute to improved patterns of receipt of acute and preventive health care services for young children in addition to the known benefits of promoting the well-being of mothers, children, and families. Such an approach would necessitate overcoming barriers of limited knowledge and availability of community mental health resources, time, and reimbursement constraints for addressing parental mental health concerns.⁴⁰ Child health care providers, however, may be the only professional contact for parents of young children in their first few months of life. Failure to screen for maternal depression represents another missed opportunity to enhance the health and well-being of children and families.

ACKNOWLEDGMENT

We gratefully acknowledge support from the Agency for Healthcare Research and Quality (grant R03 HS13053-01).

REFERENCES

1. Osofsky JH, Thompson MD. Adaptive and maladaptive parenting: perspectives on risk and protective factors. In: Shonkoff JP, Meisels SM, eds. *Handbook of Early Childhood Intervention*. Cambridge, United Kingdom: Cambridge University Press; 2000:65-67
2. McLennan JD, Kotelchuck M. Parental prevention practices for young children in the context of maternal depression. *Pediatrics*. 2000;105:1090-1095
3. Leiferman J. The effect of maternal depressive symptomatology on maternal behaviors associated with child health. *Health Educ Behav*. 2002;29:5:596-607
4. Chung E, McCollum KF, Elo IT, et al. Maternal depressive symptoms and infant health practices among low-income women. *Pediatrics*. 2004; 113(6). Available at: www.pediatrics.org/cgi/content/full/113/6/e523
5. NICHD Early Child Care Research Network. Chronicity of maternal depressive symptoms, maternal sensitivity, and child functioning at 36 months. *Dev Psychol*. 1999;35:1297-1310
6. Green M. Diagnosis, management, and implications of maternal depression for children and pediatricians. *Curr Opin Pediatr*. 1994;6:525-529
7. Beardslee WR, Versage EM, Gladstone TR. Children of affectively ill parents: a review of the past 10 years. *J Am Acad Child Adolesc Psychiatry*. 1998;37:1134-1141
8. Minkovitz CS, O'Campo PJ, Chen Y, Grason HA. Associations between maternal and child health status and patterns of medical care use. *Ambul Pediatr*. 2002;2:85-92
9. Mandl KD, Tronick EZ, Brennan TA, Alpert HR, Homer CJ. Infant health care use and maternal depression. *Arch Pediatr Adolesc Med*. 1999;153:808-813
10. Bartlett SJ, Kolodner K, Butz AM, Eggleston P, Malveaux FJ, Rand CS. Maternal depressive symptoms and emergency department use among

- inner-city children with asthma. *Arch Pediatr Adolesc Med.* 2001;155:347–353
11. Bartlett SJ, Krishnan JA, Riekert KA, Butz AM, Malveaux FJ, Rand CS. Maternal depressive symptoms and adherence to therapy in inner-city children with asthma. *Pediatrics.* 2004;113:229–237
 12. Watson JM, Kemper KJ. Maternal factors and child's health care use. *Soc Sci Med.* 1995;40:623–628
 13. Kahn RS, Zuckerman B, Bauchner H, Homer CJ, Wise PH. Women's health after pregnancy and child outcomes at age 3 years: a prospective cohort study. *Am J Public Health.* 2002;92:1312–1318
 14. Riley AW, Finney JW, Mellits ED, et al. Determinants of children's health care use: an investigation of psychosocial factors. *Med Care.* 1993;31:767–783
 15. Ward A, Pratt C. Psychosocial influences on the use of health care by children. *Aust N Z J Public Health.* 1996;20:309–316
 16. American Academy of Pediatrics, Committee on Practice and Ambulatory Medicine. Recommendations for preventative pediatric health care. *Pediatrics.* 2000;105:645–646
 17. Kessler RC. Sex differences in DSM-III-R psychiatric disorders in the United States: results from the National Comorbidity Survey. *J Am Med Womens Assoc.* 1998;53:148–158
 18. Lyons-Ruth K, Wolfe R, Lyubchik A, Steingard R. Depressive symptoms in parents of children under age 3: sociodemographic predictors, current correlates, and associated parenting behaviors. In: Halfon N, McLearn KT, Schuster MA, eds. *Child Rearing in America: Challenges Facing Parents With Young Children.* Cambridge, United Kingdom: Cambridge University Press; 2002:217–223
 19. McLearn KT, Zuckerman B, Parker S, Yellowitz M, Kaplan-Sanoff M. Child development and pediatrics for the 21st century: the Healthy Steps approach. *J Urban Health.* 1998;75:704–722
 20. Guyer B, Hughart N, Strobino D, Jones A, Scharfstein D; Healthy Steps Evaluation Team. Assessing the impact of pediatric-based developmental services on infants, families, and clinicians: challenges to evaluating the Healthy Steps program. *Pediatrics.* 2000;105(3). Available at: www.pediatrics.org/cgi/content/full/105/3/e33
 21. Minkovitz CS, Hughart N, Strobino D, et al. A practice-based intervention to enhance quality of care in the first three years of life: results from the Healthy Steps for Young Children Program. *JAMA.* 2003;290:3081–3091
 22. Anderson RM. Revisiting the behavioral model and access to medical care: does it matter? *J Health Soc Behav.* 1995;36:1–10
 23. American Academy of Pediatrics. 1997 *Red Book: Report of the Committee on Infectious Diseases.* 24th ed. Peter G, ed. Elk Grove Village, IL: American Academy of Pediatrics; 1997
 24. Radloff LS. The CES-D Scale: a self-report depression scale for research in the general population. *Appl Psychol Meas.* 1977;1:385–401
 25. Strobino D. Utilization of health care by drug-using pregnant women. Final Report. National Institute on Drug Abuse grant R01 DA07621-03; 2000
 26. Thomas JL, Jones GN, Scarinci IC, Mehan DJ, Brantley PJ. The utility of the CES-D as a depression screening measure among low-income women attending primary care clinics. The Center for Epidemiologic Studies-Depression. *Int J Psychiatry Med.* 2001;31:25–40
 27. McCullagh P, Nelder JA. *Generalized Linear Models.* New York, NY: Chapman and Hall; 1983
 28. Robins JM, Rotnitzky A, Zhao LP. Estimation of regression coefficients when some regressors are not always observed. *J Am Stat Assoc.* 1994; 89:846–866
 29. Efron B, Tibshirani RJ. *An Introduction to Bootstrap.* New York, NY: Chapman and Hall; 1998
 30. Ihaka R, Gentleman R. R: a language for data analysis and graphics. *J Graph Comput Stat.* 1996;5:299–314
 31. Bolton P, Hussain A, Hadpawat A, Holt E, Hughart N, Guyer B. Deficiencies in current childhood immunization indicators. *Public Health Rep.* 1998;113:527–532
 32. Elixhauser A, Machlin SR, Zodet MW, et al. Health care for children and youth in the United States: 2001 annual report on access, utilization, quality, and expenditures. *Ambul Pediatr.* 2002;2:419–437
 33. Freid VM, Prager K, MacKay AP, Xia H. Table 75. *Health, United States, 2003, With Chartbook on Trends in Health of Americans.* Hyattsville, MD: National Center for Health Statistics; 2003:245–248
 34. Barker L, Luman E, Zhao Z, et al. National, state, and urban area vaccination coverage levels among children aged 19–35 months—United States, 2001. *MMWR Morb Mortal Wkly Rep.* 2002;51:664–666
 35. Hammen C, Adrain C, Gordon D, Burge D, Jaenicke C, Hiroto D. Children of depressed mothers: maternal strain and symptom predictors of dysfunction. *J Abnorm Psychol.* 1987;96:190–198
 36. American Academy of Pediatrics, Task Force on the Family. Family pediatrics: report of the Task Force on the Family. *Pediatrics.* 2003;111: 1541–1571
 37. US Preventive Services Task Force. Screening for depression: recommendations and rationale. *Ann Intern Med.* 2002;136:760–764
 38. Olson AL, Kemper KJ, Helleher KJ, et al. Primary care pediatricians' roles and perceived responsibilities in the identification and management of maternal depression. *Pediatrics.* 2002;110:1169–1176
 39. Heneghan AM, Silver EJ, Bauman LJ, Stein REK. Do pediatricians recognize mothers with depressive symptoms? *Pediatrics.* 2000;106: 1367–1373
 40. Zimmer KP, Minkovitz CS. Maternal depression: an old problem that merits increased recognition by child health care practitioners. *Curr Opin Pediatr.* 2003;15:636–640

THE GENERATIONAL DIVIDE

“The Traditionalists, born between the turn of the last century and the end of World War II (1900–1945), combine 2 generations who tend to believe and behave similarly and who number about 75 million people. The Baby Boomers (1946–1964) are the largest population ever born in this country and number about 80 million. The Generation Xers (1965–1980) are a smaller but very influential population at 46 million. And the Millennials (1981–1999) represent the next great demographic boom at 76 million.”

Lancaster LC, Stillman D. *When Generations Collide.* Harper Business. 2002.

Submitted by Student