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Development and Initial Validation of the Communication About Medication by Providers–Parent Scale (CAMP-P)

Eva Igler, MA[1], Ellen Sejkora, MS[1], Rachel Greenley, PhD[2], Jill Plevinsky, PhD[3], Lindsey Bugno, MS[2], Samantha Carreon, MS[2], and W. Hobart Davies, PhD[1]

Abstract

This study evaluated the psychometric properties of the Communication about Medication by Providers–Parent Scale (CAMP-P), a 24-item measure of communication relevant to medication adherence between parents and medical providers. Parents of youth (ages 2-7 years) who had received a prescription within the last 12 months completed online surveys regarding demographic and appointment variables, and child's recent prescription medications, and they completed the newly developed CAMP-P. Exploratory factor analysis of CAMP-P identified 20 items about provider communication corresponding to 3 distinct scales: medication administration strategies, encouraging communication, and addressing barriers to medication taking. Factor scales were related to appointment variables, such as length of time spent discussing medications. The CAMP-P demonstrated good internal consistency and convergent and divergent validity. The CAMP-P is a novel, validated measure of parent perceptions of medication communication and can be utilized to evaluate parent-provider communication on pediatric medication adherence in clinical and research settings.

Keywords

communication, adherence, parents, medication, measure development

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Medication nonadherence is a significant concern in pediatric populations within primary care and specialty clinics.[1-7] Nonadherence can have significant health consequences,[3] since it diminishes treatment effectiveness[1,5,6,8,9] and can significantly affect the utilization of preventative medication use in primary care.[7] Additionally, nonadherence can result in inappropriate medication dosing adjustments by providers and higher risk for medication-related side effects including life-threatening toxicities.[10] Medication nonadherence is associated with increased health care utilization and costs in children with chronic illnesses.[11] Conversely, better medication adherence is linked with improved treatment outcomes.[3]

The added complication of child, parent, and familial factors that can influence adherence are a unique challenge in a pediatric population.[5,7] Adherence is also likely influenced by parental understanding of the medication and child developmental and behavioral concerns.[12,13] The interactions between provider and parents regarding medication management are particularly relevant since parents are most often the individuals responsible for administering medication appropriately and assuring child adherence.[5] Providing appropriate education to parents about medications and fostering communication between parents and providers is essential to reducing non-adherence risk.[2,5,12,14]

The literature reflects the importance of parent-provider communication with regard to how parents administer medication.[2,5,12] Specifically, positive and supportive communication between providers and parents is associated with increased medication adherence.[2,14] Matsui[5] suggests that medication adherence increases when medical providers educate parents about

[1]University of Wisconsin–Milwaukee, WI, USA
[2]Rosalind Franklin University of Medicine and Science, North Chicago, IL, USA
[3]Cincinnati Children's Hospital Medical Center, Cincinnati, OH, USA

Corresponding Author:
Eva Igler, University of Wisconsin–Milwaukee, PO Box 413, Milwaukee, WI 53201, USA.
Email: evaigler@uwm.edu

the benefits of the medication, as well as give parents suggestions on how to remember to administer the medication and manage negative child behaviors that interfere with administration. A study of childhood asthma patients and their caregivers found that increased provider-caregiver and provider-patient communication was associated with increased adherence 1 month after the clinic visit.[12] Additionally, for children prescribed medication for attention-deficit hyperactivity disorder by primary care physicians, parents were less likely to discontinue medication within the first year when the provider engaged parents in a discussion of risks and benefits of the medication.[15]

Parental perceptions of communication with providers may also be important when addressing medication adherence. There is evidence that parental perceptions about medications can affect adherence in specialty clinics[12] and primary care settings.[15] For example, among parents of children with attention-deficit hyperactivity disorder, more positive attitudes regarding stimulant medication were positively associated with medication satisfaction,[16] and were associated with increased medication adherence.[16,17] Greater parental satisfaction, which is linked to positive parental perceptions of provider communication,[14] is particularly relevant, as greater patient and/or parental satisfaction is associated with improved treatment adherence in adult and pediatric populations.[18,19] Given this connection, improved provider communication about novel medications and positive parental perception of this communication may improve subsequent medication adherence.

The Agency for Health Research and Quality[20,21] provides guidelines for information that medical providers should discuss with patients regarding prescription medication. These guidelines emphasize the importance of providing information regarding the medication name, possible medication side effects, and correct medication dosing. Parental concern about their child's reaction to a new medication is often cited as a reason for nonadherence; therefore, discussion of potential side effects may be especially important when considering parental administration of medications[1,6,15,22] Furthermore, Rapoff[13] emphasized the importance of discussing medication benefits, assessing parental understanding of medication administration instructions, and addressing possible adherence barriers.

The Accreditation Council for Graduate Medical Education guidelines for pediatric resident training specify that medical residents receive training in effective communication skills, specifically with patients, families, and allied health professionals.[23] Despite the recognized importance of parent-provider communication in the literature and the medical education community, this is not a well-researched area. Additionally, although the importance of parent-provider communication is well established as an important influence on adherence,[14] there is a lack of validated measures assessing parent-provider communication about medication, which stifles research progress in this area. Studies evaluating provider-patient communication often use nonvalidated measures of communication created for the specific study by the study authors.[24] Other studies utilize video-recorded parent-provider interactions with expert, trained research members coding provider behavior and communication.[25,26] For example, studies may utilize the Medication Communication Index,[27] a coding procedure that is labor intensive, requires trained coders, and is often not practical for communication assessment in hospitals and clinics. Additionally, while this measure provides an objective analysis of the interaction, it does not assess the patient's understanding and perception of the communication, which has been demonstrated to be an important factor in medication adherence.[14]

The purpose of this study was to evaluate the psychometric properties of the Communication about Medication by Providers–Parent (CAMP-P), a newly developed measure of parent perceptions of communication about pediatric medications between parents and medical providers. The primary aim of the current study was to evaluate the factor structure of the 24-item CAMP-P. Secondarily, the study evaluated whether a shortened version of the item set would be more appropriate to increase utility in practice settings. Third, the study evaluated the convergent and divergent validity of the CAMP-P. Finally, the study explored associations between CAMP-P scores and parent, child, provider, and medication characteristics.

It was hypothesized that the CAMP-P would display convergence with parent-reported medication adherence and the amount of time spent discussing the prescription with the provider and divergence with measures of parental life satisfaction and extraversion. Additionally, it was hypothesized that CAMP-P total and factor scores would not be significantly associated with parent, patient, and provider basic demographic characteristics (eg, age, gender, and race/ethnicity). However, it was hypothesized that CAMP-P total and factor scores would significantly vary as a function of appointment length, with longer appointment times associated with higher scores, and as a function of child history of chronic illness, with significantly higher CAMP-P scores reported by parents with a child with a chronic illness.

Methods

Participants

Participants were 286 community parents who had a child between the ages of 2 and 7 years and who had

received a prescription within the last 12 months. Parents who only had children outside of the age range or who were non-English speaking were excluded.

Procedure

Ethical Approval and Informed Consent. The study was approved by the institutional review board at a large Midwestern university (Approval #16.28 & #17.113). Community participants were recruited by undergraduate students in an upper-level psychology course at a large, urban, Midwestern university who had completed ethics training prior to participant recruitment. Recruiters provided potential participants with the study information sheet and the surveymonkey.com link. Snowball sampling was also used, with participants encouraged, by recruiters, to share the study information with other parents. Undergraduate recruiters were given an alternate assignment if unable to recruit participants in order to de-incentivize data fabrication.

Measures

Demographics. Parents provided demographic information including their age, gender, ethnicity, education level, number of children, and age, gender, birth order, and chronic illness history of the target child.

Prescription Characteristics. Parents reported whether their child's prescription was a new prescription, a refill, or an adjustment to an existing prescription, and if the medication was short-term (less than 30 days) or long-term. Parents also reported whether the medication was to be administered daily or as needed. Finally, parents indicated what the prescription was for in an open-response format.

Provider Characteristics. Parents reported whether the prescription was issued by a family practice physician, pediatrician, another specialty of physician, nurse practitioner, physician's assistant, other type of provider, or unsure. Parents were also asked the number of times they had seen the provider before, whether the provider was a primary care or specialty provider, and the provider's gender.

Appointment Characteristics. Parents indicated how long the appointment lasted with fixed choice response options ranging from "10 minutes or less" to "more than 60 minutes." Parents also answered how much time was spent discussing the prescription with fixed-choice response options in 2-minute time increments ranging from "less than 2 minutes" to "more than 10 minutes." Finally, parents indicated their level of satisfaction with care from 1 to 5 (1 = very unsatisfied, 5 = very satisfied).

Medication Adherence. Participants were asked to estimate what percentage of the prescribed medication doses they personally administered (0%, 25%, 50%, 75%, or 100%), the percentage of correct dosages administered, and the percentage of time the prescription was given according to the correct schedule/timing using a fixed-response option. Finally, if parents reported that the child did not take the medication correctly, they were asked to indicate any of the following reasons why the medication was not given correctly: "did not understand how to give the medication," "forgot to give the medication," "child resisted/refused the medication," "child seemed better/no longer needed," and "could not afford medication."

Provider Communication. The CAMP-P is a 24-item measure developed within the framework of established guidelines for patient-provider communication strategies to promote medication adherence[20,21] and in accord with established guidelines for measure development.[28] The guidelines include providing information about the medication dosage, administration instructions, and possible side effects. There was special consideration given to the unique interactions between parents and providers and the unique medication adherence considerations for a young pediatric population. CAMP-P was created to assess parent perceptions of provider coverage of the following core domains of medication-related communication: education, solicitation of parent understanding and concerns, and recommendations for patient behavior.[13,29] Parents rated CAMP-P items on a 4-point Likert-type scale, ranging from "strongly disagree" to "strongly agree." Higher scores denoted greater concordance with guidelines for optimal practice.

The original 24-item CAMP-P was reviewed by 4 prescribing providers with experience in treatment of children. One nurse practitioner and 3 physicians (1 medical doctor and 2 doctors of osteopathic medicine) provided feedback. The providers had a combined 35 years of experience (range 2-13 years). All providers agreed that the items were clear, understandable, and relevant to medication adherence. Additionally, the providers agreed that no element of adherence promotion was missing from the original CAMP-P measure. One provider commented that not all items may be relevant to all age ranges (ie, comment that emotional/behavioral problems may not apply to every child). Two providers commented that the items were relevant but expressed concerns about time limitations in practice. Given the

positive responses from providers and the minimal feedback, no items were deleted or added based on prescribing provider review.

Life Satisfaction. In order to assess divergent validity, parents completed the 5-item Satisfaction with Life Scale.[30] Participants rated items on a 7-point Likert-type scale, with higher scores indicating greater life satisfaction. All items were averaged to obtain a total satisfaction with life score.

Extraversion. Participants also completed the 10-item version of the Big Five Inventory[31] to assess divergent validity. The current study used the Extraversion scale. The extraversion score consists of the mean of 2 items: "is reserved" and "is outgoing, sociable." The "is reserved" item is reversed scored. The 2 item scores for the scale are combined to compute a total score. Higher scores indicate greater extraversion.

Data Analysis

All demographic data and summary data of medication, provider, and appointment characteristics was analyzed using descriptive statistics. Using SPSS version 22.0, an exploratory factor analysis (EFA) with an oblique rotation was used to determine the factor structure of the CAMP-P. Maximum likelihood estimation was used to estimate parameters.[32] Items with eigenvalues of 0.30 or higher across more than one factor were removed. An EFA was run again to evaluate a revised factor structure, and identified items with high cross-loadings were removed sequentially.[33] Using *R* version 3.3.2, χ^2 statistics, comparative fit index (CFI), square error of approximation (RMSEA), and standardized root-mean-square residual (SRMR) were used to evaluate overall model fit.[32,34] RMSEA fit of .08 is ideal; however, a value between .08 and .10 suggests at least adequate fit.[35,36] Chi-square goodness of fit tests are sensitive to larger sample sizes,[34] and in order to combat this goodness of fit test's sensitivity to sample size, a relative/normed χ^2 (χ^2/df) was used to determine overall model fit,[37] with acceptable ratios ranging from 2.0 to 5.0.[34]

The trimmed and improved fit CAMP-P, with cross-loadings removed from the model, was used in all subsequent analyses. To explore convergent validity, the authors examined correlations between the revised CAMP-P total and factor scores and parent-reported medication adherence. Additionally, a 1-way ANOVA (analysis of variance) was run in order to examine convergent validity of the CAMP-P total score and the amount of time the provider spent discussing the medication. Divergent validity was assessed via correlational analyses between CAMP-P total score and the Satisfaction with Life Scale total score and the Big Five Inventory Extraversion subscale score.[31] Using correlational analyses for continuous variables and 1-way ANOVAs for categorical variables, the relations between CAMP-P total scores with parent, prescription, provider, and appointment characteristics were also examined.

Results

Descriptive Analyses

The sample primarily identified as female (78%), non-Hispanic Caucasian (84%), and had a mean age of 33 years (standard deviation [SD] = 6.25). One third of participants reported having a bachelor's degree, and 73% were married. Approximately half the children were male, with a mean age of 4.74 years (SD = 1.45; Table 1).

Most parents reported that their child received a new prescription medication in the past year (80%) and that the medication was prescribed within the last 3 months (42%). Most prescribed medications were to be taken every day (86%) for 30 days or less (83%). The majority of medications were prescribed by either a pediatrician (56%) or family practice doctor (25%). Most providers were female (60%), and most families had seen this provider at least 5 times before (62%). The majority of medications (86%) were prescribed in a primary care setting. Parents reported variability in appointment duration, ranging from approximately 10 minutes (11%) to more than 60 minutes (4%), with 10 to 20 minutes (38%) as the most frequently endorsed length. Parents reported that 42% of providers spent less than 2 minutes (42%) discussing the medication, though occasionally providers spent more than 10 minutes (3%). Over 80% of parents reported feeling satisfied or very satisfied with their child's care.

Fifty-nine percent of parents reported administering 100% of the doses to their children themselves, 81% reported giving the correct dosage at every administration, and 58% reported giving the medication with the correct schedule or timing. For medications directed to be given until gone (eg, antibiotics), 51% of parents reported that their child received 100% of the prescribed doses. Finally, of parents who indicated that the medication was not given correctly, forgetting to give the medication (18%) was the most commonly cited reason.

CAMP-P Factor Analysis

The initial EFA for the 24-item measure resulted in a 3-factor model with 12 items loading on Factor 1, 9

Table 1. Parent and Child Demographic Variables (N = 286).

Demographic Variables	Mean (SD) or %
Parent age (years)	33 (6.3)
Parent gender	
Female	78%
Male	22%
Other	<1%
Parent race/ethnicity	
Caucasian/white	84%
Latin	5%
Mixed	4%
African American/black	3%
Middle Eastern	2%
Asian	2%
Native American	<1%
Other	<1%
Parent education	
College degree (BA)	36%
Some college	22%
Master's degree	16%
High school diploma	11%
Associate degree	8%
Doctoral degree	7%
Less than high school	1%
Parent marital status	
Married	73%
Single, never married	20%
Divorced	5%
Separated	1%
Widowed	1%
Number of children	2.1 (0.91)
Child age (years)	4.7(1.4)
Child gender	
Female	48%
Male	52%
Child birth order	
Oldest (not only)	45%
Only	26%
Youngest	17%
Middle	12%
Child with chronic condition	
Yes	19%
No	81%

items loading on Factor 2, and 3 items loading on Factor 3 and $\alpha = .95$. Three items loaded strongly (eigenvalues > 0.30) on Factors 1 and 2: "The provider asked about any difficulty that my child has with taking medication (eg, trouble swallowing pills; taste or texture sensitivity)," "The provider encouraged parent supervision and monitoring of medication administration," and "The provider gave suggestions about ways to get my child to take medication more easily (eg, crushing pills, flavored liquid medication)." One item loaded strongly on Factors 2 and 3: "The provider discussed why this was the best medication for my child's circumstances and what other options had been considered." This original 24-item measure resulted in less than optimal fit ($\chi^2[249] = 964.54$, $P < .001$; relative/normed $\chi^2 = 3.87$; CFI = .83; RMSEA = .11; SRMR = .09). The cross-loading items were removed sequentially from subsequent analyses and the final EFA was conducted with a 20-item version. The EFA of the 20-item measure ($\alpha = .94$) also yielded a 3 factor structure with 10 items loading on Factor 1, 7 items loading on Factor 2, and 3 items loading on Factor 3. See Table 2 for all final factor loadings after removal of the cross-loading items. Model fit improved with the 20-item version of the measure ($\chi^2[149] = 561$, $P < .001$; relative/normed $\chi^2 = 3.77$; CFI = .90; RMSEA = .10; SRMR = .08), and no items loaded heavily onto more than one factor. Factor 1 ($\alpha = 0.93$) was labeled "Medication Administration Strategies." Factor 2 ($\alpha = 0.89$) was labeled "Encouraging Communication." Finally, Factor 3 ($\alpha = 0.87$) was labeled "Addressing Barriers." See the appendix for the final 20-item CAMP-P measure.

Convergent and Divergent Validity

Using the 20-item version, correlational analyses demonstrated significant positive associations of CAMP-P total scores with reported correct dosage ($\rho = .22$, $P < .01$) and adherence to medication schedule ($\rho = .33$, $P < .001$). There was a significant, positive association between correct dosing and the Medication Administration ($\rho = .13$, $P < .05$), Encouraging Communication ($\rho = .27$, $P < .001$), and Addressing Barriers ($\rho = .21$, $P < .001$) factor scores. Furthermore, there was a positive correlation between dosage administration and the Medication Administration ($\rho = .22$, $P < .01$), Encouraging Communication ($\rho = .35$, $P < .001$), and Addressing Barriers ($\rho = .31$, $P < .001$) factor scores.

There was a significant effect of amount of time spent discussing the prescription and CAMP-P total scores ($F[5, 242] = 2.35$, $P < .05$; $\eta^2 = .04$) and Medication Administration factor scores ($F[5, 244] = 2.78$, $P < .05$; $\eta^2 = .05$). However, there was not a link between time spent and Encouraging Communication ($F[5, 254] = .87$, $P =$ ns, $\eta^2 = .017$) or Addressing Barriers factor scores ($F[5, 253] = 1.33$, $P =$ ns, $\eta^2 = .025$).

Regarding divergent validity, CAMP-P total scores were not significantly associated with parent life satisfaction ($\rho = .07$, $P =$ ns) or parent extraversion subscale scores ($\rho = .04$, $P =$ ns). Similarly, CAMP-P factor scores were not significantly correlated with life

Table 2. CAMP-P 20 Item Version Factor Loadings.

Item	Medication Administration Strategies	Encouraging Communication	Addressing Barriers
The provider reviewed possible discipline strategies if my child persistently refuses to take the medicine.	**.93**	−.10	.21
. . . Gave suggestions about providing small rewards to my child for taking the medicine.	**.89**	.03	.14
. . . Made suggestions about strategies we can use to remember to give the medicine.	**.83**	.08	.05
. . . Asked about whether child behavioral problems or emotional concerns might interfere with medicine administration.	**.80**	.00	.06
. . . Tried to make sure I understood how to give the medicine by asking me open-ended questions.	**.74**	−.04	−.19
. . . Gave me suggestions for how we could remember to give the medicine.	**.71**	.01	−.27
. . . Gave suggestions for how to incorporate giving the medicine into my child's daily routine.	**.67**	.22	−.05
. . . Tried to make sure I understood how to give the medicine by asking me closed-ended questions.	**.64**	–.05	−.17
. . . Explored other possible barriers to giving the medicine.	**.63**	−.06	−.37
. . . Gave me reading materials. . . . To help me understand more about the medicine.	**.50**	.20	−.03
. . . Listened carefully to my questions and concerns and took them seriously.	.06	**.92**	.16
. . . Tone during this discussion was supportive and nonjudgmental.	.04	**.88**	.15
. . . Gave me a chance to ask questions or raise concerns about the medicine.	.12	**.77**	.00
. . . Clearly told me the reason for giving my child the prescription.	−.14	**.70**	−.30
. . . Clearly told me how to give the medicine.	−.02	**.62**	−.30
. . . Clearly told me how to contact the office if I had questions or concerns once we started giving the medicine.	.15	**.61**	−.13
. . . Clearly described the expected benefits.	−.02	**.60**	−.27
. . . Talked about things that might make it difficult to give the medicine and suggested ways to address these.	.25	.24	**−.61**
. . . Clearly told me what side effects we might expect from the medicine.	.17	.30	**−.53**
. . . Clearly explained why it was important to follow the directions and what effects there might be if we did not follow the directions.	.14	.38	**−.53**

Abbreviation: CAMP-P, Communication about Medication by Providers–Parent Scale.
Note: Boldface values indicate the item eigenvalues that load onto a particular factor.

satisfaction (Factor 1: $\rho = .04$, P = ns; Factor 2: $\rho = .13$, P = ns; Factor 3: $\rho = .04$, P = ns) or extraversion scores (Factor 1: $\rho = .02$, P = ns; Factor 2: $\rho = .10$, P = ns; Factor 3: $\rho = .08$, P = ns).

Association With Parent, Child, Provider, and Medication Characteristics

Due to the high intercorrelation between subscales and CAMP-P total scores ($r = .45$ or higher), the following associations were analyzed only using CAMP-P total score. See Table 3 for a listing of significant and nonsignificant associations. There were no significant effects of parent gender ($t[241] = -.57$, P = ns, $\eta^2 = .001$), age ($\rho = -.12$, P = ns, $\eta^2 = .001$), race/ethnicity ($F[7, 237] = 1.48$, P = ns, $\eta^2 = .04$), marital status ($F[4, 238] = .29$, P = ns, $\eta^2 = .005$), or education ($F[6, 238] = 1.23$, P = ns, $\eta^2 = .03$) on CAMP-P total scores, nor were CAMP-P total scores significantly associated with child age ($\rho = .02$, P = ns). Additionally, the following

Table 3. CAMP-P Total Score Association With Parent, Child, Provider and Medication Characteristics.

Significantly Higher Scores	Nonsignificant Associations
20-30 minute appointments	Parent gender
Parents of male children	Parent age
New prescriptions	Parent ethnicity
Long-term medications	Marital status
Parents of children with a chronic condition	Parent education
	Child age
	Provider gender
	Provider specialty
	Provider training background
	Number of times family had seen provider
	Length of time since receiving prescription

provider characteristics had no significant effect on CAMP-P total scores: gender (t[242] = .41, P = ns, η^2 = .001), specialist versus primary care provider (t[240] = −1.58, P = ns, η^2 =.02), and provider training background (F[6, 238] = 1.57, P = ns, η^2 = .04). Furthermore, the number of times the family had previously seen the provider had no significant effect on CAMP-P total scores (F[3, 241] = .64, P = ns, η^2 = .008). Finally, the length of time since receiving the prescription (less than 3 months, 3-6 months, or 6-12 months) had no significant effect on CAMP-P total scores (F[2, 243] = .782, P = .ns, η^2 = .006).

Several appointment, child, and medication characteristics were related to CAMP-P total scores. First, length of appointment was significantly related to CAMP-P total scores (F[6, 238] = 2.22, $P < .05$, η^2 = .053). Games-Howell post hoc tests demonstrated that appointment times of approximately 20 to 30 minutes were associated with higher CAMP-P total scores (mean [M] = 58.71, SD = 12.46) compared with appointment durations of <10 minutes (M = 50.63, SD =11.82). Second, parents with male children (M = 58.40, SD = 12.59) had significantly higher CAMP-P total scores than parents with female children (M = 54.87, SD = 11.30; t[242] = −2.29, $P < .05$, η^2 = .021). Third, parents reporting new medication prescriptions (M = 55.78, SD = 11.71) reported higher CAMP-P total scores than parents of children who were given a refill/adjustment to existing prescription (M = 60.21, SD = 12.84; t[242] = −2.30, $P < .05$, η^2 = .021). Fourth, those prescribed a short-term medication had lower CAMP-P total scores (M = 55.60, SD = 11.73) than those with long-term (M = 61.43, SD = 12.30) prescriptions (t[243] = −2.96, $P < .05$; η^2 =. 035). Finally, parents of a child with a chronic condition had higher CAMP-P total scores (M = 59.90, SD = 12.34) than parents of a child without a chronic condition (M = 55.93, SD = 11.97; t[242] = 2.10, $P < .05$; η^2 = .02).

Discussion

The revised CAMP-P 20-item questionnaire is a promising, psychometrically sound measure of physician communication with parents regarding a child's medication. EFA indicated that the CFI, RMSEA, and SRMR fit indices all improved and indicated an acceptable model fit of the 20-item version compared with the original 24-item version.[34,35] The revised CAMP-P and factor scores demonstrated strong internal consistency, and convergent and divergent validity based on parent-reported aspects of medication adherence including correct dosing and timing of administration. Overall, the total score from the 20-item version was significantly related to several appointment-specific variables, including the amount of time spent discussing medications and the length of the appointment, suggesting that it is measuring the provider-parent communication and the quality of this interaction in an appointment. Moreover, greater amount of time spent discussing the prescription resulted in higher Medication Administration factor scores. Furthermore, the relationship between the CAMP-P and parent-reported medication adherence, a variable of significant importance,[2] indicates that the CAMP-P questionnaire is a meaningful self-report measure for use in this area. Additionally, it is particularly relevant that the CAMP-P total and factor scores were related to parental-reported adherence, as previous research has identified the importance of parental perceptions of communication as an important influence on adherence.[38]

The CAMP-P does not appear to be related to differences in parent or provider demographics or parent subjective well-being, suggesting that these variables do not overly influence CAMP-P total scores. It is noteworthy that there was no significant effect of the time since receiving the prescription on CAMP-P total scores, suggesting that parental responses did not differ related to

the length of time passed since the appointment with the prescribing physician. Additionally, parents of children receiving new prescriptions and long-term medications had higher CAMP-P total scores, suggesting greater provider-parent communication when medications were novel and/or longer-term.

The variability in CAMP-P scores as they relate to chronicity of illness of the child likely reflects differences in the ways that medical professionals provide care to this patient group. The role of the parent-provider relationship likely varies based on the duration of the relationship, the clinic setting, and the nature of a child's illness, as providers may have more or less familiarity with patients and families depending on the context in which care is provided. Future work should also consider the specific implications of, for example, the role of provider communication as it relates to adherence to standard well-child care, such as routine vaccinations, particularly due to the fact that nonadherence is prevalent in primary care settings,[7] as well as in specialty clinics.[3] The implications of medication adherence in maintenance of chronic conditions, such as inhaler use with asthma, are beginning to be understood,[1] but more work is needed to examine the relationship between provider communication and adherence to more aversive treatments, such as chemotherapy or encouraging physical activity for children with chronic pain. It may be that provider communication becomes a more important predictor of adherence when children and their families are asked to follow-through with treatments that are perceived as troublesome or painful in the short-term.

Primary care adherence literature suggests that more preventative medication prescriptions may be particularly vulnerable to nonadherence.[7] For example, in primary care settings, research has demonstrated that discussion of risks and benefits of medications may decrease discontinuation of medication.[15] Assessment of parental perceptions of provider communication regarding medications in a primary care setting has also been demonstrated in the literature[14] to be important to predicting adherence. While objective measures through use of trained coders (eg, Medication Communication Index) have been used in the literature to assess communication regarding medications,[26] this process is burdensome and impractical in most pediatric clinic settings. Therefore, assessing parental perceptions with a low burden, relatively short measure, may be especially useful in predicting adherence and allow prescribing providers to address potential non-adherence risk in real time.

While development of the CAMP-P measure is an essential step in furthering research on parent-provider interactions and pediatric adherence, there are several ways that future work could improve on the current study. First, the current study relied on parents to recall conversations that may have occurred almost a year earlier. It is probable that parents may have had difficulty remembering all aspects of the discussion they had with their child's prescribing provider, resulting in less than optimal accuracy. Future studies would benefit from having parents complete the CAMP-P measure shortly after completing their child's medical appointment. Furthermore, the current study used parent self-reported adherence ratings. It is possible that parents did not understand the intended treatment and may have felt that they were adherent but were not following the treatment as outlined by the physician. This would inflate estimates of correct dosing and administration. Parent-reported medication adherence should be corroborated in future work, for example, with electronic monitoring, pill counts, or pharmacy refill data.[5] Of note, parents willingly reported that they did not always administer their child's medications correctly. Such responses may reflect parental-awareness of the challenges with medication adherence and that the responses in the current study were not overly positively biased.

Additionally, future work should replicate the CAMP-P measurement findings recruiting from a real-world, offline sample through parent groups and/or in medical clinics. Specifically, the current study used undergraduate students as recruiters using an online study, and although the students were given an alternative assignment if unable to recruit participants, there is still the potential for data fabrication. In order to eliminate this potential, recruiting community parents in either medical context or in real-world, offline settings would mitigate potentially data fabrication. Furthermore, use of a different modes of data collection (ie, paper and pencil forms) in additional samples could account for potential common method biases in the current study. Finally, CAMP-P should be evaluated within primary care and specialty clinic settings, order to further validate the measure within a broad pediatric clinic population.

Based on the current findings, the amount of time that physicians spent engaging in medication-related communication, addressing barriers to adherence, and encouraging dialogue is related to parents' reported ability to correctly administer medication to their children. This relationship should be examined in future research. For example, the CAMP-P could be used in a practice setting, such as a primary care office, examining the link between CAMP-P scores immediately after appointments and later adherence. A reasonable goal may be to equip physicians with specific communication strategies to improve the number of children who receive the correct course of treatment.

Poor treatment adherence and barriers to medication adherence are common in pediatric care settings, but both of these areas can be addressed with improved parent-provider communication about prescription medications.[1,3,4,6] The CAMP-P measure, which demonstrated acceptable psychometric properties, can be used to simplify future research in this area by providing quick parent-reported data about provider communication, particularly given the importance of parental perceptions on medication adherence.[12,38] This measure likely has utility in clinical research, training of future medical providers, and quality improvement programs to improve parent-provider communication. Given the significant consequences of nonadherences in pediatric samples,[10,11] the novel CAMP-P measure may facilitate better understanding of the role of specific parent-provider communication patterns and patient outcomes.

Appendix. Please Indicate How Strongly You Agree With Each of the Following Statements.

	Strongly Disagree	Disagree	Agree	Strongly Agree
The provider reviewed possible discipline strategies (eg, time-out or loss of privileges) if my child persistently refuses to take the medication.				
The provider gave suggestions about providing small rewards to my child for taking the medication.				
The provider made suggestions about strategies we can use to remember to give the medication.				
The provider asked about whether child behavioral problems or emotional concerns might interfere with medication administration.				
The provider tried to make sure I understood how to give the medication by asking me open-ended questions (eg, asked me to describe how to give the medication).				
The provider gave me suggestions for how we could remember to give the medication.				
The provider gave suggestions for how to incorporate giving the medication into my child's daily routine.				
The provider tried to make sure I understood how to give the medication by asking me closed-ended questions (true/false or multiple choice).				
The provider explored other possible barriers to giving the medication (cost, insurance restrictions).				
The provider gave me reading materials or a web-link to help me understand more about the medication.				
The provider listened carefully to my questions and concerns and took them seriously.				
The provider's tone during this discussion was supportive and nonjudgmental.				
The provider gave me a chance to ask questions or raise concerns about the medication.				
The provider clearly told me the reason for giving my child the prescription.				
The provider clearly told me how to give the medication (dose, means of administration, and timing with or without food).				
The provider clearly told me how to contact the office if I had questions or concerns once we started giving the medication.				
The provider clearly described the expected benefits.				
The provider talked about things that might make it difficult to give the medication (side effects, inconvenience, and pain) and suggested ways to address these.				
The provider clearly told me what side effects we might expect from the medication.				
The provider clearly explained why it was important to follow the directions and what effects there might be if we did not follow the directions.				

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EI: wrote the majority of the manuscript, completed statistical analyses, and contributed to conceptualization.
ES: contributed to writing the manuscript, contributed to running statistical analyses, and assisted in manuscript editing.
MRG: conceptualized the project, edited the manuscript, and assisted in the statistical analyses.
JP: assisted in manuscript editing and statistical analyses.
LB: assisted in manuscript editing.
SC: assisted in manuscript editing.
WHD: conceptualised the project and assisted in manuscript editing.

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ORCID iD

Eva Igler https://orcid.org/0000-0003-2258-605X

References

1. Burgess SW, Sly PD, Morawska A, Davadason SG. Assessing adherence and factors associated with adherence in young children with asthma. *Respirology*. 2008;13:559-563.
2. DiMatteo MR. The role of effective communication with children and their families in fostering adherence to pediatric regimens. *Patient Educ Couns*. 2004;55:845-848.
3. DiMatteo MR, Giordani PJ, Lepper HS, Croghan TW. Patient adherence and medical treatment outcomes: a meta-analysis. *Med Care*. 2002;40:794-811.
4. Landier W. Age span challenges: adherence in pediatric oncology. *Semin Oncol Nurs*. 2011;27:142-153.
5. Matsui D. Current issues in pediatric medication adherence. *Pediatr Drugs*. 2007;9:283-288.
6. Walsh KE, Cutrona SL, Kavanagh PL, et al. Medication adherence among pediatric patients with sickle cell disease: a systematic review. *Pediatrics*. 2014;134:1175-1183.
7. Zweigoron RT, Binns HJ, Tanz RR. Unfilled prescriptions in pediatric primary care. *Pediatrics*. 2012;130:620-626.
8. de Oliveria BM, Viana MB, Zani CL, Romanha AJ. Clinical and laboratory evaluation of compliance in acute lymphoblastic leukemia. *Arch Dis Child*. 2004;89:785-788.
9. Shaw RJ, Palmer L, Blasey C, Sarwal M. A typology of non-adherence in pediatric renal transplant recipients. *Pediatr Transplant*. 2003;7:489-493.
10. Easton KL, Parsons BI, Starr M, Brien IE. The incidence of drug-related problems as a cause of hospital admissions in children. *Med J Aust*. 1998;169:356-359.
11. McGrady ME, Hommel KA. Medication adherence and health care utilization in pediatric chronic illness: a systematic review. *Pediatrics*. 2013;132:730-740.
12. Sleath B, Carpenter DM, Slota C, et al. Communication during pediatric asthma visits and self-reported asthma medication adherence. *Pediatrics*. 2012;130:627-633.
13. Rapoff MA. *Adherence to Pediatric Medical Regimens*. New York, NY: Academic/Plenum; 1999.
14. Nobile C, Drotar D. Research on the quality of parent-provider communication in pediatrics: implications and recommendations. *J Dev Behav Pediatr*. 2003;24:279-290.
15. Toomey SL, Sox CM, Rusinak D, Finkelstein JA. Why do children with ADHD discontinue their medication? *Clin Pediatr (Phila)*. 2012;51:763-769.
16. Dosreis S, Zito JM, Safer DJ, Soeken KL, Mitchell JW Jr, Ellwood LC. Parental perceptions and satisfaction with stimulant medication for attention-deficient hyperactivity disorder. *J Dev Behav Pediatr*. 2003;24:155-162.
17. Conn KM, Halterman JS, Lynch K, Cabana MD. The impact of parents' medication beliefs on asthma management. *Pediatrics*. 2007;3:e521-e526.
18. Bejarano CM, Milkes A, Hossain MJ, Argueta-Ortiz F, Wysocki T. Longitudinal associations of visit satisfaction and treatment alliance with outcomes in pediatric obesity clinic visits. *Children's Health Care*. 2017;46:282-300.
19. Dang BN, Westbrook RA, Black WC, Rodriguez-Barradas MC, Giordano TP. Examining the link between patient satisfaction and adherence to HIV care: a structural equation model. *PLoS One*. 2013;8:e54729.
20. Agency for Health Research and Quality. Quick tips—when getting a prescription. https://psnet.ahrq.gov/resources/resource/1052/Quick-Tips-When-Getting-A-Prescription. Published May 2002. Accessed June 11, 2019.
21. Agency for Health Research and Quality. 20 tips to help prevent medical errors: patient fact sheet. https://www.ahrq.gov/patients-consumers/care-planning/errors/20tips/index.html. Accessed June 11, 2019.
22. Demore M, Adams C, Wilson N, Hogan MB. Parenting stress, difficult child behavior, and use of routines in relation to adherence to pediatric asthma. *Children's Health Care*. 2005;34:245-259.
23. Accreditation Council for Graduate Medical Education. ACGME program requirements for graduate medical education in pediatrics. https://www.acgme.org/Portals/0/PFAssets/ProgramRequirements/320_pediatrics_2017-07-01.pdf. Accessed June 11, 2019.
24. Wigert H, Dellenmark MB, Bry K. Strengths and weaknesses of parent-staff communication in the NICU: a survey assessment. *BMC Pediatr*. 2013;13:71.
25. Opel DJ, Mangione-Smith R, Robinson JDet al, et al. The influence of provider communication behaviors on parental vaccine acceptance and visit experience. *Am J Public Health*. 2015;105:1998-2004.
26. Tarn DM, Paterniti DA, Orosz DK, Tseng C, Wenger NS. Intervention to enhance communication about newly prescribed medications. *Ann Fam Med*. 2013;11:28-36.
27. Tarn DM, Heritage J, Paterniti DA, Hays RD, Kravitz RL, Wenger NS. Physician communication when prescribing new medications. *Arch Intern Med*. 2006;166:1855-1862.
28. Holmbeck GN, Devine KA. Editorial: an author's checklist for measure development and validation manuscripts. *J Pediatr Psychol*. 2009;34:691-696.
29. Rider EA. Advanced communication strategies of relationship-centered care. *Pediatr Ann*. 2011;40:447-453.
30. Diener E, Emmons RA, Larsen RJ, Griffin S. The satisfaction with life scale. *J Pers Assess*. 1986;49:203-212.
31. Rammstedt B, John OP. Measuring personality in one minute or less: a 10-item short version of the Big Five Inventory in English and Germany. *J Res Pers*. 2007;41:203-212.
32. Brown TA. *Confirmatory Factor Analysis for Applied Research*. 2nd ed. New York, NY: Guilford Press; 2015.
33. Fields A. *Discovering Statistics Using IBM SPSS Statistics*. 4th ed. London, England: Sage; 2013.
34. Barrett P. Structural equation modeling: adjudging model fit. *Pers Indiv Differ*. 2007;42:815-824.

35. Hooper D, Couglan J, Mullen M. Structural equation modeling: guidelines for determining model fit. *EJBRM*. 2008;6:53-60.
36. MacCallum RC, Browne MW, Sugawara HM. Power analysis and determination of sample size for covariance structure modeling. *Psychol Methods*. 1996;1: 130-149.
37. Wheaton B, Muthen B, Alwin DF, Summers G. Assessing reliability and stability in panel models. *Sociol Methods*. 1997;8:84-136.
38. Croom A, Wiebe DJ, Berg CA, et al. Adolescent and parent perceptions of patient-centered communication while managing type 1 diabetes. *J Pediatr Psychol*. 2011;36:206-215.