

Assessment of the Psychometric Properties of the Family Management Measure

Kathleen Knafl,¹ PhD, FAAN, Janet A. Deatrick,² RN, PhD, FAAN, Agatha Gallo,³ RN, PhD, FAAN, Jane Dixon,⁴ PhD, Margaret Grey,⁴ RN DRPH FAAN, George Knafl,¹ PhD, and Jean O'Malley,⁵ MPH

¹University of North Carolina at Chapel Hill School of Nursing, ²University of Pennsylvania School of Nursing, ³University of Illinois at Chicago College of Nursing, ⁴Yale University School of Nursing and ⁵Oregon Health & Science University School of Nursing

Objective This paper reports development of the Family Management Measure (FaMM) of parental perceptions of family management of chronic conditions. **Method** By telephone interview, 579 parents of children age 3 to 19 with a chronic condition (349 partnered mothers, 165 partners, 65 single mothers) completed the FaMM and measures of child functional status and behavioral problems and family functioning. Analyses addressed reliability, factor structure, and construct validity. **Results** Exploratory factor analysis yielded six scales: Child's Daily Life, Condition Management Ability, Condition Management Effort, Family Life Difficulty, Parental Mutuality, and View of Condition Impact. Internal consistency reliability ranged from .72 to .91, and test-retest reliability from .71 to .94. Construct validity was supported by significant correlations in hypothesized directions between FaMM scales and established measures. **Conclusion** Results support FaMM's reliability and validity, indicating it performs in a theoretically meaningful way and taps distinct aspects of family response to childhood chronic conditions.

Key words children's chronic conditions; family illness management; instrument development.

It is estimated that 18% of children from birth to 18 years of age have a chronic physical, developmental, behavioral, or emotional condition and use more health or related services than other children generally (vanDyck, Kogan, McPherson, Weissman, & Newacheck, 2004). Although the majority of these children have mild conditions that do not limit their activity, approximately one-third experience moderate to severe limitations of activity (Barlow & Ellard, 2006). Regardless of the severity of the condition, all children, along with their families, face multiple challenges; some adapt well to life with a chronic condition while others struggle to do so. Families respond in various ways to childhood chronic illness, and family response is closely related to child's outcomes (Graf, Landolt, Mori, & Boltshauser, 2006; Rodenburg, Marie Meijer, Dekovic, & Aldenkamp, 2006; Thompson et al., 2003). For example, studies consistently have shown that the family variables of conflict and cohesion are significant mediators of children's adaptation to illness (Berge & Patterson, 2004;

Graf et al., 2006; Rodenburg et al., 2006; Thompson et al., 2003). Recognizing that multiple family variables contribute to child outcomes, researchers have developed a broad array of measures to study different aspects of family response, including those that assess specific family processes and overall family functioning, family/parent coping, and impact of childhood illness on family life (Alderfer et al., 2008).

Studies of family response to a child's chronic condition also have addressed family management of the treatment regimen and the ways in which families incorporate the regimen and their child's special needs into everyday family life (Clarke-Steffen, 1997; Ginsburg et al., 2005; Horner, 1998; Knafl, Breitmayer, Gallo, & Zoeller, 1996). Because of the varying demands and treatment regimens associated with different chronic conditions, much of the work in this area has been condition-specific, including development of measures to assess family management of a specific condition such as diabetes (Harris et al., 2000)

All correspondence concerning this article should be addressed to Kathleen Knafl, School of Nursing, 2007 Carrington, CB#7460, University of North Carolina, Chapel Hill, NC 27599-746, USA. E-mail: kknaf1@email.unc.edu

Journal of Pediatric Psychology 36(5) pp. 494–505, 2011

doi:10.1093/jpepsy/jsp034

Advance Access publication May 18, 2009

Journal of Pediatric Psychology vol. 36 no. 5 © The Author 2009. Published by Oxford University Press on behalf of the Society of Pediatric Psychology. All rights reserved. For permissions, please e-mail: journals.permissions@oup.com

or asthma (McQuaid, Walders, Kopel, Fritz, & Klinnert, 2005). However, both clinicians and family researchers have noted the merits of taking a noncategorical approach to studying families and providing services (Perrin et al., 1993; Stein & Jessop, 1982; Wallender & Varni, 1998). Noncategorical studies of family response to a child's chronic condition focus on understanding the common psychosocial challenges experienced by families. Research based on a noncategorical approach can generate knowledge of family response to conditions for which there are no condition-specific measures, as well as enable comparative study of family response across conditions.

To date, most noncategorical studies of family management of childhood chronic conditions have been qualitative, with a focus on describing specific aspects of families' management efforts (Knafl & Deatrck, 2003). Based on this research, as well as our own noncategorical studies, the first three authors developed the Family Management Style Framework (FMSF) to conceptualize parents' perceptions of the family's management efforts (Knafl et al., 1996; Knafl & Deatrck, 2003). The FMSF comprises the following eight dimensions: Child Identity (views of the child and the extent to which those views focus on illness and vulnerabilities or normalcy and capabilities); Family Focus (assessment of the balance between condition management and other aspects of family life); Future Expectations (assessment of the implications of the condition for the child's and family's future); Illness View (beliefs about the seriousness and course of the illness); Management Approach (assessment of the extent to which the family has developed a routine for managing the condition); Management Mindset (views about the ease or difficulty of carrying out the treatment regimen); Parenting Philosophy (goals and values that guide condition management); and Parental Mutuality (beliefs about the extent to which partners have shared views of their situation and approach to condition management). The FMSF focuses on key aspects of how families define and manage family life in the context of a child's chronic condition, with particular attention paid to how condition management is incorporated into everyday life. As such, it is more focused than family stress and coping frameworks such as the Double ABCX Model (McCubbin & Patterson, 1983) or the Resiliency Model of Family Stress, Adjustment, and Adaptation (McCubbin & McCubbin, 1993), which address overall family adaptation to stressful situations. The FMSF fills a unique niche that complements other frameworks and contributes to a more comprehensive understanding of family response to having a child with a chronic condition.

Our review of 55 studies of family management of childhood chronic conditions (excluding studies of families of children whose condition resulted in significant developmental delays) supported the salience and noncategorical nature of the eight FMSF dimensions, indicating they are important aspects of family management that span multiple chronic conditions and family life cycle phases (Knafl & Deatrck, 2003). The eight dimensions of the FMSF provided the conceptual underpinnings for development of the Family Management Measure (FaMM).

The FaMM measures parents' perceptions of family management of the child's treatment regimen and incorporation of the regimen into everyday family life; it is intended to complement other measures that focus on overall family adaptation to a stressful situation such as a child's chronic condition or management of a single condition. Our intent in developing the FaMM is to provide a measure that will be applicable to multiple conditions and families with a broad age range of children. A valid, reliable measure of key aspects of family management will set the stage for further research on factors that influence the quality of child and family response to chronic conditions. Being relevant to a broad array of families, the FaMM will contribute to the study of family management over time, comparison of family management at different points in the family's and child's life cycle, and comparison across families managing different chronic conditions. The FaMM also will contribute to the development and testing of interventions to change those aspects of family management that are problematic and strengthen those aspects that support optimal child and family outcomes. We also anticipate that having a quantitative measure of family management will contribute to the continuing development of the FMSF, including the further refinement of the dimensions and exploration of their interrelationships.

This paper reports the results of a study to assess the psychometric properties of the FaMM, including factor structure, internal consistency, and test-retest reliability, and to construct validity. The overall design of the study was grounded in DeVellis's (2003) approach to scale development. In particular, our assessment of the construct validity of the FaMM was consistent with DeVellis's view of construct validity, which emphasizes the extent to which a new measure performs in a theoretically meaningful way. We anticipated developing a reliable measure that would include multiple scales, some reflecting greater ease in family management and some reflecting greater difficulty. We hypothesized a significant relationship between the FaMM scales and established measures of child functional status, child behavioral problems, and family functioning. We expected a positive relationship between child and

family functioning and FaMM scales indicative of greater ease in condition management and a negative relationship between child and family functioning and FaMM scales indicative of greater difficulty in family management. We expected correlations to be moderate, since FaMM is intended to measure a construct that is related to, but distinct from, both family and child functioning.

Methods

Item Generation and Evaluation

Using the eight dimensions of the FMSF, we generated 97 items for potential inclusion in the FaMM. Each item reflected one of the eight dimensions of the FMSF, with between 9 and 15 items generated for each dimension. The content validity of these items was assessed in two ways. Twelve experts in family nursing research and/or practice rated the clarity and relevance of the 97 FaMM items in terms of the FMSF dimension that they were intended to reflect (Grant & Davis, 1997). A subsequent version of the FaMM was evaluated through cognitive interviews (Collins, 2003; Jobe & Mingay, 1991) with 27 parents of youth (age 3–20 years) with varied chronic conditions. Based on these two sources of input, we eliminated and revised items and developed a 65-item (7–9 items per dimension) version of the FaMM for further psychometric testing. The development and establishment of the content validity of the 65 items have been described in more detail elsewhere (Knafel et al., 2007).

The response format for the FaMM was a five-point scale anchored by “strongly disagree” and “strongly agree.” Additional response choices of “not applicable,” “don’t know,” and “refused to answer” were included for the instrument testing survey in order to gain additional information on the acceptability of items to a varied sample of parents with regard to child’s condition, age, and demographic characteristics. With the exception of Parental Mutuality, the items reflecting the various dimensions of the FaMM were dispersed throughout the instrument. The Parental Mutuality items, which address how spouses/partners work together to manage a child’s chronic condition, were placed at the end of the FaMM, and only partnered respondents completed this portion of the instrument.

Assessment of Psychometric Properties

Sample

The study sample included 579 parents from 417 families; 414 were mothers (349 partnered and 65 single), and 165 were spouses/partners, none of whom had participated in prior efforts to establish content validity. Partners usually

were the biological father of the child and are hereafter referred to as fathers. Inclusion criteria specified the target sample as parents who had a child 2–18 years old, who had been diagnosed with a chronic condition for 6 or more months, who had not been hospitalized within the past 2 months, was within one grade of expected level for age, and whose mother was willing to participate.

The only conditions we excluded were cancer and conditions associated with significant developmental delays. Families of children with significant developmental delays were excluded because they were not included in any of the preliminary work to develop the FMSF. Parents of children with cancer were excluded because of the frequent hospitalizations associated with treatments and research suggesting that the experience of having a child with cancer is an intensely stressful one for parents and families that sets it apart from other chronic conditions (Alderfer, Cnaan, Annunziato, & Kazak, 2005). We excluded parents whose child had been diagnosed for less than 6 months or had experienced a recent hospitalization because the focus of the FaMM is on everyday management, not initial adjustment or the management of periodic crises. Partnered mothers who were willing to participate provided contact information for their spouse/partner who was then invited to participate as well.

In instrument development studies, the required number of participants is often related to the number of items contained in the instrument under study, with most authors recommending between 5 and 10 participants per item, but also noting that the ratio of participants to items can drop as the sample size increases (DeVellis, 2003). Our sample conformed to these guidelines.

Parents were recruited from 20 sites in five states (CT, DE, IL, PA, and VT). Recruitment sites were specialty clinics, primary care clinics, family support groups, child and family support agencies, and camps for children with chronic conditions. Our primary recruitment strategy was through mailings to families, with clinic staff identifying eligible families and mailing study information to potential subjects. Approximately, 2100 letters of invitation were distributed, yielding 499 consented subjects. Additional recruitment strategies included distribution of flyers at clinics, announcements in newsletters, and follow-up with families who had participated in a prior study and agreed to be contacted for future research. Recruitment materials indicated our interest in talking to parents with a child with one or more chronic conditions. We provided examples of possible conditions but did not explicitly define the term “chronic condition” for parents. In order to recruit parents from a variety of family contexts, we defined family as a group of intimates living together

with strong emotional bonds and with a history and a future (Fisher et al., 1998), and asked parents to respond to the FaMM items in terms of “people living in your household who you think of as family.” Because of the variation in recruitment strategies and IRB limitations on our ability to approach parents directly, it is not possible to know precisely how many parents receiving information about the study subsequently participated.

Participants were primarily the biological mother (98% of all mothers) or father (97% of all fathers) of the child with the chronic condition; 90% of the mothers were between 33 and 56 years of age (mean = 44.0 years, $SD = 7.3$ years) while 90% of the fathers were between 31 and 53 years (mean = 42.0 years, $SD = 7.3$ years). The sample was predominantly white (87%) with 8% black, 2% Asian, and 1% multiracial parents. Household income ranged from less than \$20,000 to more than \$150,000 annually. Of those reporting income, 30% reported household incomes less than \$40,000, and 23% reported household incomes of \$100,000 or greater. Parents’ education ranged from grade school to completion of a professional degree. Most parents (53% mothers, 57% fathers) reported having at least a college degree, but a substantial minority (17% mothers, 23% fathers) had a high school degree or less. Twenty-two percent of the mothers and 17% of the fathers reported that they had a serious illness.

The age of the 417 children at the time of the mothers’ participation in the study ranged from 2 to 19 years (for one family, the child was 18 when parents consented to participate but had turned 19 shortly before the mother’s interview), with a mean of 11.2 years ($SD = 4.7$ years). The children’s conditions were documented based on parents’ reports, and then collapsed into 165 conditions using the International Classification of Primary Care-2 coding scheme (World Organization of Family Doctors, 1998). The most frequent conditions were type 1 diabetes (15.4%), Crohn’s disease (14.4%), cystic fibrosis (12%), arthritis (5.8%), hearing impairment (5.5%), cerebral palsy (5.3%), sickle cell disease (5.3%), asthma (4.8%), seizure disorder (4.1%), bleeding disorder (3.8%), heart defect (3.8%), phenylketonuria (3.4%), and spina bifida (2.6%), each of which affected 10 or more children in the sample.

Validation Measures

The literature has pointed to a relationship between family response to childhood chronic illness and the quality of child and family functioning. Thus, to test the construct validity of the FaMM, we used established measures of child and family functioning with sound psychometric

properties: the Eyberg Child Behavior Inventory (ECBI), Functional Status Measure II (FSM-II), and the Global Functioning Scale of the McMaster Family Assessment Device (FAD). All were considered appropriate for use in a telephone interview.

The ECBI (Eyberg & Pincus, 1999) is a 36-item measure of conduct-disordered behaviors in youth that consists of an Intensity Scale measuring the frequency with which such behaviors occur and a Problem Scale assessing whether parents consider the behavior a problem. Higher scores indicate more conduct-disordered behavior. High internal consistency reliabilities have been reported (intensity scale = .95; problem scale = .94) in a diverse sample (Eyberg & Pincus, 1999), and studies have demonstrated a significant relationship between scores on the ECBI and other measures of behavioral problems in children (Eyberg, Boggs, & Rodriguez, 1992). The internal consistency reliabilities of the ECBI in the current study were .92 on the Intensity Scale for both mothers and fathers, and .82 and .81 on the Problem Scale for mothers and fathers, respectively.

The FSM-II (Stein & Jessop, 1990) is a 14-item parent-rated measure that assesses the child’s ability to perform age-appropriate roles, with higher scores indicating healthier functioning. The functional status measure has been shown to be sensitive to changes in the affected child’s medical condition, and scores on the measure have been linked to the child’s psychological adjustment. The developers report internal consistency reliabilities greater than .80. In the current study, internal consistency reliability was .79 for mothers and .81 for fathers.

The General Functioning Scale of the FAD consists of 12 items that assess the overall quality of family functioning (Epstein, Baldwin, & Bishop, 1983). Higher scores reflect poorer functioning. The FAD is a well-established measure of family functioning, with internal consistency reliabilities usually in the .85 to .90 range (Alderfer et al., 2007). In the current study, internal consistency reliability was .89 for mothers and .87 for fathers.

In addition, the 10-item version of the Marlowe–Crowne Social Desirability Scale was used to assess social desirability bias (Strahan & Gerbasi, 1972). Internal consistency scores were .60 for mothers and .62 for fathers.

Procedure

After receiving IRB approval, parents who indicated interest in participating in the study were contacted by a research assistant who confirmed eligibility and scheduled a time for a telephone interview. Parents were interviewed separately, with mothers providing demographic

information on the child and family. Telephone interviews have been shown to provide data of comparable quality to face-to-face interviews and have the added advantage of providing access to geographically diverse samples (Dillman, 2000). In order to assess the test–retest reliability of the FaMM, 65 parents completed it a second time 2–4 weeks later. The first 65 parents agreeing to a retest were selected in order to assure recruitment of an adequate retest sample.

Analyses

Analyses were guided by principles of instrument development (DeVellis, 2003) and also took into account issues common to family research, including lack of statistical independence when multiple members from the same family participate in a study. Items were evaluated in terms of summary statistics, including nonresponse rates, means, and standard deviations. We developed the FaMM scales using exploratory techniques but utilized models of both exploratory factor analysis (EFA) type (i.e., items loading on all factors) and confirmatory factor analysis (CFA) type (i.e., items loading on one factor). These models were evaluated by likelihood cross-validation (LCV) techniques, which generate scores for comparing models with larger scores indicating better models (Knafel & Grey, 2007). First developed by Stone (1977), LCV adapts model evaluation to the distribution underlying an analysis using likelihoods for subsets of the data computed using “deleted” parameter estimates based on the remaining data. In the reported analyses, we used random partitions of the data into 15 disjoint subsets. LCV techniques have been used to support growth curve modeling (Lee, 1991), variable selection (Sauerbrei 1999; Knafel et al., 2004), cluster analysis (Delucchi, Knafel, Haug, & Sorensen, 2006; Smyth, 2000), and factor analysis (Knafel & Grey, 2007).

LCV scores for EFA models were used to choose the initial number of factors. Maximum likelihood factor extraction was used to be consistent with the use of LCV model evaluation. LCV scores for CFA models were used to choose a rotation for the associated EFA loadings. In these CFA models, items were allocated to factors on which they loaded most strongly after rotation. We also used LCV scores to reallocate items to alternative factors, reduce the number of factors, and remove items, thereby generating the final FaMM item-factor allocations. Conventional approaches to removing items based on the strength of factor loadings or item summary statistics were not used; rather, item removal was based on LCV scores. While this exploratory process was quantitatively driven, the research team met regularly to discuss the conceptual meaning of

factor solutions and the conceptual fit of items to factors throughout the analysis. In this way, justification of the resulting scales was based on a combination of quantitative and conceptual considerations. To assess the relative strength of models based on the qualitatively derived FMSF dimensions and the quantitatively derived FaMM scales, we compared the internal consistency reliability and LCV scores for these two alternatives.

Only responses for partnered mothers were used for scale development. Responses from single mothers were not used since they did not respond to the Parental Mutuality items. Responses from fathers were not used since factor analysis methods are based on the assumption of independence across participants, which is not justifiable when respondents come from the same family. We then assessed the applicability of the scales developed from partnered mothers’ responses to both fathers and single mothers. We started from the item-factor allocation determined from responses from partnered mothers, applied this to data including responses from other participating parents, and adjusted the allocation of items to factors to improve the LCV score. We used fathers’ responses to all the items in place of the responses of their spouses; we combined the responses for single mothers with the responses of partnered mothers, excluding the Parental Mutuality items.

Evaluation of internal consistency reliability and construct validity of the scales involved the entire data set, using generalizations of standard coefficients based on linear mixed models accounting for interparental correlation and differences between partnered and single mothers. Internal consistency reliability assessment was based on generalized Cronbach’s alpha coefficients and construct validity on generalized Pearson correlations assessing the strength and direction of the relationships between FaMM scales and the established measures of child and family functioning (ECBI, FSM-II, FAD) and social desirability.

Results

Item Analysis

There were very little missing data; the response options of “don’t know,” “not applicable,” or “refused” were used in only 1% (324) of the 37,635 (579 × 65) item responses. Seventy-five percent (435) of the 579 participants responded to all 65 items and 99% (571) chose the “don’t know,” “not applicable,” or “refused to answer” option for five or less items, providing evidence of the applicability of the FaMM to a broad array of families, children of varying ages, and chronic conditions.

Consequently, nonresponse item values were imputed for scale development purposes using means of nonmissing item response values. Item means ranged from 1.39 to 4.76 for mothers and from 1.30 to 4.73 for fathers. Standard deviations ranged from 0.62 to 1.68 for mothers and from 0.64 to 1.50 for fathers.

The Scale Development Process

Scales were developed using responses to 65 items from 349 partnered mothers. A 10-factor EFA solution (i.e., with all items loading on all factors) was selected on the basis of LCV scores. Factors were extracted through maximum likelihood. We considered a wide variety of rotations, both orthogonal and oblique. Since rotations do not change the EFA model, they cannot be evaluated on the basis of LCV scores for EFA models. However, rotated loadings suggest item-factor allocations with each item allocated to a single factor, the one on which it loads most strongly. Consequently, we evaluated rotations through LCV scores for CFA models, with each item loading on only the associated factor determined from rotated EFA loadings. Varimax rotation generated the best LCV score.

Item-factor allocations based on this best rotation-suggested model were adjusted further to improve the LCV score. Even after these adjustments, some factors in the 10-factor solution had unacceptable internal consistency reliability (under .70), and one factor had only two items, suggesting that a smaller number of factors would be preferable. Consequently, the number of factors was reduced systematically. Starting with the 10-factor-adjusted rotation-based allocation of items to factors, allocations for each pair of factors with low associated reliability were combined to single factors on the basis of LCV scores for associated CFA models.

This produced a seven-factor solution, but one of the resulting scales still had poor reliability (under .60) and so was dropped. Some of the items from this scale were reallocated to the other six factors based on LCV scores. Items for the resulting six factors were considered for removal from their associated scales on the basis of LCV scores. This led to a final six-factor solution based on 53 of the 65 original items with 18.5% (12/65) removed. In contrast, the conventional approach of removing items whose strongest rotated EFA loading is less than 0.4 or which have stronger loadings than 0.4 on more than one factor would have removed 33.8% (22/65) of the items. CFA models were used in generating these final scales, but for exploratory rather than for confirmatory purposes. To assess the fit for generated scales, we computed comparative fit index (CFI) values from CFA models for individual scales. CFI values for the six subscales ranged

from .67 to 1.0 with four of the six values exceeding the recommended cut-off of .90. The applicability of the final six-factor solution to fathers and single mothers was supported by the fact that reallocating items to factors improved the LCV score by less than 1%. Based on this analysis, the final scales were judged to be applicable to the entire sample.

The Family Management Measure Scales

Fifty-three items were retained, allocated to six factors, and ordered on the basis of their standardized loadings for the CFA model determined by this allocation. Standardized loadings ranged in absolute value from 4.52 to 17.67, indicating that all of the retained items contributed substantially to their associated scales. A complete listing of all items and their standardized loadings is available in the Appendix, which is posted as supplementary material for this article on the journal's website.

Five scales composed of 45 items measuring Child's Daily Life, Condition Management Ability, Condition Management Effort, Family Life Difficulty, and View of Condition Impact were identified for use with all parents, partnered or single (see Table I for example items). The Child's Daily Life Scale (five items) measures parents' perceptions of the child and his or her everyday life, with higher values indicating a more normal life for the child despite the condition. The Condition Management Ability Scale (12 items) addresses parents' perceptions of their competence to take care of the child's condition. Higher values mean parents view themselves as more capable of managing the condition. The Condition Management Effort Scale (four items) addresses the work needed to manage the condition, with higher values signifying greater effort. These two scales differentiate parents' perceptions of ability and effort; that is, parents may perceive condition management as requiring considerable effort but still view themselves as capable, or they may view condition management as requiring relatively little effort but question their competence to manage effectively. The Family Life Difficulty Scale (14 items) addresses parents' perceptions of the extent to which having a child with a chronic condition makes life more difficult, with higher values indicating greater difficulty. The View of Condition Impact Scale (10 items) measures parents' perceptions of the seriousness of the condition and its implications for their child and family. Higher values indicate greater perceived seriousness and impact. A sixth scale for partnered parents, Parental Mutuality (eight items), addresses satisfaction with how the partners work together to manage the child's condition, with higher values indicating greater satisfaction. Taken together, the six FaMM scales measure

Table 1. Family Management Measure (FaMM): Scales, Internal Consistency Reliability, and Example Items

Scale	Mother/father internal consistency reliability	Example items
Child's Daily Life	.76/.79	Our child's everyday life is similar to that of other children of his/her age. Our child enjoys life less because of the condition.
Condition Management Ability	.72/.73	We have some definite ideas about how to help our child live with the condition. We have not been able to develop a routine for taking care of our child's condition.
Condition Management Effort	.74/.78	It takes a lot of organization to manage our child's condition. Our child's condition does not take a great deal of time to manage.
Family Life Difficulty	.90/.91	Dealing with our child's condition makes family life more difficult. Our child's condition rarely interferes with other family activities.
Parental Mutuality	.79/.75	I am pleased with how my partner and I work together to manage our child's condition. My partner and I have different ideas about how serious our child's condition is.
View of Condition Impact	.73/.77	We think about our child's condition all the time. People with our child's condition have a normal length of life.

Note. For the complete listing of all items and standardized loadings see supplementary material online.

parents' perceptions of key aspects of managing childhood chronic conditions and incorporating condition management into everyday family life.

Item values were reverse-coded on the basis of signs of standardized loadings as given in the Appendix. Missing item values were then imputed using means of nonmissing item values provided by a subject for the same scale. Finally, items for subjects were summed into scale values for use in reliability and construct validity computations.

Reliability

Internal consistency and test-retest reliability were assessed for all six FaMM scales using composite scores computed from all available responses through linear mixed models accounting for interparental correlation within families with two participating partners, and differences in means for single mothers. Separate scores for mothers and fathers are reported for internal consistency reliability. Scores for fathers and mothers combined are reported for test-retest reliability because of the small numbers of each parent type.

Internal consistency reliability was acceptable (Cronbach's alpha at least .70) for all six FaMM scales. Scores for mothers and fathers, respectively, were .76 and .79 for Child's Daily Life, .72 and .73 for Condition Management Ability, .74 and .78 for Condition Management Effort, .90 and .91 for Family Life Difficulty, .79 and .75 for Parental Mutuality, and .73 and .77 for View of Condition Impact. Interparental correlations were substantial, ranging from .33 for the Condition Management Ability Scale to .58 for the View of Condition Impact Scale.

Scores computed with responses for only the 65 single mothers were, respectively, .80 for Child's

Daily Life, .74 for Condition Management Ability, .68 for Condition Management Effort, .90 for Family Life Difficulty, and .78 for View of Condition Impact, supporting the reliability of the scales for single mothers.

A total of 65 parents from 44 families completed the FaMM a second time, 2–4 weeks after their initial completion. These included four single mothers, 37 partnered mothers, and 24 fathers. All test-retest reliabilities were acceptable, ranging from .71 to .94 (i.e., .83 for Child's Daily Life, .79 for Condition Management Ability, .81 for Condition Management Effort, .94 for Family Life Difficulty, .71 for Parental Mutuality, and .87 for View of Condition Impact).

Construct Validity

The construct validity of the FaMM scales was assessed using established measures of child and family functioning to determine the extent to which the FaMM was performed as theoretically predicted with regard to these measures (DeVellis, 2003). The following hypotheses were tested: (a) significant negative relationships between the FaMM scales indicating greater ease in family management (Child's Daily Life, Condition Management Ability, Parental Mutuality) and the FAD and ECBI scores; (b) significant positive relationships between the scales indicating greater difficulty in family management (Condition Management Effort, Family Life Difficulty, View of Condition Impact) and the FAD and ECBI; (c) significant positive relationships between the FSM II and scales indicating greater ease in family management (Child's Daily Life, Condition Management Ability, Parental Mutuality); and (d) significant negative relationships between scales indicating greater difficulty in family management

Table II. Construct Validity^a of Family Management Measure Scales

FaMM scale	FAD Negative family functioning		FSM-II Positive child functional status		ECBI Intensity Negative total child adaptation		ECBI Problem Problematic child adaptation		Marlowe–Crowne Social desirability	
	Construct validity ^a IPC ^a		Construct validity ^a IPC ^a		Construct validity ^a IPC ^a		Construct validity ^a IPC ^a		Construct validity ^a IPC ^a	
	validity ^a	IPC ^a	validity ^a	IPC ^a	validity ^a	IPC ^a	validity ^a	IPC ^a	validity ^a	IPC ^a
Child's Daily Life	−0.21*	0.46*	0.39*	0.49*	−0.22*	0.61*	−0.21*	0.53*	0.05	0.43*
Condition Management Ability	−0.35*	0.35*	0.32*	0.38*	−0.25*	0.47*	−0.23*	0.38*	0.04	0.33*
Condition Management Effort	0.16*	0.48*	−0.33*	0.51*	0.17*	0.62*	0.13*	0.55*	−0.05	0.45*
Family Life Difficulty	0.38*	0.45*	−0.45*	0.50*	0.33*	0.62*	0.31*	0.53*	−0.07	0.44*
Parental Mutuality	−0.64*	0.28*	0.20*	0.44*	−0.28*	0.54*	−0.25*	0.45*	0.11*	0.37*
View of Condition Impact	0.22*	0.48*	−0.32*	0.52*	0.15*	0.62*	0.09*	0.54*	<0.01	0.44*

Notes. FAD = Family Assessment Device; FSM-II = Functional Status Measure II; ECBI = Eyberg Child Behavior Inventory; FaMM = Family Management Measure; IPC = interparental correlation.

^aComposite construct validity correlations estimated using linear mixed modeling to account for IPC.

* $p < .01$; all other correlations $> .10$.

(Condition Management Effort, Family Life Difficulty, View of Condition Impact) and the FSM II. We hypothesized nonsignificant relationships between all FaMM scales and the Marlowe–Crowne Social Desirability measure. As hypothesized, construct validity was supported by significant correlations in the expected directions between scores on the FaMM scales and all established measures other than social desirability (Table II), indicating that the FaMM performs in a theoretically meaningful way.

There were negative relationships between the General Functioning Scale of the FAD (with higher scores indicating poorer functioning) and Child's Daily Life, Condition Management Ability, and Parental Mutuality, and positive relationships between the FAD and Condition Management Effort, Family Life Difficulty, and View of Condition Impact. Parents who viewed their child as having a more normal daily life and saw the condition as more manageable had better family functioning. The negative correlation between the FAD and Parental Mutuality indicates that in two-parent families, parents' perceptions of having a shared view of their situation and approach to condition management were associated with better family functioning. The positive associations between the FAD and the Condition Management Effort, Family Life Difficulty, and View of Condition Impact Scales indicate that parents who viewed the child's condition as more serious, who believed family life was more difficult because of the condition, and who experienced condition management as requiring considerable effort had more negative perceptions of their family's functioning.

Parents' perceptions of the child's functioning were also significantly related to the FaMM scales in the predicted directions. Both the Intensity and Problem scales of the ECBI were negatively associated with Child's Daily

Life, Condition Management Ability, and Parental Mutuality, and positively associated with Condition Management Effort, Family Life Difficulty, and View of Condition Impact, indicating that parents' perceptions of the relative ease or difficulty of condition management were linked to their perceptions of problematic behaviors in their child. Parents who viewed their child as having more problematic behaviors also were more likely to view the child having a less normal life as a result of the condition. The relationship between the FSM II and the FaMM was also as expected, with better child functioning significantly positively associated with Child's Daily Life, Condition Management Ability, and Parental Mutuality, and significantly negatively associated with Condition Management Effort, Family Life Difficulty, and View of Condition Impact.

Correlations with the Marlowe–Crowne Social Desirability measure were nonsignificant except for the Parental Mutuality Scale, indicating that for the most part, parents provided candid responses to FaMM items.

Assessment of Theory-Based Scales

We also assessed the scales based on the eight conceptual FMSF dimensions used to develop the FaMM items, comparing the associated CFA model with a comparable one based on exploratory methods. LCV scores indicated that exploratory methods generated a stronger set of scales than those based on the FMSF dimensions, with the LCV score for the theory-based scales 3.3% lower (worse) than the score for the scales based on exploratory methods. Also, only four of the scales based on the eight FMSF dimensions (Family Focus, Illness View, Parental Mutuality, and View of Child) had an internal consistency reliability score of .70 or larger, and two of the dimensions

(Management Approach, Parenting Philosophy) had a very low internal consistency reliability of .33 and .46, respectively.

Discussion

The results of this study provide strong support for the reliability and validity of the FaMM. Internal consistency reliabilities, ranging from .72 to .91, were acceptable for all six scales for both mothers and fathers. Test-retest reliabilities, ranging from .71 to .94, were also acceptable. The results also demonstrate support for the construct validity of the six FaMM scales through a consistent pattern of significant relationships in hypothesized directions between the scales and established measures of child and family functioning. Correlations of limited strength between the FaMM scales and the *FAD* provide initial evidence that this new measure addresses aspects of family response to a child's chronic condition that are distinct from overall family functioning and support for the usefulness of a measure that targets those aspects of family life specifically related to condition management.

As suggested by the names of the scales, the facets of family management they reflect are similar though not identical to the eight dimensions of the *FMSF* on which the FaMM was based (Knafel & Deatrick, 2003). The Child's Daily Life Scale is comprised entirely of items generated from the Child Identity dimension of the *FMSF*; seven of the eight items in the Parental Mutuality Scale come from this dimension of the *FMSF*, and three of the four items in the Condition Management Effort Scale come from the View of Illness dimension, indicating that parents' views of the condition are closely related to the work of carrying out the treatment regimen. On the other hand, the View of Condition Impact and Family Life Difficulty scales include items from four of the *FMSF* dimensions and the Condition Management Ability Scale includes items from six of the eight dimensions. The *FMSF* was grounded in predominantly small-sample qualitative studies that provided important insights into the key aspects of family management, and we anticipated that development of the FaMM based on a large, more diverse sample would contribute to the further development of the framework. When considered more broadly, both the original dimensions and the quantitative scales reflect three key aspects of family management: parents' view of the child, beliefs about the implications of the condition for the child and family, and perceptions of the work of condition management. Thus, the original dimensions and newly developed scales, though not identical, are complementary.

We intend to use the results of this study in conjunction with an updated review of relevant literature to examine the implications of the FaMM for further development of the *FMSF*.

Austin and Sims (1998), in their review of assessment models and instruments for examining children's and families' responses to chronic illness, pointed to the importance of developing measures that address family functioning in the context of chronic conditions and identify factors that are likely targets for health care interventions. The FaMM contributes to both these goals. The six FaMM scales measure important aspects of family condition management that cut across chronic conditions and child developmental stages, reflecting the experiences of single and partnered mothers as well as fathers. As indicated by the very limited use of the "don't know," "not applicable," and "refused" response options, the FaMM is acceptable and relevant to parents of children of different developmental stages who are managing varied chronic conditions.

Despite providing considerable support for the reliability and validity of the FaMM, there were several limitations to the current study. Although we were successful in recruiting mothers and fathers of children aged 2–18 with a wide array of chronic conditions and with diverse incomes and educational backgrounds, we were less successful in recruiting single mothers and parents from minority groups. Our recruitment strategies targeted sites that served diverse clientele. However, because of human subject considerations, sites did not allow us to contact subjects directly, limiting our ability to actively recruit from specific groups. The sample had limited geographic variability as well, with participants coming primarily from the Midwest, New England, and Mid-Atlantic states. Thus, it would be useful to continue to assess the psychometric properties of the FaMM of parents with greater ethnic and geographic diversity. Future studies are also needed to test the applicability of the FaMM to a broader array of conditions, including cancer and those associated with developmental delays, and to assess its performance across child's developmental stages and conditions with different management demands. All data were collected using telephone interviews, raising the question of whether the FaMM's psychometric properties would be the same for data collected through face-to-face interviews or self-report questionnaires. Although the answer to this question awaits further research, the literature indicates that these different data collection techniques can generate data of comparable quality. Finally, we relied entirely on parental assessment, and we have no way of knowing if the clinicians caring for these children and families would have

similarly evaluated their functioning. However, based on the literature, we assumed that parents' subjective views of their child, the chronic condition, and their family situation were key determinants of their management efforts.

The FaMM has potential relevance for both clinicians and researchers. It could be used by clinicians to complete a comprehensive assessment of the family's everyday management of the child's chronic condition and would be especially useful for assessing parents' perceptions of family strengths and areas of difficulty related to management of the condition. For example, assessment using the FaMM might reveal that parents viewed themselves as highly competent in managing the treatment regimen, but viewed condition management as entailing considerable effort and their child's everyday life as far from normal as a result of the condition. In this situation, the clinician might want to build on parents' management skills by working with them to streamline or adapt the treatment regimen to reduce the effort involved and enhance possibilities for the child and family to engage in valued activities. When used in conjunction with other measures of child and family functioning and measures related to management of specific conditions, the FaMM would yield a more complete understanding of child adaptation and family functioning in the context of childhood chronic conditions and a more precise understanding of factors that support or impede optimal child and family functioning. It would be especially useful for those clinicians who work with children and families experiencing varied conditions.

The FaMM will also contribute to researchers' efforts to understand the relationship between family response to chronic conditions and child and family outcomes. Unlike measures of family functioning that address general family processes and condition-specific measures of managing a particular treatment regimen, the FaMM addresses the family context of childhood chronic conditions from a noncategorical perspective. As such, it will be especially useful in comparing family management of different conditions in children of different ages and testing the extent to which family management mediates the impact of variables such as child functional status and family functioning on child outcomes. In addition, using the statistical technique of cluster analysis, the FaMM could also be used to identify patterns of family management to childhood chronic conditions based on the six scales. The applicability of the FaMM to different chronic conditions and child developmental levels would further research comparing patterns of family management across groups and over time. Fisher and colleagues (2000) have advocated for

the use of cluster analysis as a way to convey a picture of the family as a whole that is particularly relevant to clinicians. Such understanding supports the development and testing of individualized health care interventions that address the unique needs of families and contribute to their ability to manage childhood chronic conditions in ways that result in both control of the condition and healthy child and family functioning.

Supplementary Data

Supplementary data can be found at: <http://www.jpepsy.oxfordjournals.org/>.

Acknowledgments

The authors wish to thank Blair G. Darney, Elizabeth Tornquist, Virginia Lewis, and Sherry Handfinger for their assistance with this paper. The FaMM website (<http://nursing.unc.edu/research/famm>) contains a copy of the FaMM, scoring instructions, and information on requesting permission to use it.

Funding

National Institute of Nursing Research; National Institutes of Health (1R01, NR08048); Donaghue Medical Research Foundation.

Conflict of interest: None declared.

Received May 8, 2008; revisions received March 25, 2009; accepted March 30, 2009

References

- Alderfer, M. A., Cnaan, A., Annunziato, R. A., & Kazak, A. E. (2005). Patterns of posttraumatic stress symptoms in parents of childhood cancer survivors. *Journal of Family Psychology, 19*, 430–440.
- Alderfer, M., Fiese, B., Gold, J., Cutuli, J., Holmbeck, G., Goldbeck, L., Chambers, C., Abad, M., Spetter, D., & Patterson, J. (2008). Evidence-based assessment in pediatric psychology: Family measures. *Journal of Pediatric Psychology, 9*, 1046–1061.
- Austin, J. K., & Sims, S. L. (1998). Integrative review of assessment models for examining children's and families' responses to chronic illness. In M. Broome, K. Knafl, K. Pridham, & S. Feetham (Eds.), *Children and families in health and illness*. Thousand Oaks, CA: Sage.

- Barlow, J. H., & Ellard, D. R. (2006). The psychosocial well-being of children with chronic disease, their parents and siblings: An overview of the research evidence base. *Child: Care, Health & Development*, *32*, 19–31.
- Berge, J., & Patterson, J. (2004). Cystic fibrosis and family life: A review and critique of the literature. *Families, Systems & Health*, *22*, 74–100.
- Clarke-Steffen, L. (1997). Reconstructing reality: Family strategies for managing childhood cancer. *Journal of Pediatric Nursing*, *12*, 278–287.
- Collins, D. (2003). Pretesting survey instruments: An overview of cognitive methods. *Quality of Life Research*, *12*, 229–238.
- Delucchi, K., Knafll, G., Haug, N., & Sorensen, J. (2006). Adaptive Poisson modeling of medication adherence among HIV-positive methadone patients. In *2006 Proceedings of the American Statistical Association, Section on Statistics in Epidemiology* (pp. 2525–2527). Alexandria, VA: American Statistical Association.
- DeVellis, R. (2003). *Scale development: Theory and applications* (2nd ed.). Newbury Park, CA: Sage.
- Dillman, D. A. (2000). *Mail and Internet surveys: The tailored design approach*. New York: Wiley.
- Epstein, N. B., Baldwin, L. M., & Bishop, D. S. (1983). The McMaster family assessment device. *Journal of Marital & Family Therapy*, *9*, 171–180.
- Eyberg, S. M., Boggs, S. R., & Rodriguez, C. M. (1992). Relationships between parenting stress and child disruptive behavior. *Child & Family Behavior Therapy*, *14*, 1–9.
- Eyberg, S. M., & Pincus, D. (1999). *Eyberg child behavior inventory and Sutter–Eyberg student behavior inventory—Revised: Professional manual*. Odessa, FL: Psychological Assessment Resources.
- Fisher, L., Chesla, C. A., Bartz, R. J., Gilliss, C., Skaff, M. A., Sabogal, F., et al. (1998). The family and type 2 diabetes: A framework for intervention. *The Diabetes Educator*, *24*, 599–607.
- Fisher, L., Chesla, C. A., Skaff, M. A., Gilliss, C., Kanter, R. A., Lutz, C. P., et al. (2000). Disease management status: A typology of Latino and Euro-American patients with type 2 diabetes. *Behavioral Medicine*, *26*, 53–66.
- Ginsburg, K. R., Howe, C. J., Jawad, A. F., Buzby, M., Ayala, J. M., Tuttle, A., et al. (2005). Parents' perceptions of factors that affect successful diabetes management for their children. *Pediatrics*, *116*, 1095–1104.
- Graf, A., Landolt, M. A., Mori, A. C., & Boltshauser, E. (2006). Quality of life and psychological adjustment in children and adolescents with neurofibromatosis type 1. *Journal of Pediatrics*, *149*, 348–353.
- Grant, J., & Davis, L. (1997). Selection and use of content experts in instrument development. *Research in Nursing & Health*, *20*, 269–274.
- Harris, M. A., Wysocki, T., Sadler, M., Wilkinson, K., Harvey, L. M., & Bueckloh, L. M. (2000). Validation of a structured interview for the assessment of diabetes self-management. *Diabetes Care*, *23*, 1301–1304.
- Horner, S. D. (1998). Catching the asthma: Family care for school-aged children with asthma. *Journal of Pediatric Nursing*, *13*, 356–366.
- Jobe, J., & Mingay, D. (1991). Cognition and survey measurement: History and overview. *Applied Cognitive Psychology*, *5*, 175–192.
- Knafll, G. J., Fennie, K. P., Bova, C., Dieckhaus, K., & Williams, A. B. (2004). Electronic monitoring device event modeling on an individual-subject basis using adaptive Poisson regression. *Statistics in Medicine*, *23*, 783–801.
- Knafll, G. J., & Grey, M. (2007). Factor analysis model evaluation through likelihood cross-validation. *Statistical Methods in Medical Research*, *16*, 77–102.
- Knafll, K., Breitmayer, B., Gallo, A., & Zoeller, L. (1996). Family response to childhood chronic illness: Description of management styles. *Journal of Pediatric Nursing*, *11*, 315–326.
- Knafll, K., Deatrck, J., Gallo, A., Holcombe, G., Bakitas, M., & Dixon, J. (2007). The analysis and interpretation of cognitive interviews for instrument development. *Research in Nursing & Health*, *30*, 224–234.
- Knafll, K. A., & Deatrck, J. A. (2003). Further refinement of the family management style framework. *Journal of Family Nursing*, *9*, 232–256.
- Lee, J. (1991). Tests and model selection for the general growth curve model. *Biometrics*, *47*, 147–159.
- McCubbin, M., & McCubbin, H. (1993). Families coping with illness: The Resiliency model of family stress, adjustment, and adaptation. In C. Danielson, B. Hamel-Bissel, & P. Winstead-Fry (Eds.), *Families, health, and illness* (pp. 21–63). New York: Mosby.
- McCubbin, H., & Patterson, J. (1983). The family stress process: The Double ABCX Model of adjustment and adaptation. *Marriage and Family Review*, *6*, 7–37.
- McQuaid, E. L., Walders, N., Kopel, S. J., Fritz, G. K., & Klinnert, M. D. (2005). Pediatric asthma management in the family context: The family

- asthma management system scale. *Journal of Pediatric Psychology*, 30, 492–502.
- Perrin, E. C., Newacheck, P., Pless, I. B., Drotar, D., Gortmaker, S. L., & Leventhal, J. (1993). Issues involved in the definition and classification of chronic health conditions. *Pediatrics*, 91, 787–793.
- Rodenburg, R., Marle Meijer, A., Dekovic, M., & Aldenkamp, A. P. (2006). Family predictors of psychopathology in children with epilepsy. *Epilepsia*, 47, 601–614.
- Sauerbrei, W. (1999). The use of resampling methods to simplify regression models in medical statistics. *Applied Statistics*, 48, 313–329.
- Smyth, P. (2000). Model selection for probabilistic clustering using cross-validated likelihood. *Statistics and Computing*, 10, 63–72.
- Stein, R. E., & Jessop, D. J. (1982). A non-categorical approach to chronic childhood illness. *Public Health Reports*, 97, 354–362.
- Stein, R. E., & Jessop, D. J. (1990). Functional status II(R): A measure of child health status. *Medical Care*, 28, 1041–1055.
- Stone, M. (1977). An asymptotic equivalence of choice of model by cross-validation and Akaike's criterion. *Journal of the Royal Statistical Society, Series B*, 39, 44–47.
- Strahan, R., & Gerbasi, K. C. (1972). Short, homogeneous versions of the Marlowe–Crowne Social Desirability Scale. *Journal of Clinical Psychology*, 28, 191–193.
- Thompson, R. J., Jr., Armstrong, F. D., Link, C. L., Pegelow, C. H., Moser, F., & Wang, W. C. (2003). A prospective study of the relationship over time of behavior problems, intellectual functioning, and family functioning in children with sickle cell disease: A report from the cooperative study of sickle cell disease. *Journal Pediatric Psychology*, 28, 59–65.
- Van Dyck, P., Kogan, M., McPherson, M., Weissman, G., & Newacheck, P. (2004). Prevalence and characteristics of children with special health care needs. *Archives of Pediatric & Adolescent Medicine*, 158, 884–890.
- Wallender, J. L., & Varni, J. W. (1998). Effects of pediatric chronic physical disorders on child and family adjustment. *Journal of Child Psychology and Psychiatry*, 39, 29–46.
- World Organization of Family Doctors (1998). International classification of primary care, version 2. Available online at: <http://www.globalfamilydoctor.com/wicc/pagers.html>. Accessed November 29, 2006. (Oxford: Oxford University Press).