Validity of the Family Asthma Management System Scale with an Urban African-American Sample

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Objective. To examine the reliability and validity of the Family Asthma Management System Scale for low-income African-American children with poor asthma control and caregivers under stress. The FAMSS assesses eight aspects of asthma management from a family systems perspective.

Methods. Forty-three children, ages 8–13, and caregivers were interviewed with the FAMSS; caregivers completed measures of primary care quality, family functioning, parenting stress, and psychological distress. Children rated their relatedness with the caregiver, and demonstrated inhaler technique. Medical records were reviewed for dates of outpatient visits for asthma.

Results. The FAMSS demonstrated good internal consistency. Higher scores were associated with adequate inhaler technique, recent outpatient care, less parenting stress and better family functioning. Higher scores on the Collaborative Relationship with Provider subscale were associated with greater perceived primary care quality.

Conclusions. The FAMSS demonstrated relevant associations with asthma management criteria and family functioning for a low-income, African-American sample.

Key words. adherence; asthma; family functioning; parent stress.

A burgeoning literature documents the effect of family processes on asthma morbidity in children. Suggested mechanisms of influence include both asthma management behaviors and/or disease-related psychophysiologic pathways (Celano, 2006; Kaugars, Klinnert, & Bender, 2004). Of asthma management behaviors, poor medication adherence has been demonstrated to be associated with poor family functioning (Bender, Milgrom, Rand, & Ackerson, 1998) and parental criticism (Wamboldt, Wamboldt, Gavin, Roesler, & Brugman, 1995). Available evidence suggests that pediatric psychology interventions for poorly controlled pediatric asthma should focus on the family system and on the full range of behaviors required for effective asthma management (McQuaid, Walders, Kopel, Fritz, & Klinnert, 2005).

Psychoeducational interventions have been developed to improve pediatric asthma outcomes by imparting knowledge and skills (Evans et al., 1999) and/or by targeting specific family processes thought to impede asthma management (Ng et al., 2008). Unfortunately, the design of measures to assess family processes related to asthma management lags behind treatment and education development. General measures of family functioning may not be specific enough to identify intervention targets, or sensitive enough to detect the clinically meaningful changes sought by time-limited family interventions.

The Family Asthma Management System Scale (FAMSS; Klinnert et al., 1997; McQuaid et al., 2005) is a comprehensive, semi-structured clinical interview that includes open-ended questions assessing family management of pediatric asthma. The interview is recorded and rated using a standard manual on seven core subscales and two optional subscales (Table I). The FAMSS is considered a “well-established” measure of illness management/adherence (Quittner, Modi, Lemanek, Ievers-Landis, & Rapoff, 2008); its validity and reliability have been demonstrated for two samples of largely middle-income, Caucasian children (Klinnert et al., 1997;
McQuaid et al., 2005) and for a low-income, multi-ethnic population of infants (Kaugars, Klinnert, Robinson, & Ho, 2008), most with mild to moderate asthma. Although psychometrics on the FAMSS have been reported for a school-aged sample that includes a significant proportion of minority children (McQuaid et al., 2005), reliability and validity have not been reported for an exclusively low-income, African American school-aged sample, a group at high risk for asthma morbidity (McDaniel, Paxson, & Waldfogel, 2006). In addition, the instrument has not been used to assess family asthma management of a school-aged sample selected for poor asthma control, or those with caregivers under stress—arguably, those families most in need of pediatric psychology interventions.

The current study assesses the reliability and concurrent validity of the FAMSS for a sample of urban, low-income, African American families with poorly controlled asthma whose caregivers were identified as experiencing psychosocial stress. In consultation with our Community Advisory Board, we defined stress broadly as parenting stress, psychological distress, and/or numerous stressful life events generally experienced by a low-income population of caregivers. We expected that the FAMSS would demonstrate adequate internal consistency reliability for our sample (Hypothesis 1). We also expected the scale to demonstrate adequate criterion-related validity, as evidenced by a significant and positive correlation between the FAMSS summary score and two practical criteria expected to be related to several dimensions of asthma management: accuracy of metered dose inhaler (MDI)/spacer technique (Hypothesis 2), and documented attendance at a recent outpatient healthcare visit (Hypothesis 3). We proposed to demonstrate convergent validity through a positive association between the FAMSS Collaborative Relationship with Provider subscale and a measure of caregiver satisfaction with asthma medical care (Hypothesis 4). Although the FAMSS was not explicitly developed for use with African-American samples, we believed that the FAMSS would demonstrate good psychometric properties when used with low-income, African American families because of the semi-structured interview format, in which questions and probes can be adapted flexibly to the family’s cultural context.

A secondary aim was to examine the associations between the FAMSS and general measures of family functioning and stress, in order to clarify the relationships between asthma management and family processes previously linked to increased asthma morbidity. Studies of low-income families have found pediatric asthma morbidity to be related to caregiver distress (Weil et al., 1999). Family emotional climate and parent–child relatedness may also contribute to pediatric asthma severity (Wood et al., 2006). Thus, we expected the FAMSS to be positively correlated with family functioning and child-reported relatedness with the caregiver, and negatively correlated with caregiver-reported parenting stress and psychological stress.

### Table I. Family Asthma Management System Scale Subscales, Domains, and Descriptive Statistics

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<tr>
<th>FAMSS Subscale</th>
<th>Domains measured</th>
<th>Mean (SD) Range</th>
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<tr>
<td>I. Asthma knowledge</td>
<td>Basic anatomy of asthma, concept of chronic disease, roles of triggers, function of prescribed asthma medications</td>
<td>4.65 (1.73) 2–7</td>
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<tr>
<td>II. Symptom assessment</td>
<td>Signs of asthma exacerbation, identification of early warning signs, daily/seasonal patterns, gradation of symptoms</td>
<td>4.84 (1.11) 3–7</td>
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<tr>
<td>IIIa. Family response to exacerbations</td>
<td>Family actions taken to manage exacerbations, monitor symptoms, and implement appropriate action plan</td>
<td>4.05 (1.57) 1–7</td>
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<tr>
<td>IIIb. Child response to exacerbations (optional)</td>
<td>Child’s actions taken to manage exacerbations, monitor symptoms, and implement appropriate action plan</td>
<td>3.33 (1.36) 1–7</td>
</tr>
<tr>
<td>IV. Environmental control</td>
<td>Reported exposure to smoke, pets, dust, and other triggers</td>
<td>3.28 (2.44) 1–7</td>
</tr>
<tr>
<td>V. Medication adherence</td>
<td>Availability and appropriate use of rescue medications; adherence to long-term controller medications</td>
<td>3.93 (2.03) 1–8</td>
</tr>
<tr>
<td>VI. Collaborative relationship with provider</td>
<td>Relationship with identified care provider, including communication and provider’s adherence to established guidelines for asthma management</td>
<td>4.00 (1.80) 1–8</td>
</tr>
<tr>
<td>VII. Balanced integration of asthma and family life</td>
<td>Balance of attention to asthma management and other developmental and family issues</td>
<td>4.00 (1.81) 1–8</td>
</tr>
<tr>
<td>VIII. Alternate caregivera</td>
<td>Adequacy/continuity of asthma care by alternate caregivers</td>
<td>n/a</td>
</tr>
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</table>

*aThis optional scale was not used as it did not apply to a majority of the sample.*
Method

Participants and Procedure

Participants were enrolled in a randomized clinical trial of a home-based family intervention for pediatric asthma. Families were recruited from an urban children’s hospital and a 1 week residential camp for children with asthma. Children were eligible to participate in the study if they lived in one of two metropolitan Atlanta counties, were 8- to 13-years old, covered by Medicaid or SCHIP, had a current prescription of a daily controller agent (ascertained by medical record review), and had poorly controlled asthma. Poorly controlled asthma was defined as one or more emergency department (ED) visits or hospitalizations for asthma or prescription of more than one oral steroid burst to treat asthma within the past year. In addition, eligible children lived with a primary caregiver under stress, operationalized by a T-score at or above the 90th percentile on the Parenting Stress Index (PSI-SF), a T-score above 63 on the Brief Symptom Inventory (BSI), or an elevated score (14 or more stressful life events or 9 or more negative events) on the Crisis in Family Systems–Revised (CRISYS-R; Berry, Shalowitz, Quinn, & Wolf, 2001). Children were excluded if they had a non-atopic, nonpsychiatric illness requiring daily medication (e.g., diabetes), or had been diagnosed with asthma for less than a year.

Most of the participants were identified from ED billing records from an urban hospital. Caregivers of children meeting initial eligibility criteria (county of residence, Medicaid/SCHIP, age, medication regimen, poor asthma control) were interviewed briefly by phone to determine if a screening assessment for stress eligibility was warranted. The phone interview included three questions developed in collaboration with the project Community Advisory Board to assess the presence of parental stress (elevated score (14 or more stressful life events or 9 or more negative events) or 9 or more stressful life events or 9 or more negative events) on the Crisis in Family Systems–Revised (CRISYS-R; Berry, Shalowitz, Quinn, & Wolf, 2001). Children were excluded if they had a non-atopic, nonpsychiatric illness requiring daily medication (e.g., diabetes), or had been diagnosed with asthma for less than a year.

The Family Asthma Management System Scale (FAMSS) is a semi-structured interview, administered jointly to caregivers and children, that assesses asthma knowledge and management practices (Klinnert et al., 1997). The domains of the FAMSS include knowledge and understanding of asthma management; communication between caregiver and provider; adherence to treatment; roles and responsibilities of caregivers; caregiver confidence in asthma management; caregiver decision making; and daily management plans. The FAMSS is a validated, reliable, and valid tool for assessing asthma management practices and family functioning. The FAMSS was administered to all caregivers at the baseline assessment, two families became ineligible and six declined participation or could not be reached, leaving 43 families with baseline assessment visits. Of these 43, 38 (88%) were recruited from the hospital and 5 (12%) were recruited from the residential camp. Most caregivers met eligibility for stress based on their CRISYS-R scores alone (37%) or both CRISYS-R and BSI or PSI-SF scores (37%); 12% met stress eligibility based on BSI and PSI-SF scores, 9% based on PSI-SF scores, and 5% on BSI scores.

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3The last 20 screening assessments (11 of those enrolled in the trial) were conducted by phone to lessen barriers to study enrollment. To minimize respondent burden, not all stress measures were administered to all caregivers. We gave the CRISYS-R and PSI to all participants interviewed in person, administering the BSI only if they did not meet stress eligibility based on the other measures. For caregivers interviewed by phone, we gave the PSI only if they did not meet stress eligibility based on their CRISYS-R scores.
of behavior assessed by the instrument were derived conceptually from a family systems approach to pediatric psychology (Kazak, Segal-Andrews, & Johnson, 1995), from theory and research in developmental psychopathology (Sroufe & Rutter, 1984), and from asthma self-management theory (Clark, Evans, Zimmerman, Levison, & Mellins, 1994). The interview is recorded and rated on management theory (Clark, Evans, Zimmerman, Levison, & Mellins, 1994). The interview included both caregivers, and several included siblings. Project staff members were trained in administering and rating the FAMSS by the developers of the scale according to established procedures (Klinnert et al., 1997; McQuaid et al., 2005). The FAMSS interviews were administered primarily by a trained public health professional or a postdoctoral fellow in psychology. The interviews were rated independently by one of these two staff members and the first author, a psychologist, with final ratings achieved by consensus between the two. To insure standard ratings and monitor reliability, 12% of baseline FAMSS interviews were independently rated by the developers of the FAMSS, with ratings discussed and consensus achieved in monthly phone conferences. Project team members were successfully trained to reliability as indicated by moderate to high intraclass correlations between project members’ and consensus ratings (mean ICC = .91). Interrater reliability between the two primary project raters (n = 11) was strong for the FAMSS summary score (ICC = .86) and acceptable for FAMSS subscales (mean ICC = .68).

We did not use the Alternate Caregiver subscale of the FAMSS because most of the children in our sample did not spend significant time with an alternate caregiver outside the home.

The FAMSS interview was conducted primarily with the caregiver and the target child only, although one interview included both caregivers, and several included siblings. Project staff members were trained in administering and rating the FAMSS by the developers of the scale according to established procedures (Klinnert et al., 1997; McQuaid et al., 2005). The FAMSS interviews were administered primarily by a trained public health professional or a postdoctoral fellow in psychology. The interviews were rated independently by one of these two staff members and the first author, a psychologist, with final ratings achieved by consensus between the two. To insure standard ratings and monitor reliability, 12% of baseline FAMSS interviews were independently rated by the developers of the FAMSS, with ratings discussed and consensus achieved in monthly phone conferences. Project team members were successfully trained to reliability as indicated by moderate to high intraclass correlations between project members’ and consensus ratings (mean ICC = .91). Interrater reliability between the two primary project raters (n = 11) was strong for the FAMSS summary score (ICC = .86) and acceptable for FAMSS subscales (mean ICC = .68).

Metered Dose Inhaler Checklist
The Metered Dose Inhaler Checklist (MDIC) is an observational rating scale used to assess children’s MDI technique with or without a spacer. It has acceptable inter-rater reliability and internal consistency reliability (α = .90) for low-income, African-American children with persistent asthma (Boccuti, Celano, Geller, & Phillips, 1996). Although the scale consists of 11 items tapping specific MDI/spacer use skills, these skills are not equally instrumental in achieving drug delivery; thus, a mean or summation of item scores is not recommended (Boccuti et al., 1996). The MDIC, slightly adapted for use with modern spacers, yields a dichotomous score based on whether four skills deemed critical for drug delivery (e.g., inhaling) are demonstrated. A score of one indicates adequate technique, whereas a score of zero suggests technique so poor that drug delivery is unlikely. Participants’ videotaped demonstrations of their MDI/spacer technique were rated by a team including a certified asthma educator and/or a pediatric asthma specialist after receiving training from one of the developers of the scale. Discrepancies among trained raters were reconciled by consensus, and consensus scores were used in the analyses.

Parent’s Perceptions of Primary Care (P3C)–Revised
The P3C-R is adapted from the 23-item Parent’s Perceptions of Primary Care (P3C), a measure of perceived pediatric primary care quality (Seid et al., 2001). The P3C has demonstrated excellent internal consistency reliability, a stable factor structure, and good concurrent validity for a large sample of parents of elementary school children (Seid et al., 2001). We revised the P3C by dropping seven items that were not relevant for our sample, eliminating three items deemed to be vague or redundant, and adding two items suggested by our Community Advisory Board (e.g., “Do you and your doctor talk about how your child’s asthma or medicines affect his/her behavior?”). Item analyses of the P3C-R revealed good distributions for all 15 items. Two items with considerable missing data (12%) were subsequently dropped, as they did not appear applicable to all patients, resulting in a 13-item revised scale. Higher scores on the P3C-R indicate favorable perceptions.

Caregiver Stress Measures
Although up to three stress measures were used to screen caregivers into the study, only two stress measures were re-administered at baseline: the Parenting Stress Index–Short Form (PSI-SF) and the BSI. The Crisis in Family
Systems–Revised (CRISYS-R; Berry et al., 2001), administered only at screening, is a 63-item scale measuring contemporary life stressors validated for a sample of parents of children with asthma. Respondents indicate whether each stressor has occurred within the past 6 months and rate the experience of the stressor as positive, negative, or neutral. Total count of stressors and number of stressors rated as negative are significantly and positively correlated with Center for Epidemiologic Studies-Depression scores (Berry et al., 2001), supporting the scale’s validity. In addition, the CRISYS-R discriminated between parents using Medicaid and living in the city from those without Medicaid and living outside the city. The internal consistency reliability of the CRISYS-R was adequate for our sample (Cronbach’s $\alpha = .72$).

The PSI-SF (Abidin, 1995) is a well-studied 36-item questionnaire that measures stress in the parent–child system. Its three subscales, parental distress, parent–child dysfunctional interaction, and difficult child, yield a Total Stress score that can be referenced to a normative sample (Cronbach’s $\alpha = .92$ for our sample). The BSI (Derogatis & Melisaratos, 1983) is a 53-item scale designed to measure overall psychological distress; it has acceptable reliability and validity and has been used in over 400 research studies. The BSI Global Severity Index T-score was used as a summary score in the analyses. Higher scores on both the PSI-SF and the BSI indicate greater stress. The BSI had excellent internal consistency reliability for our sample (Cronbach’s $\alpha = .96$).

### Family Functioning Measures
Caregivers completed the Family Relationship Index (FRI; Holahan & Moos, 1982), a 27-item measure derived from the Family Environment Scale (FES; Moos & Moos, 1986) composed of three subscales measuring expressiveness, cohesion, and conflict. The FRI has acceptable internal consistency reliability and is a “well-established” measure of general family functioning in pediatric psychology (Alderfer et al., 2008). The FRI demonstrated satisfactory internal consistency (Cronbach’s $\alpha = .74$) for our sample. Higher scores suggest greater expressiveness and cohesion, and less conflict, than lower scores.

Children completed the Relatedness Questionnaire (RQ), a 17-item scale developed by Wellborn and Connell (1987). The scale yields two factor-based subscales consistent with attachment and self-system theory: emotional quality, assessing children’s feelings of specific positive and negative emotions when with the caregiver, and psychological proximity seeking, assessing the degree to which children wish they were psychologically closer to the caregiver. Internal consistency reliabilities are adequate to excellent (.67 to .93; Lynch & Cicchetti, 1991), with Cronbach’s $\alpha$’s of .82 (proximity seeking) and .72 (emotional quality) in our sample. Subscale scores are used to classify children as having one of five patterns of relatedness (Lynch & Cicchetti, 1991). Optimal and adequate patterns are characterized by positive emotion and satisfaction with existing closeness with the caregiver, whereas deprived, disengaged, or confused patterns indicate negative appraisals on one or both subscales. Consistent with previous research in pediatric asthma (Wood et al., 2006), we classified these categories into two patterns of relatedness: “secure” (optimal and adequate) or “insecure” (deprived, disengaged or confused). Evidence for the RQ’s construct validity is suggested by associations between patterns of relatedness and child adjustment (Toth & Cicchetti, 1996).

### Documented Recent Outpatient Healthcare Visit
Research assistants were trained to review medical records to abstract information about healthcare visits for asthma. Medical records of all children were reviewed at baseline to determine the date of the most recent outpatient healthcare visit. Consistent with NHLBI guidelines for medical monitoring of children with persistent asthma, a healthcare visit was defined as recent if occurred within the past 6 months. The visit counted as a documented healthcare visit for asthma if the medical record included documentation of evaluation or treatment by a primary care provider or asthma specialist, with a diagnosis of asthma; ED visits for asthma did not count.

### Data Analyses
Descriptive statistics characterized the sample. Internal consistency reliability of the FAMSS was assessed with Cronbach’s $\alpha$. Effect sizes of the relationships between FAMSS scores and continuous measures (P3C-R, PSI-SF, BSI, FRI) were assessed with Pearson correlations, and effect sizes between FAMSS scores and dichotomous variables (MDI Technique, recent healthcare visit, and Relatedness) were tested with point biserial correlations. To minimize Type I error given the number of proposed analyses, significant $p$-values for analyses of individual FAMSS subscale scores were adjusted to .01, with the

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3We dropped an item about abortion in response to advice from our Community Advisory Board.
exception of hypothesis 4, which predicted a specific association with a single FAMSS subscale. Following Cohen (1988), we characterize correlations of .3 to .49 as moderate and .5 or higher as strong. With a sample of 43 and an alpha level of .05, the power is .96 to detect strong correlations and .52 to detect moderate correlations. With an α-level of .01, the power is .86 for strong correlations, and .27 for moderate correlations.

Results
Preliminary Analyses

Mean levels of caregiver stress were high for this sample, as expected given the screening procedures. The mean PSI-SF Total Stress score was 84.0 (SD = 20.6; range = 40 to 139), corresponding to the 82nd percentile. The mean BSI Global Severity Index T-score was 57.1 (SD = 10.9; range = 33 to 80), at about the 75th percentile. The mean FRII score was 19.0, (SD = 4.2; range = 7 to 26) within a theoretical range of 0 to 27. Patterns of relatedness derived from children’s responses to the RQ were 26 (60%) secure and 17 (40%) insecure.

FAMSS: Descriptive Statistics and Reliability Analysis

The mean FAMSS summary score for the sample was 4.01 (SD = 1.28), corresponding to the lower middle range of the 9-point scale. Summary scores ranged from 1.88 to 6.63 within a possible range of 1 to 9, consistent with characterization of poor asthma control established by the screening criteria. Table I shows the FAMSS subscale means, standard deviations, and ranges. The relatively low Environmental Control score likely reflects the sample’s exposure to triggers: 33% of the families owned a furry pet, and 54% reported that a household member smoked cigarettes in the home. The internal consistency reliability of the summary score (consisting of eight subscales) was acceptable (Cronbach’s α = .87).

Validity Analyses

Table II shows the correlations between the FAMSS summary and subscale scores and the hypothesized validity variables. Of the 37 children demonstrating MDI/spacer technique, 13 (35%) made critical errors indicating the absence of drug delivery. Twelve received a score of zero because they did not inhale at all. According to t-tests, children with adequate MDI/spacer technique evidenced higher scores than those with poor technique for the FAMSS summary score (t[35] = -2.39, p = .022) and for two of eight subscales: Family Response to Symptoms (t[35] = -3.68, p = .001) and Child Response to

<table>
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<tr>
<th>Table II. Correlations Between FAMSS Scores and Validity Measures</th>
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<tr>
<td>FAMSS Summary Score</td>
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<tr>
<td>I. Asthma Knowledge</td>
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<tr>
<td>II: Assessment of Symptoms</td>
</tr>
<tr>
<td>IIIa: Family Response to Symptoms</td>
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<tr>
<td>IIIb: Child Response to Symptoms</td>
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<td>IV: Environmental Control</td>
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<td>V: Adherence</td>
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<tr>
<td>VI: Collaborative Relationship with Provider</td>
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<td>II: Balanced Integration</td>
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MDI, metered dose inhaler; for MDI technique, 0 = no drug delivery; for Recent Healthcare Visit, 0 = none.

*p < .05, *p < .01

Symptoms (t[35] = −3.08, p = .004).4 Children with a recent outpatient healthcare visit (n = 27) evidenced higher scores than those without such a visit (n = 16) for the FAMSS summary score (t[41] = −2.83, p = .007); p-values for the subscale comparisons did not reach significance, although they were in the expected direction for six subscales.

The 13-item P3C-R adapted for this study had satisfactory internal consistency reliability (Cronbach’s α = .84). The mean overall P3C-R score was 2.95 (SD = .78; range = 1 to 4), corresponding to “almost always” on the 5-point Likert scale and indicating positive perceptions of the child’s primary care quality. As expected, P3C-R scores were significantly correlated with the FAMSS Collaborative Relationship with Provider subscale (r = .34, n = 43, p = .028). The P3C-R was correlated positively but not significantly with the FAMSS summary score (r = .27, n = 43, p = .078) and with the other FAMSS subscales; the lowest correlation was with Environmental Control (r = .06).

Family Functioning and Stress

To provide a context for interpreting the correlations between the FAMSS and family functioning or stress, relationships between the FAMSS and demographic variables

4MDIC scores are not available for six participants; two could not be assessed because there was no asthma medicine in the home during the baseline visit, and two demonstrated poor technique during a later home visit. When these four cases are given a “0” on the MDIC for likely poor technique, t-test analyses show a more striking pattern of results, with a significant difference in the expected direction for the FAMSS summary score (t[39] = −2.50, p = .016).
were examined. The FAMSS summary score was not related to child age or gender, or caregiver age, education, marital status or asthma status; however, it was negatively related to the number of household members ($r = -0.42, n = 43, p = .005$), which ranged from 2 to 13 (Table III).

The PSI was negatively related to the FAMSS summary score ($r = -0.41, n = 43, p = .006$) and three of the eight FAMSS subscales. In contrast, the BSI Global Severity Index was not related to any of the FAMSS scores. Parenting stress remained a significant predictor of asthma management even after controlling for number of household members; post hoc regression analyses showed that the PSI accounted for incremental variance in the FAMSS summary score (change in $R^2 = 0.075, \beta = -0.294, SE = .009, p = .052$). The FRI was positively related to the FAMSS summary score ($r = .33, n = 43, p = .031$). Children with secure patterns of relatedness had significantly higher FAMSS summary scores than those with insecure patterns ($t(43) = 3.04, p = .004$; secure $M = 4.45$, insecure $M = 3.34$).

### Discussion

Our data provide further support for the internal consistency reliability and criterion-related concurrent validity of the FAMSS, a semi-structured clinical interview designed to assess family functioning across a range of behavioral domains relevant to family management of pediatric asthma. These data provide validity support for the FAMSS for a sample distinct from those previously evaluated (Kaugars et al., 2008; Klinnert, McQuaid, & Gavin, 1997; McQuaid et al., 2005), as participants were African-American urban families selected specifically for poorly controlled asthma and high levels of caregiver psychosocial stress. Although the current sample was more homogeneous than other inner city samples (Evans et al., 1999) in terms of asthma morbidity and caregiver stress, the FAMSS summary score was nevertheless related to clinically relevant behaviors such as children’s MDI technique and attendance at a recent healthcare appointment for asthma.

### Validity Support

The pattern of correlations between FAMSS scores and criteria of practical value advances the scale’s elaborative validity (Foster & Cone, 1995), its applied utility in a “real life” context. As hypothesized, the FAMSS summary score was lower for children who demonstrated poor MDI/spacer technique, a clinically relevant skill required for asthma self-management. Although planned validity tests evaluated the relationship between the FAMSS summary score and MDI/spacer technique, we found that adequate MDI/spacer technique was also related to the FAMSS subscales Family Response to Symptoms and Child Response to Symptoms. Both subscales assess verbal reports of behavior related to the appropriate use of medication to manage exacerbations. The relationship between FAMSS scores and children’s MDI/spacer technique is notable given that the children’s technique was evaluated by objective raters who were blind to the FAMSS interview responses.

Our data also demonstrated a significant relationship between the FAMSS summary score and documentation of a recent non-urgent healthcare visit for asthma. Importantly, documentation of recent outpatient healthcare visits provided validity data that were independent from questionnaire responses from either the caregiver or child. Convergent validity for the FAMSS was supported by the hypothesized positive relationship between the Collaborative Relationship with Provider subscale and the P3C-R, which assesses the caregiver’s perceptions of the child’s primary care provider. This finding is important in that previous studies of the FAMSS have not assessed caregiver perception of or communication with the child’s healthcare provider.

Interestingly, the Environmental Control subscale did not correlate with MDI technique, documentation of a recent outpatient healthcare visit, or the caregiver’s perceptions of the primary care provider, though none of these criteria was explicitly selected to assess the validity of this FAMSS subscale. Environmental Control was demonstrated to be integral to the FAMSS through significant

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**Table III. Correlations between FAMSS Scores, Household Size, and Stress/Family Functioning Variables**

<table>
<thead>
<tr>
<th>Number of household members</th>
<th>PSI</th>
<th>BSI</th>
<th>FRI</th>
<th>RQ: Relatedness</th>
</tr>
</thead>
<tbody>
<tr>
<td>FAMSS Summary Score</td>
<td>−0.42</td>
<td>−0.41</td>
<td>−0.06</td>
<td>0.33</td>
</tr>
<tr>
<td>I: Asthma Knowledge</td>
<td>−0.19</td>
<td>−0.14</td>
<td>0.20</td>
<td>0.13</td>
</tr>
<tr>
<td>II: Assessment of Symptoms</td>
<td>−0.03</td>
<td>−0.18</td>
<td>0.21</td>
<td>0.04</td>
</tr>
<tr>
<td>IIIa: Family Response to</td>
<td>−0.30</td>
<td>−0.21</td>
<td>0.12</td>
<td>0.21</td>
</tr>
<tr>
<td>Symptoms</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IIIb: Child Response to</td>
<td>−0.20</td>
<td>−0.39</td>
<td>−0.06</td>
<td>0.08</td>
</tr>
<tr>
<td>Symptoms</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV: Environmental Control</td>
<td>−0.43</td>
<td>−0.35</td>
<td>−0.28</td>
<td>0.32</td>
</tr>
<tr>
<td>V: Adherence</td>
<td>−0.34</td>
<td>−0.37</td>
<td>0.00</td>
<td>0.29</td>
</tr>
<tr>
<td>VI: Collaborative Relationship with Provider</td>
<td>−0.34</td>
<td>−0.32</td>
<td>−0.16</td>
<td>0.37</td>
</tr>
<tr>
<td>VII: Balanced Integration</td>
<td>−0.38</td>
<td>−0.39</td>
<td>−0.16</td>
<td>0.35</td>
</tr>
</tbody>
</table>

PSI, Parenting Stress Index; BSI, Brief Symptom Inventory; FRI, Family Relationship Index; RQ, Relatedness Questionnaire; for Relatedness, 0 = secure pattern and 1 = insecure pattern.

$p < .05; \, ^p < .01.$
intercorrelations with the other subscale scores and with the summary score, relationships that are reflected in the adequate internal consistency reliability coefficient. Nevertheless, Environmental Control has a different emphasis than the other FAMSS subscales in that it measures the child’s exposure to triggers, rather than the family’s efforts to control them. Given that low-income caregivers don’t always have control over their home environments (i.e., substandard housing, or lease in someone else’s name), it may be that certain features of environmental control for our sample are less related to the family’s asthma management in other areas (e.g., MDI technique or medical care), where they can exercise greater control.

The FAMSS and Family Processes

Associations of FAMSS scores with indices of family functioning suggest not only that pediatric asthma management behaviors are embedded in family interactions and parent–child relationships (Klinnert & Bender, 2002), but also that the adequacy of asthma management is directly related to the quality of family relationships. In this study, family functioning marked by high cohesion and expressiveness and low conflict, as measured with the FRI, was positively related to the FAMSS summary score. This finding is consistent with a previously reported association between family dysfunction and nonadherence (Bender et al., 1998); our findings indicate that family problems may be associated with difficulties in multiple aspects of asthma management.

We found that caregiver-reported parenting stress was strongly inversely related to the FAMSS summary score, Child Response to Symptoms, Medication Adherence, and Balanced Integration. The parenting stress score indexes a combination of parent–child dysfunctional interaction, parental distress, and perceptions of the child as difficult. Our finding of an association between the FAMSS assessment of asthma management and a high PSI score supports the hypothesized role of parent–child relationship difficulties in compromised asthma management (Klinnert & Bender, 2002). In contrast, we found no association between FAMSS scores and the nonrelational variable of caregiver psychological distress.

Associations between the FAMSS and the child’s report of the relationship with the caregiver lend further support to the relational nature of the system of knowledge and behaviors that are required to manage pediatric asthma. Children classified as having a secure relationship with the caregiver yielded higher summary FAMSS scores than those with an insecure relationship. Among other subscales significantly related to a secure pattern of child relatedness was Assessment of Symptoms, indicating that the caregiver and child were jointly aware of the child’s unique pattern of symptom onset, progression, and severity, as well as daily and seasonal patterns. Similarly, a secure pattern of relatedness was significantly related to Adherence, a subscale that assesses the extent to which the caregiver and child have developed a coordinated system to ensure that preventive medications are taken as prescribed and rescue medications are available as needed. A similar pattern of attunement, communication, and behavioral coordination is required for higher ratings on Family Response to Symptoms, which was also associated (at p = .017) with a secure pattern of child relatedness. This pattern of findings suggests that in addition to measuring the family behaviors required for successful asthma management, the FAMSS also taps into more general family processes, reflecting the relationship between family functioning and quality of pediatric disease management previously described by Kazak et al. (1995).

Strengths and Limitations

A strength of this study is that criterion validity measures were assessed from informants other than the caregiver; children’s MDI/spacer technique was rated by trained observers, and attendance at a recent healthcare visit was assessed from medical record review. In addition, the demographic and medical characteristics of our sample allow us to investigate the validity and reliability of the FAMSS for a population at high risk for asthma morbidity and for whom pediatric psychology interventions are most needed: low-income, urban children with poor asthma control and caregivers under psychosocial stress. One limitation of the study is the small sample size, which limits statistical power and precludes validity analyses by subgroups (e.g., child gender). Additionally, we relied on caregiver report to assess perceived quality of the child’s pediatric primary care. Thus, it is possible that common method variance accounts in part for the significant correlation between the P3C-R and the FAMSS, as caregiver report is considered in achieving the FAMSS ratings.

Clinical and Research Implications

Pediatric psychologists and other clinicians often assess family asthma management informally to determine if psychoeducational and/or behavioral interventions are needed. The FAMSS interview and rating methodology is relatively time consuming and expensive relative to most self-report instruments. However, previous studies have used separate questionnaires and measurement instruments to assess the multiple behavioral domains involved in asthma management of pediatric patients. The FAMSS
An interview is a single instrument that integrates various perspectives and provides information across multiple domains of asthma management behavior. As such, it is a parsimonious method for assessing the range of behavioral systems required for asthma management within the relationship contexts in which the child is embedded. The FAMSS ratings consolidate families’ asthma management strengths and weaknesses into a snapshot that can be communicated to treating clinicians and used to identify specific goals for behavioral and family interventions. We are currently conducting a randomized clinical trial as part of a community-based participatory research project targeting low-income children with poor asthma control; focus groups were used to identify specific barriers to asthma management and develop relevant curriculum modules (Laster et al., 2009), and FAMSS subscale scores were used to select which modules to implement with each family. The format of the FAMSS interview is flexible enough to accommodate adaptations to the family’s cultural context. For example, we used the term “everyday medicine” instead of “daily controller medicine,” and discussed realistic hypothetical situations in which the child might be required to manage asthma symptoms without the caregiver present. Future research is needed to evaluate the cost effectiveness of integrating this method into real-world clinical practice.

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**References**


Klinnert, M. D., & Bender, B. G. (2002). A family asthma management approach to behavioral assessment and treatment in children with asthma. In A. Kaptein,