Objective  To develop a self-report measure of barriers to adherence and to evaluate its reliability and validity in a sample of adolescents with asthma.  

Methods  The Illness Management Survey (IMS) was developed through item generation, expert panel review, and focus group administration. Adolescents with asthma (N = 152) completed the measure. Participants reported on perceived drawbacks to medication, risk-taking behavior, and social desirability tendencies. Providers rated adolescents' illness severity and adherence. Reliability and validity of the IMS were assessed, and factor structure was examined.  

Results  The 27-item IMS shows high internal consistency (alpha = .87). Scores correlate with perceived medication drawbacks, risk taking, and self- and provider reports of adherence. Principal-components analysis indicates five domains of barriers, accounting for 52.4% of the variance: disease/regimen issues, cognitive difficulties, lack of social support/lack of self-efficacy, denial/distrust, and peer/family issues.  

Conclusions  Preliminary data indicate that the IMS reliably and validly assesses perceived barriers to adherence within this sample of adolescents with asthma. It shows promise as a tool for identifying subgroups of nonadherent adolescents. 

Key words  regimen adherence, adolescence, psychological assessment, chronic illness.

Despite growing knowledge about adherence to pediatric medical regimens, the variables most crucial to successful interventions for improving adherence among adolescents with chronic illnesses remain elusive (Riekert & Drotar, 2000). Adherence is commonly defined as the “extent to which a patient’s behavior coincides with medical or health advice” (Haynes, 1979). This definition delineates a range of patient behaviors (taking medications consistently, keeping clinic appointments, following special diets, making lifestyle changes) and suggests that patients’ choice of behaviors may or may not align with medical recommendations. Studies have shown that poor adherence results in increased morbidity and mortality, overuse of health care services, and distorted results of medication trials (Lemanek, Kamps, & Chung, 2001; Matsui, 2000, Quittner, Espelage, Ievers-Landis, & Drotar, 2000). Approximately 50% of pediatric patients are considered nonadherent to treatment recommendations (Rapoff & Barnard, 1991). These rates vary widely with illness type, severity, duration, regimen requirements, and developmental stage. Given that adolescence is recognized as a period of increased risk for adherence problems (La Greca, 1990), this study seeks to identify adolescents’ own perceptions of what makes adherence so difficult to maintain at their stage of development.

In developing a measure of barriers or obstacles that interfere with adherence, ecologically based theoretical models that have been proposed to explain illness behaviors—such as the Children’s Health Belief Model (Bush & Ianotti, 1990) and Hanson’s (1992) systemic model for youth with diabetes—were used. Compared with more individually based frameworks, these models suggest a prominent role for systemic factors. Consistent with the Children’s Health Belief Model, the theoretical foundation for this study focuses on the role of perceived barriers to adherence and views caregivers as important...
environmental influences. This is augmented with a multisystemic view as described by Hanson (1992), incorporating influences on perceived barriers to adherence that are exerted by family (e.g., support, resources, family members’ perceptions of the illness), peers (e.g., peer relationships), and the medical team (e.g., relations with patient and family, perceptions of severity, communication skills).

Because the primary influences on adherence are likely to differ across individuals (Bauman, 2000), the goal of this study was to develop a measure that could identify specific barriers to adherence for individual adolescents. Currently, comprehensive assessment tools to elucidate adolescents’ perceptions of potential barriers to adherence are lacking. This is information that could aid clinicians in estimating patients’ level of risk for nonadherence. The few existing measures that accomplish this aim are limited to a specific illness, or even to one aspect of a particular regimen (e.g., Glasgow, McCaul, & Schafer, 1986; Kynagas, Kroll & Duffy, 2000; Schlunt et al., 1996). The present study will advance the research in this area by developing an assessment technique that covers a wide spectrum of barriers. The many illness-specific factors that can potentially influence adherence present challenges to adopting a broad, non–illness based view of adherence behaviors. However, noncategorical approaches to the study of adherence are needed (Quittner et al., 2000).

Intervention studies aimed at improving rates of adherence typically have not addressed whether different subgroups of nonadherers might benefit from interventions tailored to specific areas of difficulty. Conceptualizing adherence on a continuous and fluid spectrum has advantages with regard to understanding intricacies and changes over time (Lemanek et al., 2001; Quittner et al., 2000). Several researchers suggest that delineating nonadherence subtypes is a fruitful area for further research efforts (La Greca, 1990; Byron, 1998), yet few studies have attempted to accomplish this goal. One study (Koocher, McGrath, & Gudas, 1990) identified three typologies of nonadherence in youth with cystic fibrosis (i.e., inadequate knowledge, psychosocial resistance, and educated nonadherence), but the authors did not subject their typology to empirical validation. Developing an empirically supported and valid measure for classifying subgroups or typologies of nonadherent adolescents, based on the barriers that contribute most heavily to their nonadherent behaviors, would therefore advance this area of inquiry. Developing a multidimensional assessment device with a solid base in the literature on barriers to adherence can enable us to design interventions tailored to specific subgroups of nonadherent adolescents.

The aims of the present study were therefore twofold. The first aim was to develop and validate a brief measure, the Illness Management Survey (IMS), designed to assess perceptions of barriers to adherence and to be used easily in clinical settings. This aim incorporates the processes of instrument development, reliability assessment, and validation. The second aim was to determine, with the use of the IMS, whether chronically ill adolescents could be classified into typologies based on their perceptions of the relative importance of specific types of barriers to adherence. We hypothesized that subgroups could be classified by their responses to this self-report assessment. Based on a comprehensive review of the pediatric adherence literature, we proposed that the following domains (described under Methods, below) would capture these subgroups: (a) disease and regimen factors (e.g., pain/discomfort, hassles, physical changes); (b) cognitive factors (e.g., confusion, memory, knowledge of illness); (c) interpersonal and developmental factors (e.g., autonomy issues, perceived immortality, denial/minimizing, pessimism/optimism, self-efficacy); (d) family and medical system influences (e.g., parent guidance/shared responsibility, closeness, relationship to medical team); and (e) peer influences (e.g., wishes not to appear different from friends, exposure to other teens with similar illnesses).

Patients with asthma were selected as the target population for this stage of measure development for several reasons: (a) Asthma is the most common pediatric chronic illness (Creer & Bender, 1995); (b) There are well-documented high rates of nonadherence among this group despite widespread availability of effective treatments (Bender, Milgrom, Rand, & Ackerson, 1998; Milgrom et al., 1996); and (c) Due to the complexity of treatment regimens, the requirements of both continuous maintenance and crisis treatment, and the intermittent and variable course of the illness, asthma patients are in great need of continued study to understand adherence decisions and facilitate adaptive illness management (e.g., Spector, 2000). At this development stage we chose not to limit participation to adolescents identified as nonadherent, so that we could obtain input from adolescents representing the full spectrum of adherence-related attitudes and behaviors.

Methods
Initial Measure Development

As a first step in the process of measure development, the pediatric adherence literature was reviewed in detail. Correlates of nonadherence that were supported by previous empirical studies were identified and grouped into cate-
illness management and adherence among adolescents with chronic illness. The review yielded a list of empirically supported barriers to adherence among adolescents (e.g., Lemanek et al., 2001; Rapoff, 1999). Other systems also play a role in adherence; for instance, qualities of the relationship between the patient/family and the medical team, physician’s communication skills, and perceptions of the physician as warm and approachable also are important influences (e.g., Lemanek et al., 2001; Rapoff, 1999). This review yielded a list of empirically supported barriers to adherence among adolescents with chronic illness. Questionnaire items were written to reflect each barrier. The items were purposely general enough to pertain to a range of chronic illnesses. Agreement with each statement was indicated with a 5-point Likert-type scale, with a range of 1 = strongly disagree to 5 = strongly agree.

Next, five experts in the area of medical regimen adherence (pediatric psychologists and pediatricians) reviewed the original list of 80 potential items. These experts rated each item for its relevance to the aim of assessing barriers to adherence among adolescents. They also gave feedback regarding which of the hypothesized domains of nonadherence (i.e., disease/regimen, cognitive, intrapersonal, family/medical systems, peer influences) they thought the item tapped. Based on the expert panel review, one of our hypothesized domains (family/medical systems) was divided into separate family and medical systems categories. Items were retained if the average rating for the item’s relevance as an adherence barrier exceeded 3.0 on a 5-point scale and if 4 out of 5 experts agreed on which factor the item represented. Using this system, 55 items were retained for the pilot questionnaire. The exact wording of some items was refined based on specific comments from the review panel.

The IMS was subsequently administered to a focus group (N = 6) of adolescents with asthma. The group consisted of 3 males and 3 females with a mean age of 16.2 years. Ethnically, the group was 50% white, 33% African American, and 17% Latino. These teens were identified for participation by their primary asthma care providers (e.g., pulmonology nurse practitioner, allergy physician) based on providers’ opinions of patients who would give helpful feedback about adherence issues. Parental consent and adolescent assent were obtained via telephone prior to the focus group. Adolescents’ written and verbal feedback on the questionnaire supported the measure’s face validity and did not identify any additional barriers that adolescents believed were missing from the measure. Additional minor wording revisions were made upon recommendation of the focus group participants.

**Participants**

One hundred fifty-two adolescents (91 males, 61 females) aged 11–18 years were recruited from outpatient pulmonology and allergy clinics at a large pediatric hospital. Exclusion criteria were (a) inability to comprehend written English at the fifth-grade reading level and (b) asthma diagnosed within the past year. Participants represented a range of racial and ethnic backgrounds, including white (50.7%), African American (39.3%), Latino (2%), Asian American (1.3%), biracial (3.3%), and other (3.3%). Ninety-nine (65.1%) of the participants reported that their parents were married, 26 (17.1%) came from divorced families, 3 (2%) had a parent who was widowed, and 19 (12.5%) reported that their parents had never been married. The age at which participants were diagnosed with asthma ranged from birth to 16 years with a mean of 6.25 years.

**Procedures**

The study was approved by the hospital’s institutional review board. Eligible adolescents and their parents were approached during outpatient clinic visits. Study staff explained the study and obtained written parental consent and adolescent assent/consent. Adolescents then completed the battery of questionnaires, requiring an average of 25–30 minutes. Families received no financial or other compensation for participation. Three families who were approached refused to participate, and five adolescents failed to complete the full battery of questionnaires after enrolling, resulting in a response rate of 95%. A random subset of the total sample (n = 100, or two thirds of the sample) was recontacted by mail 4 weeks after clinic visit to complete the IMS a second time for the purposes of establishing test-retest reliability. Response rate for this was low; of the 100 participants contacted, 31 responded.
Measures

Demographic and Illness Information Form
This form gathered background information (e.g., gender, age, ethnicity, family status, socioeconomic status) as well as information pertaining to participants’ illness (e.g., diagnosis, duration, limitations). Perceived asthma severity was assessed with a single item asking teens to indicate whether asthma was mild, moderate, or severe. Adolescents also were asked to report their own perceived level of adherence to their medical regimen by responding to single items covering (a) adherence to maintenance medication, (b) management of asthma attacks, (c) avoidance of environmental irritants, and (d) adherence to scheduled medical appointments. Likert-type scales were used with responses ranging from never to always or almost every day (depending on the construct being measured).

Marlowe-Crowne Social Desirability Scale–Short Form (Reynolds, 1982)
This 13-item true-false questionnaire is commonly included in studies using self-report measures in order to control for social desirability biases in response patterns. The short form has adequate validity and reliability when compared with the standard 33-item form (Reynolds, 1982).

Perceptions of Asthma Medication Scale (PAM; DePaola, Roberts, Blaiss, Frick, & McNeal, 1997)
This questionnaire assesses perceptions of the benefits and drawbacks of asthma medication. The 15-item Drawbacks subscale from the children’s version (CPAM-D) is used in this study. The measure uses a 5-point Likert-type response scale, with potential total scores ranging from 15 to 75. The CPAM has demonstrated test-retest reliability of .81 for a group of 9–15 year old participants and a Cronbach’s alpha of .85 for the drawbacks subscale (DePaola et al., 1997). Correlations between the IMS and the CPAM-D will be one indicator of the IMS’s validity, since both measures assess barriers to medication use (although the IMS also targets other aspects of the medical regimen).

Adolescent Risk Taking Survey (ARTS; Alexander et al., 1990)
This six-item scale assesses risk-taking propensity among adolescents and is included to gauge the relationship between nonadherent attitudes and general risk-taking behavior. It was developed in a sample of young adolescents and found to have good reliability and validity. The 3-point response scale yields total scores of 6–18. Scale alpha coefficients were .78 and .80 at separate administrations, and item-total correlations remained stable over a 1-year period (see Alexander et al., 1990).

Clinician Assessment of Adherence
The primary asthma care providers rated participants’ current level of adherence to three realms of asthma care—maintenance medication, response to asthma attacks, and preventive efforts (e.g., avoiding environmental irritants). A 4-point scale was used to classify adherence in each area. This clinician rating scale was modeled after that of Van Sciver, D’Angelo, Rappaport, and Woolf (1995), which was shown to be a reliable method of obtaining clinician adherence ratings.Clinicians also indicated their judgments of participants’ level of asthma severity (mild, moderate, or severe). Detailed clinician reports of adherence were not collected at this stage; rather, this global clinician assessment provided preliminary data regarding the relationship between adolescent self-reports and clinician judgment of medical adherence.

Results
Following descriptive information about the study measures, results are reviewed with attention to the steps involved in measure development. These include item analysis and other scale-reduction techniques, assessment of reliability and validity, and factor analysis to determine the subscale structure that emerged within the questionnaire.

Descriptive Information
Mean (SD) scores were: Marlowe-Crowne social desirability scale–short form, 6.5 (3.2); CPAM-D, 30.6 (10.0); ARTS, 9.3 (2.3). See Table I for descriptive data related to provider and self-reports of perceived disease severity and adherence.

Scale Reduction
Given our aim of developing a brief and clinically useful measure, we began our data analyses by examining the original 55-item pilot questionnaire for items that could be eliminated without detracting from the scale’s useful properties. Each item was examined to determine whether it elicited a range of responses. Four items had insufficient distribution, with a significant skew toward one end of the continuum, and were therefore eliminated. Next, corrected item-total correlations were examined. Items were eliminated if they failed to correlate with the total scale score at a level of $r = .25$ or greater. Using this criterion (DeVellis, 1991), 11 additional items (with correlations ranging from $r = .01$ to $r = .24$) were eliminated.
Correlations between individual IMS items and total scores on the Marlowe-Crowne measure of social desirability were examined next. We wanted to develop a scale that was not overly influenced by social desirability, a challenging problem in the area of adolescent self-report on adherence (Bender, Milgrom, & Wamboldt, 2000). Therefore, we eliminated items that varied heavily with Marlowe-Crowne total scores. Four items that correlated with Marlowe-Crowne scores at $r = .25$ (directly or inversely) or greater were omitted from the scale at this stage. Combined, these reduction techniques yielded a 36-item scale. Each remaining item had a range of responses. Total scale score showed no significant skew pattern (skewness = .14, standard error = .20).

**Reliability**

The IMS's reliability was assessed through several methods. First, Cronbach's alpha was calculated to indicate internal consistency. The 36-item scale had an alpha of .89, indicating strong internal consistency (and potential for further item reduction). Test-retest reliability also was assessed. Although the aim was to obtain these data on one third of the sample, the response rate resulted in 21% of the total sample available for test-retest analysis. Compared with those who did not respond, those who returned their test-retest questionnaires were significantly more likely to be from two-parent homes [$t(59.8) = 2.7, p < .01$] and from white rather than nonwhite families [$t(52.8) = 3.9, p < .001$]. Based on this subset of the full sample, we obtained a test-retest reliability correlation of $r = .88$ for the IMS total score at the first and second administrations.

**Validity**

Correlations between the IMS and other measures of adherence attitudes (CPAM-D) and behaviors (self-report and provider ratings) are provided in Table II. Higher IMS scores correlated positively with stronger perceptions of drawbacks to medications. IMS scores also showed significant inverse relationships with both self- and provider-reported adherence (i.e., higher IMS scores indicated less adherence per both sets of reporters). The positive correlation between the IMS and the ARTS indicates a moderate relationship between adolescents’ perceptions of barriers to adherence and self-reports of general risk-taking behavior.

**Factor Structure**

After establishing the psychometric properties of the IMS, a principal components analysis (PCA) with Varimax rotation was performed. The joint criteria of eigenvalues >1 and Cattell's elbow criteria on the scree plot (DeVellis, 1991; Kim & Mueller, 1978) indicated that three to eight factors could explain the structure of the IMS. Examination of the factor analysis results suggests that a five-factor solution is most interpretable.

Based on our PCA results, 5 additional items were omitted because they had no factor loadings of .40 or greater. The factor analysis was then rerun with 31 items. After initial inspection of the revised rotated component matrix, 4 final items were deleted for lack of conceptual integrity with the factors on which they loaded; deletion of these items did not alter the measure's factor structure. The principal component analysis was rerun, resulting in a final five-factor solution accounting for 52.4% of the variance in the responses (see Table III). The resulting 27-item scale has a Cronbach's alpha of .87. Sample mean for the 27-item scale was 58.9 ($SD = 13.6$). Two items had loadings of .40 or above on two separate factors each. The remaining 25 items each had distinct single-factor loadings.

Empirical results suggest some revisions to our hypothesized factor structure. Factor 1, labeled disease/regimen/medical systems, contains seven items ($\alpha = .78$). Factor 2, labeled cognitive difficulties, contains seven items ($\alpha = .79$). Our hypothesized intrapersonal/developmental domain, along with some of the more...
relationship-focused aspects of our hypothesized medical systems domain, formed the basis of the next two factors. Factor 3 is a six-item factor, labeled lack of social support/lack of self-efficacy ($\alpha = .74$), with a focus on beliefs that others fail to help the adolescent manage his/her regimen, and that the teen’s own behaviors (e.g., following the regimen) do not affect the illness. Factor 4, labeled denial/distrust, centers on the wish to deny the presence of illness or the possibility of negative consequences to nonadherence and beliefs that health care providers were unhelpful. It contains five items ($\alpha = .65$). Finally, Factor 5, labeled peer/family issues, has only four items ($\alpha = .56$). The factors were significantly intercorrelated (see Table III).

**Discussion**

This study provides initial psychometric data on the IMS. The measure development process described herein yielded a brief self-report assessment of adolescents’ perceived barriers to medical regimen adherence, which was piloted among adolescents with asthma. At this stage in its development, the IMS appears to be a psychometrically sound tool for gauging individuals’ perceptions of the number and intensity of barriers to their adherence. Additional research may demonstrate that the IMS also can identify subgroups of nonadherers based on the types of barriers they view as most challenging.

Regarding the demographic characteristics of our sample, IMS total scores were significantly related only to age of respondents, with older teens reporting more barriers. It is well known that older adolescents have more difficulty with regimen adherence than do younger adolescents (e.g., Kyngas, 1999). This finding may have implications for the development of interventions to improve adherence, because it suggests that developmental or age influences play a significant role. Intervening earlier may therefore serve a protective function in preventing adolescents from becoming nonadherent. IMS scores bore no other statistically significant relationships to adolescent or family demographic characteristics.

Participants who perceived their asthma as more severe had higher IMS scores. Provider perceptions of greater disease severity also related to higher IMS scores. Teens with more difficult-to-manage asthma may encounter more barriers because their illness requires more work. Alternatively, it may be that teens who identify more barriers to care are less adherent, therefore they experience more symptoms, leading to perceptions of greater illness severity. The study did not incorporate an objective marker of adherence, but it is important to consider that unless adolescents themselves perceive their illness to be severe, they may be unmotivated to change behaviors or to work toward decreasing barriers to adherence. In future research, it will be useful to examine possible mediating influences on the relationship between perceived illness severity and adherence attitudes, such as family influences.

This new instrument shows evidence of concurrent validity in its correlations with other measures of barriers to adherence (perceptions of medication drawbacks) and general risk-taking behavior. There is some promise of predictive validity in the significant associations between IMS total scores and adolescents’ self-report and provider ratings of patients’ actual adherence behaviors. Rates of nonadherent behaviors reported by our participants and providers are consistent with published self-report and provider-report rates of nonadherence among this population (Bender et al., 1998; Spector, 2000). Although neither self- nor provider report of adherence behavior can be
assumed to gauge patients’ adherence behavior accurately (Rapoff, 1999), these results represent a good first step toward establishing the IMS as a tool to identify one aspect of risk for nonadherence (i.e., perceived barriers).

Preliminary factor analytic findings yield a factor structure that departs somewhat from the originally hypothesized typology of adolescent nonadherence. Based on theory and past findings, we originally proposed six rationally derived domains—disease and regimen factors, cognitive factors, intrapersonal/developmental factors, family systems influences, medical systems influences, and peer influences—that we believed would account for the major barriers to adherence. The empirically derived factor structure of the IMS suggests that grouping barriers on the basis of the different ecological systems in the adolescent’s life may not be the most useful method for classifying subgroups of nonadherers. Rather, it may be more accurate to group barriers based on internal processes, such as adolescents’ cognitive skills, tendency toward denial, and level of pessimistic thinking (i.e., perceptions of low social support and low self-efficacy). Some environmental influences, however, such as disease and regimen

### Table III. Factor Structure for the Illness Management Survey

<table>
<thead>
<tr>
<th>Item</th>
<th>Factor 1 Disease/Regimen</th>
<th>Factor 2 Cognitive Problems</th>
<th>Factor 3 Lack Social Support/Self-efficacy</th>
<th>Factor 4 Denial/Distrust</th>
<th>Factor 5 Peer Influences</th>
</tr>
</thead>
<tbody>
<tr>
<td>My regimen causes changes to my body that I really don’t like.</td>
<td>.80</td>
<td>.20</td>
<td>.01</td>
<td>−.01</td>
<td>.02</td>
</tr>
<tr>
<td>The doctors don’t seem to understand how much my regimen gets in the way of important things in my life.</td>
<td>.67</td>
<td>.05</td>
<td>.34</td>
<td>.32</td>
<td>.11</td>
</tr>
<tr>
<td>My regimen has side effects that I really don’t like.</td>
<td>.60</td>
<td>.37</td>
<td>−.08</td>
<td>−.01</td>
<td>−.01</td>
</tr>
<tr>
<td>Following my regimen causes me physical pain and discomfort.</td>
<td>.57</td>
<td>.39</td>
<td>.09</td>
<td>.10</td>
<td>.09</td>
</tr>
<tr>
<td>I have trouble understanding what the doctors tell me to do for my regimen.</td>
<td>.55</td>
<td>.41</td>
<td>.10</td>
<td>.09</td>
<td>.09</td>
</tr>
<tr>
<td>My illness is easier to take care of than a lot of other illnesses.</td>
<td>.54</td>
<td>−.03</td>
<td>.26</td>
<td>−.39</td>
<td>.24</td>
</tr>
<tr>
<td>Sometimes I can’t remember everything I’m supposed to do about my illness.</td>
<td>.11</td>
<td>.76</td>
<td>.03</td>
<td>−.08</td>
<td>.11</td>
</tr>
<tr>
<td>When there are changes to my regimen, I sometimes get confused.</td>
<td>.03</td>
<td>.72</td>
<td>.18</td>
<td>−.09</td>
<td>.04</td>
</tr>
<tr>
<td>It’s hard for me to stay organized enough to keep track of medications or other things related to my illness.</td>
<td>.21</td>
<td>.61</td>
<td>.15</td>
<td>.24</td>
<td>.16</td>
</tr>
<tr>
<td>When I feel anxious or nervous about something, it’s hard to follow my regimen.</td>
<td>.22</td>
<td>.60</td>
<td>−.02</td>
<td>.19</td>
<td>.25</td>
</tr>
<tr>
<td>It’s hard for me to plan things out carefully, so sometimes I don’t get around to following my regimen.</td>
<td>.10</td>
<td>.59</td>
<td>.13</td>
<td>.39</td>
<td>−.22</td>
</tr>
<tr>
<td>My regimen takes a lot of time and work.</td>
<td>.31</td>
<td>.55</td>
<td>−.18</td>
<td>.07</td>
<td>.13</td>
</tr>
<tr>
<td>I understand what I am supposed to do to take care of my illness.</td>
<td>−.02</td>
<td>.22</td>
<td>.70</td>
<td>−.04</td>
<td>.10</td>
</tr>
<tr>
<td>The doctors do a good job of explaining things to me.</td>
<td>.36</td>
<td>.15</td>
<td>.69</td>
<td>.11</td>
<td>−.01</td>
</tr>
<tr>
<td>My family gives me a lot of support to help me follow my illness.</td>
<td>−.14</td>
<td>.01</td>
<td>.66</td>
<td>.13</td>
<td>.03</td>
</tr>
<tr>
<td>My doctors are friendly and easy to talk to.</td>
<td>.20</td>
<td>−.06</td>
<td>.60</td>
<td>.35</td>
<td>.04</td>
</tr>
<tr>
<td>If I take care of myself and follow my regimen my health will improve.</td>
<td>.10</td>
<td>−.04</td>
<td>.54</td>
<td>.03</td>
<td>.19</td>
</tr>
<tr>
<td>The doctors are too busy or rushed to talk with me about my illness and regimen.</td>
<td>.38</td>
<td>.02</td>
<td>.41</td>
<td>.38</td>
<td>−.09</td>
</tr>
<tr>
<td>I refuse to give up time with my friends to take care of my illness.</td>
<td>.03</td>
<td>−.01</td>
<td>.13</td>
<td>.72</td>
<td>.10</td>
</tr>
<tr>
<td>Nothing bad would happen to me if I didn’t follow my regimen.</td>
<td>−.06</td>
<td>.16</td>
<td>.26</td>
<td>.61</td>
<td>.17</td>
</tr>
<tr>
<td>I don’t always trust the doctors and nurses.</td>
<td>.43</td>
<td>.03</td>
<td>.33</td>
<td>.44</td>
<td>.03</td>
</tr>
<tr>
<td>I try to forget that I have an illness.</td>
<td>.07</td>
<td>.13</td>
<td>−.13</td>
<td>.43</td>
<td>.35</td>
</tr>
<tr>
<td>The doctors treat me like a little kid who can’t take care of him/herself.</td>
<td>.32</td>
<td>.08</td>
<td>.39</td>
<td>.43</td>
<td>.14</td>
</tr>
<tr>
<td>I don’t mind if my friends bring up my illness or ask me questions about it.</td>
<td>−.09</td>
<td>.09</td>
<td>.24</td>
<td>.01</td>
<td>.72</td>
</tr>
<tr>
<td>I don’t want my friends to know about my illness.</td>
<td>.03</td>
<td>.20</td>
<td>.16</td>
<td>.05</td>
<td>.70</td>
</tr>
<tr>
<td>None of my friends has to deal with this, why do I?</td>
<td>.39</td>
<td>−.01</td>
<td>−.09</td>
<td>.24</td>
<td>.59</td>
</tr>
<tr>
<td>My family doesn’t understand what it’s like to live with my illness.</td>
<td>.23</td>
<td>.12</td>
<td>.08</td>
<td>.33</td>
<td>.47</td>
</tr>
</tbody>
</table>

| Eigenvalues      | 6.06 | 2.81 | 1.76 | 1.61 | 1.54 |
| Percent variance explained | 24.5 | 9.8  | 6.5  | 6.0  | 5.7  |
| Correlation with Factor 1 | − .58** | 37** | .43** | .39** |
| Correlation with Factor 2 | − 23*  | .36** | .36** |
| Correlation with Factor 3 | − .45** | .28** |
| Correlation with Factor 4 | − .24*  |     |      |      |

*p < .01.

**p < .001.
characteristics and peer/family influences, do emerge as important contextual forces. It is also interesting to note that family influences were a smaller component than we expected, with only one family-focused item—"My family members don't understand what it's like to live with my illness"—loading on the peer/family factor. This may reflect the normative developmental tendency among adolescents to emphasize peer relationships over family relationships (e.g., Hartup, 1996) and for peer relationships to link to health-risk behaviors (La Greca, Prinstein, & Fetter, 2001).

The sample of adolescents who participated in this phase of measure development consisted of chronically ill youth representing a range of adherence attitudes and behaviors. Although all participants had a single chronic illness (asthma), further pilot work may reveal that the measure is adaptable to adolescents across illnesses. The IMS represents an important contribution to the field of adherence research given its potential applicability across illness types, its face validity, resistance to social desirability in its final item pool, and strong internal consistency. The IMS also shows promise as a tool for classifying subgroups of adolescent nonadherers based on the prominent factors teens report as central to their attitudes toward regimen adherence. It is important to note that the intercorrelations among the IMS subscale scores suggest that the typologies elicited by the IMS do not represent vastly divergent subgroups of nonadherers. Rather, use of this measure can elucidate the relative importance of different domains of adherence barriers for individuals. Put another way, the IMS offers data regarding which barriers to adherence are primary influences on individuals’ behaviors and which are in turn secondary (Bauman, 2000).

The study findings have implications for research on adolescent nonadherence. In future studies, the IMS can be used to quantify the extent of barriers to adherence perceived by adolescents. It may therefore contribute to the assessment of adolescents’ risk for nonadherence. Additionally, it can be used as a measure of intra-individual change in attitudes toward adherence over time, such as before and after participation in adherence-focused interventions. With further development to verify its factor structure, the IMS also can be used to identify subgroups of nonadherent teens to participate in targeted interventions designed to reduce specific barriers to adherence or to modify teens’ perceptions of these barriers.

Clinically, the IMS offers health care providers an efficient method to determine the issues that adolescents perceive as the greatest barriers to their regimen adherence. This knowledge can aid providers in their attempts to reduce the hurdles adolescents encounter in living with a chronic illness. It may also enhance providers’ abilities to engage parents and other sources of social support to work collaboratively toward the goal of increasing adolescents’ adherence.

The implications of our findings should be considered within the limitations of the study. As previously noted, the sample was limited to asthma patients. Our next step in developing the measure is to validate its use with other illness groups. Study design relied upon a clinic-based sample. Teens who did not receive care in the specialty clinics or who failed to show for appointments were missed by this recruitment strategy, thus introducing some potential bias into the findings, especially given that clinic attendance is one indicator of treatment adherence. The ethnic characteristics of our sample (i.e., the low proportions of Latino and Asian American teens) limit generalizability of the findings and highlight the need for additional development in samples with larger representations of these minority groups.

The study did not include an objective measure of adherence such as electronic measurement of medication use, limiting our ability to form conclusions about the relationships between the IMS and actual adherence behaviors. However, for the purposes of this development study (where overall level of adherence was of less interest than adolescents’ perceptions of barriers to adherence), we felt that obtaining self- and provider-report data was adequate. Future work should compare IMS response patterns with objective markers of adherence. The low response rate for test-retest reliability analysis is an additional limitation. Our test-retest results should be interpreted with caution, given that participants who returned their forms differed from the full sample in some known ways (ethnic composition and family structure) and may represent a group more adherent to their medical regimens.

It is important to underscore that the findings presented here represent the development phase of the instrument. Further work is necessary to confirm the factor structure that emerged in the current sample. Our sample was the minimum size acceptable for a factor analysis given the number of items and domains we examined (McCallum, Widaman, Zhang, & Hong, 1999); replicating these findings within a larger sample is an important future step. It would also be informative to use the measure in a sample of identified nonadherent adolescents to determine whether it functions in a similar manner within a more behaviorally homogeneous sample.

In summary, the IMS represents a promising tool for identifying adolescents’ perceptions of the barriers to their medical regimen adherence. It can serve as a brief screening device in clinical settings to help providers gain more
comprehensive understanding of how adolescents manage their chronic illnesses. In the future we hope that the IMS will assist researchers and clinicians in designing interventions tailored to specific areas of adherence difficulties.

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