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Assessment of the physician–caregiver relationship scales (PCRS)☆

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Abstract

Objective: The physician–caregiver relationship affects patients' health outcomes, but measures of this important relationship are lacking. We develop and validate the physician–caregiver relationship scales (PCRS), incorporating three relationship domains (liking, understanding, dominance).

Methods: Videotapes of 100 children's visits were coded for verbal and nonverbal communication. Roter interaction analysis system utterance categories (personal remarks, laughter, agreements, approvals, concerns, reassurances, back channels and empathy) and summary measures (physician proportion of total talk and of number of questions) along with nonverbal measures (touch initiations, upright postures and leaning toward a participant) were used as indicators. Model fit was evaluated with confirmatory factor analysis (CFA). Validity was evaluated by associations of the PCRS with visit characteristics and global affect ratings.

Results: PCRS domains incorporating verbal and nonverbal indicators demonstrated good model fit (RMSEA < 0.05; SRMR < 0.12; TLI and CFI > 0.95). Construct and predictive validity were demonstrated with PCRS domains relating to visit characteristics and affect ratings as predicted.

Conclusions: CFA supported the multi-dimensional PCRS with three domains—liking, understanding and dominance. Such measures are valuable tools for investigations of physician–caregiver relationships.

Practice implications: Models suggest specific indicators of the physician–caregiver relationship and inform interventions to improve these relationships.

Keywords: Physician–patient relationship; Physician–caregiver relationship; Confirmatory factor analysis; Pediatrics; RIAS

1. Introduction

Forming a relationship with a patient is a key function of the medical encounter [1]. In many visits, a family member or caregiver may typically accompany the patient. As with physician–patient relationships, physician–caregiver relationships determine adherence to physician guidance [2,3], health outcomes [3] and satisfaction [4], but measures of this important relationship are lacking. We develop a measure of physician–caregiver relationships that incorporates multiple relationship dimensions and nonverbal communication. Reliable and valid measures would provide standard assessment tools and facilitate understanding of the communication processes that foster physician–caregiver relationships. These advances then allow targeted development and meaningful evaluation of interventions to improve such relationships.

1.1. Conceptual framework for the physician–caregiver relationship

This study brings together relationship research from sociology, communication, philosophy and medicine to

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develop conceptual and measurement models for assessing the quality of physician–parent relationship in pediatric visits. As with all relationships, the quality of this relationship is theorized to exist between participants and may not necessarily reflect qualities of the individual physician or caregiver [5]. This is in contrast to prior research on physician–patient relationships that predominantly describes this relationship in terms of physician behaviors [6], less frequently examining patient behavior or interaction of the two.

We propose that physician–caregiver relationship measures be multi-dimensional and incorporate nonverbal affective content. Previous studies have suggested that quality in the physician–patient relationship may be a multi-dimensional construct [5,7], with some constructs comprised of other constructs. For example, trust has been theorized to include power/dependence along with caring [8]. In addition, as with all relationships, therapeutic relationships contain both task-focused content that is often delivered verbally and affective content often conveyed both verbally and nonverbally [9–12]. The task-focused content of the therapeutic relationship supports the goal of healthcare decision-making and includes information exchange [13–17] and deliberation [18]. Prior measures of aspects of the affective content of the relationship have predominantly examined verbal communication [13–16,18–20] with assessment of nonverbal cues being infrequent [12,21–23]. Our work develops and validates a measure of the affective content of physician–caregiver relationships as conveyed both verbally and nonverbally.

1.2. Hypotheses and research questions

We sought to develop and validate the physician–caregiver relationship scales (PCRS). We began by evaluating an existing measure of physician or patient ''relationship building'' [16,19] based on the widely accepted Roter interaction analysis system (RIAS) [15–17,19,20,24–27] with confirmatory factor analysis (CFA). Based on comprehensive literature review, we then developed and examined three relationship domains (liking, understanding and dominance) assessed with verbal and nonverbal indicators. We assessed the scales' interrater reliability and model fit as well as content [28], construct [29], discriminant [30] and concurrent [29] validity.

For the physician–parent relationship, we hypothesized that (1) models of ''relationship building'' would fit poorly when modeled separately for the physician and parent because the relationship is constructed between the participants, and is not a characteristic of an individual participant, (2) because the level achieved for each of the domains in the relationship may not necessarily be correlated (e.g., it is possible to like your relationship partner very much, yet not understand them well), the PCRS would be comprised of multiple domains as opposed to being assessed well with a single scale and (3) nonverbal indicators would contribute significantly to the PCRS. We expected that PCRS domains would correlate with global affect ratings [31] for the physician and parent. For example, global ratings for friendliness were expected to correlate positively with the liking domain, while affect ratings for responsiveness were expected to correlate positively with the understanding domain. Similarly, physician hurriedness was expected to be negatively correlated to liking and to understanding. Based on prior work, we also expected that PCRS domains would relate to visit characteristics in a predictable manner. For example, we expected more liking in caregiver relationships with female physicians [32] and in longer visits [14,24]; more understanding in visits with longer continuity [33] and in longer visits [14,24]; and less dominance by female physicians [34].

2. Methods

2.1. Subjects

We recruited Wisconsin-licensed family practitioners ($n = 7$) and pediatricians ($n = 8$), targeting physicians to maximize variability in characteristics (approximately 50% female, 25% minority, 50% pediatricians, 50% family practice) that influence physician–patient relationships [32,34–37]. Once physicians were recruited, all parents with children ages 3 months to 18 years visiting for an acute complaint during enrollment periods were approached before the visit, until 6–9 families were enrolled per physician. Children in distress, with chronic illness or from non-English speaking families were excluded. Of 122 families approached for participation, 101 (83%) agreed. Technical difficulties precluded the inclusion of one videotape and four visits had no parent present resulting in a sample of 96 visits, each with a unique physician–parent dyad.

2.2. Data collection

Before patient recruitment, physicians completed a survey including sociodemographics and practice characteristics. Before the visit, parents completed a survey including child and parental sociodemographics and prior health care utilization by the child. Survey items were chosen based upon either theoretical or known associations with visit participation or visit outcomes [9,15,16,23,24,33,38]. Physicians and parents provided written consent; children older than 7 years provided written assent. The research was approved by the institution's Human Subjects Committee and participating sites.

Each visit was videotaped in its entirety. All but three of the 101 visits were videotaped with mobile video cameras positioned to facilitate capture of each participant's nonverbal communication. Videotapes were coded with RIAS, a widely used and reliable system for coding communication during medical visits including pediatric encounters [15,16,19,23,24]. This system categorizes each speaker's utterances into one of thirty-four mutually exclusive categories (e.g., concern, agreements, giving medical information) and also allows ratings of global affect for physician and parent [31]. Utterances were coded only for those periods in which the physician was present. In the rare instance of more than one physician ($n = 2$ visits (2%)) or more than one parent ($n = 7$ visits (7%)) at a visit, all physician or parent talk was coded as if it came from a single person. In the analyses, demographics of the parent or physician who spoke more were utilized. Using the NOLDUS observer system [39], nonverbal

behaviors were also coded for the entire visit for each participant. These behaviors were selected based on their association with specific relationship qualities or with patient outcomes [21,22]. One of two trained coders coded RIAS as well as nonverbal communication with a 15% random sample double-coded to ensure interrater reliability. Coders were unaware of study hypotheses.

2.3. Measures

2.3.1. Latent variables

In total, we evaluated five candidate latent variables to describe the physician–caregiver relationship. The first two of these latent variables, ''physician relationship building'' and ''parent relationship building,'' were based on measures used in prior RIAS studies [16,19]. Based on an exhaustive review of the literature on therapeutic relationships, we examined three additional latent variables as domains of the PCRS—liking [40], understanding [41,42] and dominance [43]. We discuss the content and construct validity of these three domains as well as their indicator variables below.

2.3.2. Global affect ratings

For the purpose of evaluating validity, global affect ratings were correlated to PCRS domains. Trained coders rated physician and parent affect using a six-point scale (1 = low; 6 = high) for the entire visit as developed for RIAS [31]. Affect scales included anger, anxiety, depression (patient only), upset, dominance, friendliness, interest, empathy, hurriedness and responsiveness. Coder agreement within one point on the six-point scale ranged 71–100% for physician affect and 70–98% for parent affect. For each affect rating, we averaged the ratings from three coders.

2.3.3. Visit characteristics

Visit characteristics included number of physician visits by the child annually (assessed as number of physician visits in the last 12 months), number of visits to the participating physician by the child annually (assessed as number of visits to the participating physician in the last 12 months), and an indicator of whether the physician was the child's primary care physician. Child characteristics included age, gender and race/ethnicity (white non-Hispanic/all other). Parent characteristics included gender of the accompanying parent (mother only, father only, both parents, no parent), age and education (college graduate/non-college graduate). Physician characteristics included gender, race/ethnicity (white non-Hispanic/all other), specialty (pediatrics/family practice) and years in practice.

2.4. Analyses

Interrater reliability for indicator variables was assessed with Cohen's kappa. Models were evaluated using CFA in LISREL 8.54 with weighted least squares estimation, polychoric correlation matrices, and asymptotic variance/covariance matrices as appropriate for ordinal variables, count variables with skewed distributions and for variables whose correlations are not bivariate normal [44]. All indicator variables were entered into models as ordinal variables. Model fit was assessed with the criteria suggested by Bentler and Hu (root mean square error of approximation, (RMSEA) < 0.06; standardized root mean square residual (SRMR) < 0.08; Comparative Fit Index (CFI) > 0.95; Tucker–Lewis index (TLI) > 0.95) [45]. Inclusion of correlations among indicator residuals was avoided, except where such a correlation explained non-random variance and was supported by theory [46]. Latent variable distributions are described with means and standard deviations (S.D.). Discriminant validity between domains was assessed with correlation coefficients. PCRS construct validity was assessed by examining Spearman correlations with affect ratings. PCRS concurrent validity was assessed with beta coefficients and 95% confidence intervals from latent variable regression of the domains on visit characteristics. All descriptive analyses were conducted in Stata 8.0 [47].

3. Results

3.1. Visit characteristics

The majority (60%) of the visits were to the child's primary physician (Table 1). Visit length averaged 12 minutes

Table 1
Visit characteristics ($n = 96$)

Visit characteristics	
Visiting child's primary physician	60%
Annual physician visits (mean, S.D.[a])	6.3 (9.0)
Annual visits to participating physician (mean, sd)	3.2 (8.8)
Visits length in minutes (mean, S.D.)	12.2 (5.3)
Child characteristics	
Age in years (mean, S.D.)	5.4 (4.9)
Age group	
Infant/toddler, 0–2 years	45%
Preschooler, 3–4 years	12%
Gradeschooler, 5–11 years	28%
Adolescent, 12–17 years	16%
Female	48%
White, non-Hispanic	76%
Parent characteristics	
Age in years (mean, S.D.)	34.5 (7.3)
Parent at visit	
Mother only	77%
Father only	12%
Both parents	7%
No parent in exam room	4%
Parent a college graduate	27%
Physician characteristics ($n = 15$)	
Pediatrician	57%
Family physician	43%
Years in practice (mean, S.D.)	13.3 (8.3)
Female	61%
White, non-Hispanic	73%

[a] S.D. = standard deviation.

Table 2
Interrater reliabilities for indicator variables

Indicator	Kappa[a]
Liking	
Physician personal remarks	0.55
Physician approvals	0.82
Physician laughter	0.69
Physician leans toward parent	0.48
Parent personal remarks	0.91
Parent approvals	1.00
Parent laughter	0.91
Parent leans toward physician	0.77
Understanding	
Physician agreements	0.73
Physician concern	0.77
Physician back channels	0.90
Physician reassurance	0.75
Physician empathy	1.00
Physician touches	0.71
Parent agreements	0.91
Parent concern	0.90
Dominance	
Physician's proportion of talk	0.82
Physician's proportion of questions	0.91
Difference between physician and parent upright postures	0.71

[a] Kappas calculated on ordinal variables as entered in the factor analysis models.

(median = 11; interquartile range 8.9–15.5). Children's mean age was 5.4 years (S.D. = 4.9, range 0–18 years). Forty-eight percent were female and 76% were white non-Hispanic. Parents accompanying the children were predominantly mothers (77%) and 27% had college educations. Physicians were 61% female, 73% white non-Hispanic, 57% pediatricians, with a wide range of years in practice (range 0.5–28 years).

3.2. Reliability

3.2.1. Interrater reliability

Interrater reliability for indicator variables was moderate to almost perfect [48] (Table 2).

3.2.2. Internal consistency

Internal consistency is a commonly used indicator of reliability for summative scales. Because models did not support equal factor loadings for the domain indicators (see below), their use as summative scales without indicator weights is not appropriate. Thus, an assessment of internal consistency is also not appropriate [49].

3.3. Validity

3.3.1. Content validity

In developing the PCRS domains, we incorporated the multiple important relationship constructs delineated in the literature. To achieve representativeness, the first author reviewed and summarized multidisciplinary literature on requisite qualities of therapeutic relationships [7,40–43,50–52]. This process identified 19 relationship qualities, which were then supplemented with definitions and contextual examples. To identify similarities and reduce redundancy, three researchers reviewed the literature summary, definitions and examples; then independently sorted the qualities into conceptually similar domains. We then negotiated consensus on the relationship domains—liking, understanding and dominance. Liking was defined as having a preference or fondness for another and included such qualities as affiliation [43], positive regard [50], approval [42], alliance [42] and warmth [42]. Understanding was defined as knowing or accepting another and included acceptance [42], recognition [42], appreciation [42], interest [42], caring [42,50], concern [42,50], empathy [41,42,51], genuineness [42,50] and respect [50,52]. Dominance was having the power or right to make decisions and included power [7,50] and authority [53]. Second order domains, i.e. those domains defined by multiple other domains, were excluded as their assessment would follow from assessing first order domains.

Similarly, in selecting PCRS indicators, the first author reviewed literature relating verbal or nonverbal communication to qualities of therapeutic relationships. Indicators were selected for inclusion in factor models when supported by literature and reliably measured. Based on prior research with RIAS measures of physician or parent relationship building [15,16,19], verbal indicators for models of either physician or parent "relationship building" were counts of utterances including concerns, reassurances, approvals, agreements, compliments, personal remarks and laughter [31]. Due to their extremely rare occurrence, negative talk such as criticisms and disapprovals were not included. When modeling the PCRS domains, verbal indicators were counts of RIAS categories reflecting the content of the domain and based on prior research. For liking, these included counts of personal remarks, laughter and approvals. For understanding, the verbal indicators included counts of concern, reassurance, back channel ("uh-huh" or similar utterances by a listener that confirm listening or encourage the speaker to continue), empathy and agreement. For dominance, verbal indicators were the physician's proportion of total visit talk [24,54,55] and the physician's proportion of total information gathering (measured by summing the number of utterances coded as questions about medical, therapeutic, lifestyle or psychosocial concerns) during medical visits [9,19]. In addition, nonverbal indicators were selected for each domain based on previous associations between nonverbal cues and relational qualities. Leaning toward a participant is associated with increased liking [56]. Thus, for liking, the indicator was operationalized as counts of leaning toward the other participant. Similarly, for understanding, the nonverbal indicator was a count of physician touches. Lastly for dominance, upright vertical postures [53] have been associated with power or authority. This indicator was operationalized as the difference in counts of physician's upright body postures and the parent's upright body postures.

3.3.2. Construct validity

Based on the existing approach of summing RIAS indicators to assess relationship building for physician and parent

separately, we constructed uni-dimensional models for both physician and parent ''relationship building'' [16,19]. Both models demonstrated poor fit (RMSEA = 0.10; SRMR = 0.11; CFI = 0.84; TLI = 0.76 for physician model; RMSEA = 0.22; SRMR = 0.17; CFI = 0.62; TLI = 0.46 for parent model). Using verbal indicators from RIAS as well as nonverbal indicators, a latent variable model for each of the three PCRS domains – liking, understanding, and dominance – was constructed and evaluated. Correlated error terms were avoided, except in the instance of personal remarks in the liking domain where it is highly probable that a coder would expect a personal remark to receive a personal remark in response. For example, ''Hello, I'm Dr. Jones,'' is expected to be followed by a similar parent introduction. Thus, these two error terms were allowed to correlate. Each model demonstrated good to excellent model fit. (Fig. 1) The mean for liking was 2.2 (S.D. = 1.9; coefficient of variation (CV) = 1.2); the mean for understanding was 2.8 (S.D. = 1.8; CV = 1.6) and the mean for dominance was 8.1 (S.D. = 1.8; CV = 0.22).

The majority of PCRS indicators loaded above 0.50. (Fig. 1) Not all indicators were significantly associated with their respective domains, but all were retained based on theory and evidence of model fit (i.e., their inclusion did not create model misfit; fit indices available from the authors). Among the indicators for liking, laughter by both the parent and the physician loaded most heavily while personal remarks by the

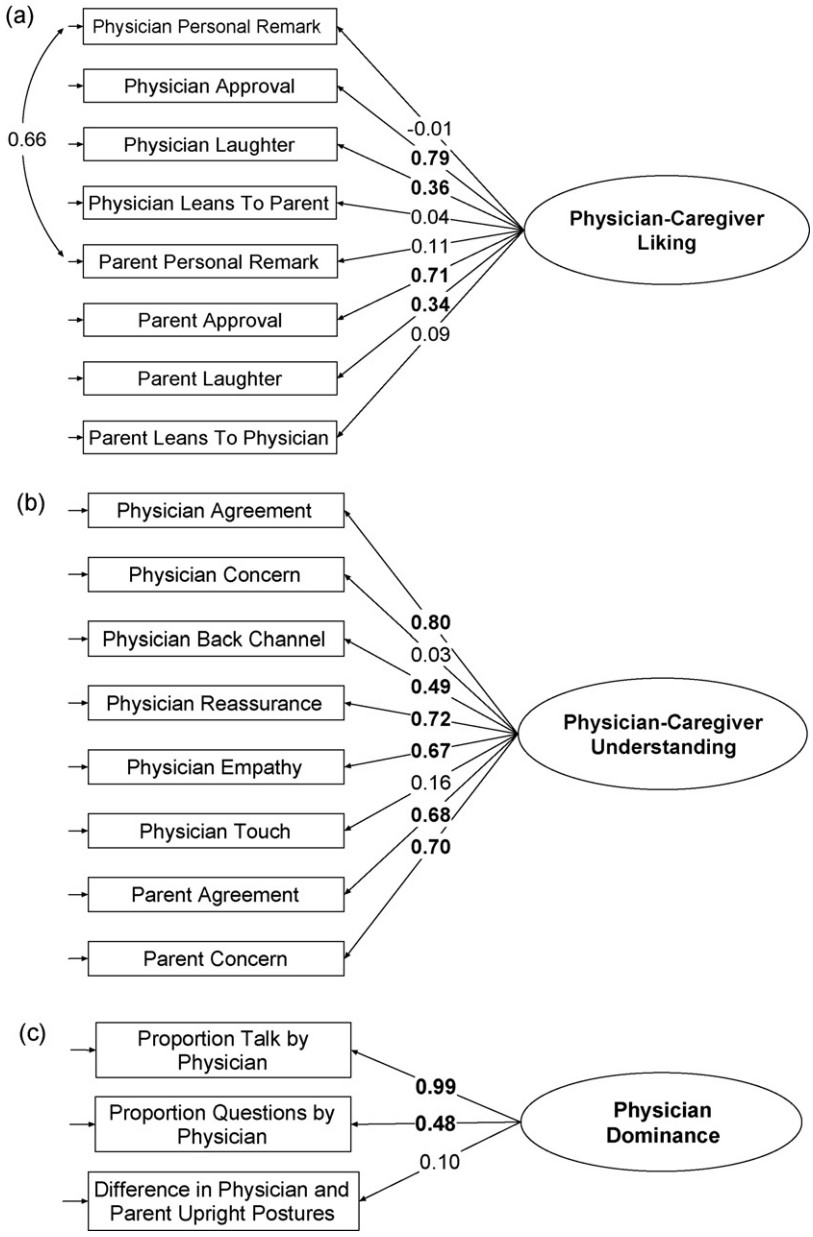

Fig. 1. Measurement models for the physician–caregiver relationship scales (PCRS). (a) Measurement model with standardized factor loadings for the PCRS ''liking''; model fit indices—RMSEA = 0.013; SRMR = 0.093; CFI = 0.999; TLI = 0.998. (b) Measurement model with standardized factor loadings for the PCRS ''understanding''; model fit indices—RMSEA = 0.053; SRMR = 0.126; CFI = 0.972; TLI = 0.961. (c) Measurement model with standardized factor loadings for the PCRS ''dominance''; model fit indices—RMSEA = 0.000; SRMR = 0.036; CFI = 1.00; TLI = 1.030. *Bolded values indicate $p < 0.05$ for the significance of the factor loading.

Table 3
Affect ratings and their correlations with physician–caregiver relationship domains ($n = 96$ visits)

Affect rating	Mean (S.D.)	Liking, ρ	Understanding, ρ	Physician dominance, ρ
Physician affect				
Anger/irritation	0.02 (0.09)	−0.19	−0.22[a]	−0.11
Anxiety/nervousness	0.04 (0.15)	0.13	0.15	−0.08
Emotional distress/upset	0.01 (0.06)	−0.06	0.06	−0.14
Dominance/assertiveness	3.50 (0.36)	−0.16	0.08	−0.05
Interest/attentiveness	3.64 (0.43)	0.04	0.23[a]	−0.09
Friendliness/warmth	3.70 (0.69)	0.22[a]	0.16	0.05
Responsiveness/engagement	3.67 (0.52)	0.14	0.29[b]	0.04
Sympathetic/empathetic	2.83 (0.62)	0.08	0.26[b]	0.07
Hurried/rushed	2.15 (0.53)	−0.21[a]	−0.24[a]	0.00
Parent affect				
Anger/irritation	0.06 (0.18)	−0.18	−0.07	−0.02
Anxiety/nervousness	0.38 (0.46)	0.00	0.45[c]	−0.05
Depression/sadness	0.06 (0.15)	0.03	0.29[b]	0.16
Emotional distress/upset	0.08 (0.20)	0.02	0.32[b]	−0.01
Dominance/assertiveness	3.13 (0.56)	0.14	0.27[b]	−0.22[a]
Interest/attentiveness	3.56 (0.43)	0.09	0.26[a]	−0.08
Friendliness/warmth	3.32 (0.54)	0.28[b]	0.19	−0.11
Responsiveness/engagement	3.55 (0.55)	0.16	0.36[b]	−0.18
Sympathetic/empathetic	2.77 (0.51)	0.03	0.33[b]	0.13
Hurried/rushed	1.82 (0.26)	−0.20	0.05	0.09

[a] Significant at $p < 0.05$.
[b] Significant at $p < 0.01$.
[c] Significant at $p < 0.001$.

physician were less important. For understanding, agreements and reassurances by the physician were strong indicators as were parent concerns and agreements. For dominance, high proportions of physician talk were the strongest indicators of physician-dominated encounters. Further, equating the indicator loadings within any of the domains produced significant model misfit (fit indices available from the authors).

The PCRS were significantly correlated with global affect ratings (Table 3). Liking was positively correlated to physician and parent friendliness and negatively correlated to physician hurriedness. Understanding was highly positively correlated to both physician and parent responsiveness and sympathy, as well as to parent anxiety, depression, upset and dominance. Dominance by the physician was negatively correlated with ratings of parent dominance.

3.3.3. Discriminant validity

Discriminant validity of the PCRS was assessed with correlations between PCRS domains. The correlation between liking and understanding was 0.03, between liking and dominance 0.21, and between understanding and dominance 0.94.

3.3.4. Concurrent validity

Concurrent validity was established using latent variable regression to examine the association of the PCRS with visit characteristics (Table 4). Relational history in the form of having a primary care relationship with the physician and the number of prior visits to the physician were positively associated with liking. Longer visits were associated with more understanding. Dominance by physicians was less with college graduate parents. Female physician gender was associated with less dominance by the physician and less liking.

4. Discussion and conclusion

4.1. Discussion

Although caregivers play a unique and important role in healthcare visits, tools for assessing the physician–caregiver

Table 4
Regression coefficients and 95% confidence intervals (95% CI) for bivariate associations between physician–caregiver relationship domains and visit characteristics[a]

Characteristic	Liking		Understanding		Physician dominance	
	β[b]	95% CI	β[b]	95% CI	β[b]	95% CI
Visiting child's primary physician	**0.49**	**(0.36, 0.62)**	**−0.16**	**(−0.31, −0.01)**	−0.16	(−0.39, 0.07)
Annual visits to participating physician	**0.27**	**(0.21, 0.33)**	0.02	(−0.02, 0.06)	−0.08	(−0.16, 0.00)
Visit length (seconds)	0.08	(−0.04, 0.20)	**0.20**	**(0.09, 0.31)**	−0.01	(−0.20, 0.18)
College graduate parent	**−0.44**	**(−0.59, −0.29)**	**0.50**	**(0.42, 0.58)**	**−0.28**	**(−0.48, −0.08)**
Visiting female physician	**−0.57**	**(−0.68, −0.46)**	−0.10	(−0.26, 0.06)	**−0.31**	**(−0.49, −0.13)**

[a] Bolded values indicate significance at $p < 0.05$.
[b] Beta represents the standard deviation unit change in the latent domain variable associated with a one unit change in the characteristic.

relationship are lacking. The PCRS provides an objective measure of domains within the physician–caregiver relationship, using both verbal and nonverbal indicators. Construct validity for the PCRS is good with fit indices demonstrating good to excellent model fit. The validity of the PCRS is further supported by significant correlations of the relationship domains with both global affect ratings and visit characteristics. Such reliable and valid measures advance the study of therapeutic relationships, bringing us closer to understanding the mechanisms through which communication impacts perceptions of the relationship, a critical factor in outcomes such as adherence and satisfaction [2–4].

Several hypothesized correlations of the PCRS with both global affect ratings and visit characteristics were found, providing evidence for PCRS validity. For global affect ratings, strong positive associations existed between liking and both physician and parent friendliness and between understanding and ratings indicative of parent distress (upset, depression and anxiety), as well as a strong negative association between PCRS scores indicating dominance by the physician and ratings of parent dominance. Most visit characteristics were associated with relationship domains as expected, with the exception that female physician gender was negatively associated with liking. Given that most accompanying parents are mothers, this finding may relate to gender-based differences in physician communication that exist in specialties such as gynecology where the majority of patients are female [26,57]. Specifically, in specialties dominated by female patients, male physicians have been suggested to work harder at their communication to support patient-centered care.

Prior pediatric studies yield differing results when examining the association of participant characteristics such as child gender with types of RIAS-coded talk in visits [15–17]. Our results suggest at least two potential mechanisms through which discrepant results might arise—either through inconsistencies in selecting utterance types (indicators) for various talk categories (domains) and/or through the inability to weight those utterance types. First, to assess the socioemotional aspects of the relationship, prior work has often summed the verbal indicators used in the PCRS liking and PCRS understanding domains, while other work with pediatric visits has attempted to separate these indicators further into categories such as positive talk, social talk and rapport building [15,17,19,24]. The selection of indicators for these categories does not correspond to the grouping of indicators from our validated PCRS. For example, ''positive talk'' has included both agreements and approvals as coded by RIAS, while in the PCRS, these indicators contribute to two distinctly different relationship domains. Second, we find that the relative value of each indicator in the PCRS varies, which also could contribute to prior studies' discrepant results. Thus, item weighting, rather than simply summing counts of utterances, would improve assessments of the physician–caregiver relationship. (Appendix A contains instructions for scoring the PCRS using item weighting.)

Since our identification of relationship domains relied on recognition of the domains within therapeutic relationships, we may have inadvertently neglected previously unidentified domains. However, this process increases the likelihood that the PCRS domains may be important in other therapeutic relationships, perhaps with different indicator items or factor loadings. One very natural extension of the PCRS would be its application for assessing physician–patient relationships. However, caution is warranted in extending the PCRS to these relationships because relationship quality is shaped by each additional participant [58]. Also, because the caregiver is in a position of advocating for the patient [59], differences in relationship roles and goals could produce important differences between physician–caregiver and physician–patient relationships [60]. Caregivers have been noted to alter healthcare communication, mediating the therapeutic relationship by acting as a supportive advocate, a passive participant, a gatekeeper or even an antagonist [59,61–66]. For example, parents influenced the physician–child communication in pediatric visits as nearly 60% of physician attempts to direct a turn of talk to a child were responded to by parents [66]. Thus, further validation would be required to ensure the PCRS's validity outside the context of the pediatric visit. Future work could also bolster validity by examining the association of PCRS with outcomes such as satisfaction or adherence.

While our work advances research in this area by providing a measurement model for the physician–caregiver relationship, we recognize several limitations. Our sample size is relatively small, perhaps limiting the ability to detect significant improvements in model fit with the addition of nonverbal indicators. Given the cost and complexity of assessing nonverbal indicators and the good model fit obtained without these indicators, researchers could utilize the PCRS with RIAS indicators alone. We were limited to visually observed nonverbal indicators so additional work could consider expanding indicators to include other communication events or techniques such as vocal tones or speech/pause patterns [12]. Also, although every attempt was made to videotape each participant's nonverbal communication, unanticipated movements (particularly by children) could result in a participant being off-screen. Our analyses also do not consider the sequencing of indicators [5,27]. For example, a well-placed touch may have more impact on the relationship than a handshake greeting. Lastly, the analyses do not account for the lack of independence of observations created by clustering of visits by physician. This likely reduces variability in physician communication and could overestimate model fit. However, results of prior work with this data suggest that the effect of clustering is negligible [14].

Our measure of dominance may have been limited by low variability in dominance during acute, general pediatric visits. While the expected correlation between the PCRS assessment of dominance and the affect rating of parent dominance was demonstrated, there was high correlation between the PRCS domains of dominance and understanding. This may have occurred because as patient concern increases, dominance by the physician increases as a result of the sick role [67]. Our factor loadings support this explanation as patient concern loads significantly and positively on the understanding domain.

However, future work should evaluate this theory in visits with diversity in disease severity or patient population, where greater variability in dominance may exist.

Despite considerable research on how health communication relates to health outcomes, we still know little about the specific communication processes that account for these associations. The PCRS could be used to investigate which domains in the physician–caregiver relationship impact specific outcomes such as adherence [2,3] and satisfaction [4]. This is particularly relevant for children and older adults who suffer chronic conditions requiring significant self-management and who often have visits that include a caregiver [3]. While we intended the PCRS to be comprised of objective indicators, one cannot deny that the meaning of the communication is left up to the sender and constructed by the recipient. Comparing PCRS scores with subjective caregiver and physician assessments of their relationships would add to our knowledge of the mechanisms through which communication tasks influence perceived relationship quality. In addition, because relationships are comprised of a series of interactions [5], longitudinal study with the PCRS could inform how relationships develop and change over time. Each of these areas of research would provide insights about interventions to improve health outcomes.

4.2. Conclusion

Our results suggest that the physician–caregiver relationship is not a single construct and that verbal and nonverbal behaviors have differential impacts on relationship domains.

4.3. Practice implications

Our models of domains within the physician–caregiver relationship represent a useful tool for further research on relationships and healthcare quality or outcomes. The results suggest that researchers or clinicians interested in quality improvement around therapeutic relationships might consider each domain rather than the relationship broadly. Future work with these models can also suggest specific communication interventions to improve the physician–caregiver relationship and ultimately health outcomes.

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Appendix A. Scoring the physician–caregiver relationship scales (PCRS)

This appendix provides scoring instructions for the physician–caregiver relationship scales (PCRS). This scoring involves two steps. The first step is to create ordinal variables from the roter interaction analysis system (RIAS) and nonverbal data. The second step involves aggregating the indicator variables using weights (factor scores).

The following sections detail each of these processes. These processes are critical to scoring the PCRS and to interpretation of the scales. Any changes in these processes may compromise scale reliability and validity or invalidate comparisons of scale results.

After coding the RIAS and nonverbal data from videotapes as described in the methods section, PCRS scale scores are created as follows:

A.1. Step 1. Creating ordinal variables from RIAS and nonverbal data

The first step in computing scale scores for the PCRS involves creating ordinal variables from the RIAS and nonverbal data. For most indicator variables, the raw count variable can be utilized. However, for a few indicators (physician agreements, MD proportion of total talk, MD proportion of total questions and difference in upright

Table A1
Cutpoints to create ordinal variables from RIAS and nonverbal data

	MD agreement	Parent agreement	MD proportion of total talk	MD proportion of total questions	Difference between upright postures for MD and parent
Ordinal value					
0	0–3	0–7	0–0.13	0–0.10	≤(−14.78)
1	4–6	8–15	>0.13–0.19	>0.10–0.20	>(−14.78)–(−5.50)
2	7–9	16–23	>0.19–0.25	>0.20–0.30	>(−5.50)–3.80
3	10–12	24–30	>0.25–0.31	>0.30–0.40	>3.80–13.10
4	13–15	31–38	>0.31–0.37	>0.40–0.50	>13.10–22.40
5	16–18	39–46	>0.37–0.44	>0.50–0.60	>22.40–31.70
6	19–21	47–53	>0.44–0.50	>0.60–0.70	>31.70–40.99
7	22–24	54–61	>0.50–0.56	>0.70–0.80	>40.99–50.28
8	25–27	62–69	>0.56–0.62	>0.80–0.90	>50.28–59.58
9	>27	>69	>0.62–0.68	>0.90	>59.58–68.87
10			>0.68		>68.87

Box A1. Factor scores for aggregating indicator variables

1. MD dominance = (0.986 × MD proportion of total talk) + (0.012 × MD proportion of total questions) + (0.002 × difference between upright postures for MD and parent)
2. MD-parent liking = (−0.031 × MD personal remarks) + (0.530 × MD approval) + (0.011 × MD forward leans) + (0.104 × MD laughter) + (0.046 × parent personal remarks) + (0.357 × parent approval) + (0.023 × parent forward leans) + (0.096 × parent laughter)
3. MD-parent understanding = (0.321 × MD agreement) + (0.004 × MD concern) + (0.222 × MD reassurance) + (0.095 × MD back channels) + (0.176 × MD empathy) + (0.025 × MD touch) + (0.204 × parent concern) + (0.186 × parent agreement)

postures), an ordinal value must be created. For these indicators, ordinal values are created by categorizing variables from the RIAS or nonverbal data according to the cutpoints described in Table A1.

4.4. Step 2. Aggregation of RIAS and nonverbal ordinal variables to create PCRS scores

After the RIAS and nonverbal data have been converted to ordinal values, the next step computes aggregate scale scores for each of the three PCRS domains. Computation of an aggregate scale score for liking consists of multiplying the ordinal values for each of the eight RIAS or nonverbal indicator variables by their respective physical factor score and summing the eight products, as shown in Box A1. Similarly, an aggregate scale score for understanding is obtained by multiplying the ordinal values for each of the eight RIAS or nonverbal indicator variables by their respective physical factor score and summing the eight products. An aggregate scale score for physician dominance is obtained by multiplying the ordinal values for each of the three RIAS or nonverbal indicator variables by their respective physical factor score and summing the eight products.

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