Using the Relational Coordination Instrument With a Diverse Patient Sample

Rebecca Wells, PhD, Trey W. Armstrong, MS,† and Daniel F. Brossart, PhD†*

Background: The Relational Coordination (RC) instrument has been used extensively in the context of health care interprofessional coordination. However, the instrument's applicability to patient experiences of their interactions with professionals is largely untested.

Objectives: This study's objectives were to determine: (1) whether the RC instrument could be modified for phone administration to yield internally consistent results when used with a diverse group of patients with complex health needs; and (2) whether the RC factor was invariant across patients of differing education, levels of emotional problems, race, and ethnicity, thereby showing similar interpretation of items across these groups.

Research Design: The RC instrument was administered through a phone survey to patients in Texas (n = 346) who reported receiving care coordination. Data collection occurred between 2014 and 2016. Cronbach α coefficients and confirmatory factor analysis were used to determine whether the original set of RC items could be used for phone surveys with patients. Factorial invariance testing was used to assess how consistently the instrument was interpreted across patient subgroups.

Results: The RC scale generally met acceptable α statistic and confirmatory factor analysis thresholds for internal consistency. Factorial invariance results indicated that the scale also generally performed consistently across patient subgroups.

Conclusions: This study provides preliminary evidence that the RC instrument can be used for surveying diverse patient populations. Future use of this instrument with patients can better reflect their experiences as partners with professionals in improving their health.

Key Words: Relational Coordination, care coordination, patient-centered care, psychometrics, patient surveys

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From the *Department of Management, Policy, and Community Health, The University of Texas School of Public Health, Houston; and †Department of Educational Psychology, Texas A&M University, College Station, TX.

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Reprints: Rebecca Wells, PhD, Department of Management, Policy, and Community Health, The University of Texas School of Public Health, 1200 Pressler Street, RAS E343, Houston, TX 77096. E-mail: rebecca.s.wells@uth.tmc.edu.

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Health care today is increasingly premised on partnerships between patients and providers. Patient-centered care includes ensuring that patient values guide clinical decisions.[1] Results can include better patient self-management, more preventive care, less emergent care, and improved cost effectiveness.[2–6]

Reflecting the importance of care coordination as a dimension of patient experience, prominent patient questionnaires now either include care coordinators' responsiveness and helpfulness[7] or focus entirely on this topic.[8] The Relational Coordination (RC) instrument differs from these questionnaires in originating as a way to measure teamwork.[9] RC is thus particularly well suited to revealing how patients experience their partnerships with health care professionals. Reflecting its origins, RC has been applied extensively to interdisciplinary teams.[9–12] In addition, research has applied RC to professionals' interactions with patients and family members. Two Dutch studies found that patient perceptions of RC with providers were positively associated with chronic care quality.[13,14] Another study found patient-professional RC to be positively correlated with patient well-being.[15] RC between formal and informal care providers has also been associated with better physical and psychological postsurgical patient outcomes.[16,17]

The current study tests an extension of the RC instrument to a diverse statewide sample of patients served by provider-based care coordinators. Unlike previous studies using RC, in the current study the instrument was administered by phone. Showing the internal consistency of RC for phone administration can increase the range of people with whom this instrument can be used, including patients who do not have internet access. Finally, unlike previous research focused on RC's predictive validity,[15–17] the current study explicitly tested RC's psychometric properties.

The second focus of this study was whether RC worked consistently across 4 patient subgroups. First, although previous studies have used RC with professionals of varying educational backgrounds,[18] the scale's use with patients of differing education has not previously been tested. Individuals who do not have a high school diploma or general education development (GED) certification may have more limited verbal comprehension than do those with more formal education,[19] which could affect interpretation of the RC scale. Second, emotional problems such as anxiety and depression are very common among patients with complex health needs,[20] and may affect the ways questions about relationships are interpreted.[21] Third, previous research has documented lower levels of trust in health care professionals among blacks/

African Americans, relative to whites.[22–25] This may affect interpretation of interactions with care coordinators, and hence how consistently scales such as RC perform across racial groups. Finally, people of Hispanic backgrounds may interpret relationships differently than people of other ethnicities do for cultural reasons.[26] Evidence also suggests that linguistic barriers may impede communication for some Hispanic patients.[27] Of course, each of these populations is internally heterogenous; nonetheless, showing how consistently RC performs with each key subgroup is a next step in establishing how broadly this instrument can be used.

Given frequent use of the RC instrument in health services research[10–15] and its potential to measure patient perceptions of their partnerships with providers, this study attempted to answer the following questions:

(1) Does the RC instrument exhibit internal consistency when used for phone surveying with diverse patients with complex health needs?
(2) Does the RC instrument exhibit consistency across patients with differing educational levels, emotional problems, race, and ethnicity?

The study context was the Texas Medicaid 1115(a) waiver, which provides incentive payments for a range of patient-centered projects, including care coordination. Past studies have found care coordination to be associated with improved primary care use[28] and lower emergency department readmission rates.[29] The core of care coordination is a partnership between the patient and coordinator. Hence, this care coordination appeared to be particularly well suited to measurement through the RC instrument.

METHODS

Patient Sample

Data were collected through phone surveys of 2 cohorts of patients from 20 sites in Texas. The sampling frame was composed of patients identified by study sites as receiving Medicaid waiver-funded care coordination at the 2 points when the sites sent rosters to the research team, or identified by study sites or through Medicaid enrollment and claims files as having used emergency departments ≥ 5 times in the previous year. Half of the sites had Medicaid waiver care coordination projects, typically focused on frequent emergency department use, and the other half had a range of other similar initiatives for patients with complex health needs, including enhanced care transitions, chronic care management, and case management. Sites included hospitals, emergency medical services, and community mental health centers. Care coordination programs varied in their use of nurses versus social workers as well as the nature of training coordinators received and caseloads. However, programs shared a common model of addressing whatever was precipitating each individual's emergent care, often including gaps in routine services and disease self-management. Hence, a substantial proportion of patients at all sites reported receiving care coordination, who were asked about their experiences thereof. Cohort 1 (n = 187) was surveyed in 2014–2015, and cohort 2 (n = 159) was surveyed in 2016.

The survey participation rate averaged 29% across the 2 cohorts. Some sites sent information in patient rosters that made it possible to compare attributes of participants and nonparticipants: 1 site included ethnicity; 2 sites included whether patients spoke English; 3 sites included patient sex; 4 sites included health insurance status; and 6 sites included age. Comparisons using these data indicated that nonparticipants were more likely to be uninsured than were participants ($\chi^2 = 31.88$, $P < 0.001$). However, participants and nonparticipants did not differ in ethnicity, language, sex, or age. All study processes were approved by the (omitted for peer review) Institutional Review Board and patients surveyed gave oral consent.

RC Measures

The 7 items in the RC instrument address frequency, timeliness, accuracy, problem-solving communication, shared goals, shared knowledge, and mutual respect.[30] Relational Coordination Analytics Inc.[31] gave permission to modify the instrument for consistent response options on a single Likert scale for phone surveying. This affected 1 item in particular: The original problem-solving communication question was "When there is a problem with (work process), do people in each of these groups blame others or work with you to solve the problem?" This was premised on the assumption that blaming and working together were opposite ends of a single continuum, an assumption that had not previously been tested. To use a single Likert response scale for phone administration, this item was split into 2 questions, one related to blaming and the other to problem-solving. The original language of the instrument and that used with patients in the current study are shown in Table 1. Wording was also slightly simplified in some instances.

The RC items were part of a broader questionnaire that included patient background attributes used in the current study to assess scale consistency across patients of differing education, emotional problems, race, and ethnicity, as well as other topics that were not included in the current analysis, such as routine and emergent health care use. To assess how consistently RC questions were interpreted across levels of emotional problems, the following question was used from the SF-8 Health Survey[32]: "During the past 4 weeks, how much have you been bothered by emotional problems (such as feeling anxious, depressed, or irritable)?" For current analyses, the measure was dichotomized to be low when patients chose responses of "not at all," "slightly," or "moderately," and high for "quite a lot" or "extremely." Pilot testing indicated that patients who identified as Hispanic were often confused or annoyed when asked their race; hence, the team subsequently treated race and Hispanic ethnicity as mutually exclusive. Finally, patients were also asked about age, sex, insurance status, aspects of living circumstances reflecting social support and other resources (whether the patient lived alone or worked outside the home), as well as a number of prevalent health conditions. Because the research team changed questions about health conditions between cohorts, 3 of these measures were available only for cohort 1.

Statistical Analyses

The η^2 statistic was used to estimate the proportion of variance in RC values attributable to site versus patient attributes.

TABLE 1. Patient and Care Coordinator Relational Coordination Instrument Wording

Construct	Original Wording of the Question	Wording of the Question as Used With Patients in This Study
Frequency	How frequently do people in each of these groups communicate with you about (work process/client population)?	(After a question about how often the patient needed information from the care coordinator) When you need that information from (care coordinator), how often do you get it?
Timeliness	Do they communicate with you in a timely way about (work process/client population)?	How often does (care coordinator) give you information (to manage your health condition) as quickly as you need it?
Accuracy	Do they communicate with you accurately about (work process/client population)?	How often do you think the information (care coordinator) gives you is accurate?
Problem-solving Communication	When there is a problem with (work process/client population), do people in each of these groups blame others or work with you to solve the problem?	Problem-solving When there is a problem, how often does (care coordinator) work with you to solve the problem? Blaming* When there is a problem, how often does (care coordinator) blame others?
Shared knowledge	Do people in each of these groups know about the work you do with (work process/client population)?	How often does (care coordinator) know about the work you do to manage your health?
Mutual respect	Do people in each of these groups respect the work you do with (work process/client population)?	How often does (care coordinator) respect the work you do to manage your health?
Shared goals	Do people in each of these groups share your goals for (work process/client population)?	How often does (care coordinator) have the same goals as you do for managing your health?

Response options for the original instrument varied. Response options for the revised instrument were: never (0); rarely (1); some of the time (2); most of the time (3); all of the time (4); or not applicable (missing).

*Subsequently deleted as a result of the psychometric analysis.

A significant value would indicate the need to incorporate site in subsequent analyses. The study questions were then addressed through 2 sets of analyses. First, confirmatory factor analysis (CFA) tested the internal consistency of RC items for the current patient sample. Second, factorial invariance testing was used to assess how consistently different patient subgroups interpreted RC.[33]

CFA-related analyses were conducted using STATA 14.[34] Maximum likelihood with missing values was used to retain observations with missing data. A Dornik-Hansen test was used to determine whether the data had multivariate normality.

A combination of criteria were used to assess RC internal consistency with and without the blame item, using cohort 1 (n = 187). First, a minimum threshold of 0.7 for Cronbach α was used.[35] When Cronbach α was <0.7, the item that most adversely affected the overall α coefficient was removed. This process was repeated until the α either exceeded 0.7 or could not be further maximized. In addition, the factor analysis process involved removing any items with absolute value factor loadings less than a minimum threshold set at the 0.4.[36]

The indices used to assess global model fit were root mean square error of approximation (RMSEA), Tucker-Lewis index (TLI), and comparative fit index (CFI), with acceptable thresholds for each index were set as: RMSEA < 0.06, TLI > 0.95, and CFI > 0.95.[37] These fit index values were used to assess appropriateness of the models run sequentially, starting with all items in the model, removing any items that were not significant, and refitting the modified model. The χ^2 statistics indicating model fit are also shown, although not emphasized because of their sensitivity to sample size.[38]

Factorial invariance was tested using configural, metric, and scalar tests on the combined sample (n = 346) through maximum likelihood estimation with robust SEs (MLR) in MPlus 8.[39] The comparisons were between: for education, patients who had neither completed high school nor a GED (n = 116), and patients with at least a GED (n = 227; this measure was missing for 3 individuals); for emotional problems, patients who indicated low levels (n = 231) and those with high levels (n = 115); for race, patients who self-reported as black or African American (n = 95) and those who did not (n = 251); and for ethnicity, patients who self-reported as Hispanic (n = 186) and those who did not (n = 160).

Configural invariance indicates whether a scale's "pattern" fits well across groups (ie, has the same underlying latent configuration, such as all belonging to 1 factor). For the current study, this was assessed beginning with CFA for each patient group's overall RC model fit. Metric invariance indicates equal factor loadings across groups. The χ^2 tests were then used to compare metric versus configural model fits for each set of patient groups. Nonsignificant χ^2 statistics for this comparison indicate metric invariance, sometimes referred to as weak invariance. Finally, a χ^2 test comparing the scalar and metric models was used to determine whether item intercepts were consistent across groups. Nonsignificant results indicate that a scale meets the more stringent threshold of scalar (or "strong") invariance, showing consistent interpretations of means across groups.

RESULTS

Patient attributes are shown in Table 2. The average patient participating in this survey who reported receiving care coordination was 49 years old. The majority of survey participants (63%) were female. More than half (54%) of the sample identified as Hispanic, and 27% identified as non-Hispanic black/African American. Over half (56%) of the

TABLE 2. Patient Attributes

	Cohort 1 (n = 187)	Cohort 2 (n = 159)	Combined Sample (n = 346)
Age [mean (range)] (y)	47.1 (range, 18–84)	50.9 (range, 19–86)	48.8 (range, 18–86)
Male	32	42	37
Race/ethnicity (%)			
Hispanic	55	53	54
Non-Hispanic white	17	15	17
Non-Hispanic black/ African American	26	30	27
Other	2	2	2
Education (%)			
No GED or high school	37	31	34
GED	11	8	9
High school	22	29	25
Some college/ associates	23	26	24
College degree or higher	7	7	7
Insurance type (%)			
None	30	30	30
Medicaid only	16	25	20
Medicare only	8	13	10
Dual eligibility	16	15	15
Other (eg, private)	31	18	25
Other characteristics (%)			
Live alone	23	25	24
Work outside the home	21	13	17
Self-reported health conditions (%)			
Hypertension	60	72	66
Diabetes	45	54	49
COPD	21	27	24
Asthma	26	NA	NA
Bipolar depression	15	NA	NA
Schizophrenia	8	NA	NA
Emotional problems (SF-8) health survey			
Not at all	24	29	26
Slightly	30	22	26
Moderately	16	13	14
Quite a lot	20	24	22
Extremely	10	13	11

Totals may sum to >100% due to rounding.

COPD indicates chronic obstructive pulmonary disease; GED, general education development; NA, not available; SF-8, 8-item short form health survey.

patients had at least a high school diploma or GED. Almost a third (30%) of the patients were uninsured, and, consistent with the high level of health complexity among patients identified for care coordination, 15% had dual Medicare-Medicaid eligibility. Under one fifth (17%) worked outside the home. The most commonly identified physical condition was hypertension (66%), and 33% of patients indicated "quite a lot" or "extremely" high levels of emotional problems.

Testing the Inclusion of Blaming as Part of Problem-solving Communication

The η^2 value for RC of 0 indicated that variation was fully explained by patient-level attributes; hence, analyses were conducted at the patient level. Table 3 shows the results of 2 iterations of CFA for cohort 1 patients' perceptions of interactions with care coordinators, initially including 2 items for problem-solving versus blaming others, as well as frequency, timeliness, accuracy, shared goals, shared knowledge, and mutual respect. A loading factor of 0.07 for (reverse-scored) blaming, well below the minimum acceptable value of 0.40, indicated poor fit of this item with the rest of the scale. The problem-solving and (original) blaming items were also weakly intercorrelated (–0.017; not shown), contrary to initial expectations they would exhibit a strong correlation as opposite ends of a common continuum. Because of the weak intercorrelation and nonsignificant factor loading ($P = 0.411$), the blaming item was removed from subsequent analyses and not included in the questionnaire used with cohort 2.

With the blaming item removed, the second model iteration yielded acceptable values for the Cronbach α (0.88) and factor loadings (range, 0.69–0.83), as well as RMSEA (0.10), TLI (0.93), and CFI (0.95) close to acceptable thresholds. Thus, this second and final CFA model for cohort 1 patients included the following items: frequency, timeliness, accuracy, problem-solving communication, shared goals, shared knowledge, and mutual respect.

Factorial Invariance–Education

The RC Cronbach α was 0.80 for patients with less than a high school/GED and 0.91 for patients with more education, which did not yield a statistically significant difference ($t = 1.37$, $P = 0.172$; Table 4). Fit indices for the configural model fit yielded values at or close to acceptable thresholds (RMSEA = 0.07 for those without high school or GED and 0.13 for those with, TLI = 0.95 for those without high school/GED and 0.92 with, and CFI = 0.96 for those without high school and 0.94 for those with). Thus, model fit statistics were slightly better for patients with less than a high school education, despite the (nonsignificantly) lower α coefficient for this group, relative to patients with at least a high school diploma or GED. Comparing the fit of the metric model to the configural model yielded a nonsignificant χ^2 value ($\chi^2 = 7.18$, $P = 0.305$; Table 5) as did comparing the scalar model to the metric model ($\chi^2 = 1.30$, $P = 0.972$). Thus, RC showed both metric and scalar variance across patient educational levels. Collectively, these statistics indicate that the RC instrument generally met acceptable internal consistency thresholds and showed strong factorial invariance for patients with varying levels of education.

Factorial Invariance–Emotional Problems

The RC Cronbach α was 0.87 for patients with low self-reported emotional problems and 0.91 for patients with high levels of emotional problems ($t = 0.44$, $P = 0.664$; Table 4). Fit indices related to the overall configural model fit yielded results at or approaching acceptable thresholds (RMSEA = 0.12 vs. 0.10 for those with low vs. high emotional problems; TLI = 0.90 for those with low emotional problems and 0.96 for those with high; CFI = 0.93 for those with low emotional problems and 0.97 for those with high). Fit statistics were thus slightly better for patients who reported higher levels of emotional problems. The metric model compared with the configural model yielded a nonsignificant χ^2 value ($\chi^2 = 7.25$,

TABLE 3. Confirmatory Factor Analysis Testing Overall Scale Internal Consistency

	Cohort 1 (n = 187)						
	Relational Coordination With Blame			Relational Coordination Without Blame			
Internal Consistency Scale	**Measure**	**95% CI**	***P***	**Measure**	**95% CI**	***P***	***P* of Difference**
Cronbach α	0.82	—	—	0.88	—	—	0.40
Item factor loading							
Frequency	0.71	0.62–0.80	< 0.001	0.71	0.62–0.80	< 0.001	—
Timeliness	0.83	0.76–0.89	< 0.001	0.83	0.76–0.89	< 0.001	—
Accuracy	0.81	0.74–0.88	< 0.001	0.81	0.74–0.88	< 0.001	—
Problem-solving	0.69	0.61–0.78	< 0.001	0.69	0.61–0.78	< 0.001	—
Blame (reverse coded)	0.07	0.23–0.09	0.411	—	Removed	—	—
Shared knowledge	0.72	0.64–0.81	< 0.001	0.72	0.64–0.80	< 0.001	—
Mutual respect	0.74	0.66–0.82	< 0.001	0.74	0.66–0.82	< 0.001	—
Shared goals	0.76	0.69–0.84	< 0.001	0.76	0.69–0.83	< 0.001	—
Fit measures							
RMSEA (90% CI)	0.10	0.07–0.13	0.008	0.10	0.07–0.14	0.001	—
TLI	0.92	—	—	0.93	—	—	—
CFI	0.94	—	—	0.95	—	—	—
χ^2	54.43 (20 *df*)	—	< 0.001	40.57 (14 *df*)	—	< 0.001	—

CFI indicates comparative fit index; CI, confidence interval; *df*, degrees of freedom; RMSEA, root mean square error of approximation; TLI, Tucker-Lewis index.

$P = 0.299$; Table 5), indicating metric invariance. However, the scalar model compared with the metric model yielded a significant χ^2 value, failing to support scalar invariance ($\chi^2 = 12.79$, $P = 0.047$). Hence, the RC instrument exhibited acceptable or nearly acceptable model fit across levels of emotional problems, as well as weak invariance.

Factorial Invariance–Race

RC Cronbach αs were virtually identical for black/African American (0.88) versus other (0.89) patients ($t = 0.10$, $P = 0.918$; Table 4). Fit indices for the configural model were at or near acceptable thresholds (RMSEA = 0.13 for black/African American, and 0.10 for other; TLI = 0.90 for African American, and 0.95 for other; and CFI = 0.93 for African American and 0.96 for others). Fit statistics were generally slightly worse for African American patients than for other patients. The metric compared with the configural model yielded a nonsignificant χ^2 value ($\chi^2 = 12.11$, $P = 0.060$; Table 5), whereas the scalar model compared with the metric model yielded a significant χ^2 value ($\chi^2 = 14.10$, $P = 0.029$). Thus, as with emotional problems, the RC instrument exhibited metric but not scalar invariance across patient racial groups, although CFA indicated generally acceptable or close to acceptable internal consistency for both groups.

Factorial Invariance–Ethnicity

As with race, the RC Cronbach α was virtually identical for Hispanic (0.88) versus other (0.88) patients ($t = 0.11$, $P = 0.909$; Table 4). Also as with previous cross-group comparisons, fit indices related to the configural model values were at or near acceptable thresholds: RMSEA = 0.10 for Hispanic and 0.13 for other, TLI = 0.94 and 0.91, and CFI = 0.96 and 0.94. Overall, differences in fit indices were very small across ethnic groups. The metric model compared with the configural model yielded a nonsignificant χ^2 value ($\chi^2 = 6.11$, $P = 0.411$) as did the scalar model compared with the metric model ($\chi^2 = 9.56$, $P = 0.145$; Table 5). Hence, the RC instrument exhibited generally acceptable fit across Hispanics and non-Hispanics as well as strong factorial invariance.

DISCUSSION

The current study suggests that the RC instrument can yield generally acceptable internal consistency when used over the phone with a diverse sample of patients who have high levels of medical complexity and often very limited resources. Philosophically, RC is appealing in including the voice of patients as members of their health care teams. Using this common scale with patients and professionals may also yield new insights. For instance, comparing patient and professional perceptions of their common interactions may identify discrepancies in their views, which could then be addressed to improve trust and cooperation. The RC instrument might also be used to trace effects of planned or unplanned organizational changes on patient as well as staff experiences; doing so proactively might facilitate more timely recalibrations. Future testing on larger samples may support using the RC to compare the quality of coordination across groups as part of efforts for ensuring equity.

An incidental finding of interest from the initial CFA was that blaming and problem-solving do not appear to be different ends of a single continuum. It may be that individuals facing problems can both blame one another and work together to solve them. Thus, although the original problem-solving item with both problem-solving and blame components has loaded well on the RC scale in previous administrations,[10] results of the current study indicate that future administrations could omit blaming.

Results also indicate that key patient subgroups interpreted RC in generally consistent ways, although factorial invariance was weak relative to levels of emotional problems and race.[40] These results might reflect the small numbers of patients in some of these subgroups.

Finally, the current findings indicate that, despite previous evidence that limited education and linguistic barriers

TABLE 4. Relational Coordination Internal Consistency Across Patient Subgroups

	Education							Emotional Problems						
	Less than High School or GED (n = 116)			High School/GED or More (n = 227)				Low (n = 231)			High (n = 115)			
	Measure	95% CI	*P*	Measure	95% CI	*P*	*P*-value Difference	Measure	95% CI	*P*	Measure	95% CI	*P*	*P*-value Difference
Cronbach α	0.80	—	—	0.91	—	—	0.172	0.87	—	—	0.91	—	—	0.664
Item factor loading														
Frequency	0.61	0.45–0.77	< 0.001	0.82	0.77–0.88	< 0.001	—	0.81	0.75–0.87	< 0.001	0.72	0.61–0.83	< 0.001	—
Timeliness	0.67	0.53–0.81	< 0.001	0.85	0.80–0.90	< 0.001	—	0.82	0.76–0.88	< 0.001	0.84	0.77–0.91	< 0.001	—
Accuracy	0.79	0.69–0.90	< 0.001	0.79	0.73–0.86	< 0.001	—	0.76	0.68–0.84	< 0.001	0.82	0.74–0.89	< 0.001	—
Problem-solving	0.57	0.43–0.71	< 0.001	0.84	0.80–0.89	< 0.001	—	0.74	0.75–0.81	< 0.001	0.84	0.78–0.91	< 0.001	—
Shared knowledge	0.65	0.51–0.78	< 0.001	0.78	0.73–0.84	< 0.001	—	0.72	0.65–0.80	< 0.001	0.79	0.72–0.87	< 0.001	—
Mutual respect	0.65	0.52–0.78	< 0.001	0.83	0.78–0.88	< 0.001	—	0.75	0.69–0.82	< 0.001	0.86	0.81–0.92	< 0.001	—
Shared goals	0.70	0.58–0.82	< 0.001	0.79	0.73–0.84	< 0.001	—	0.75	0.69–0.82	< 0.001	0.82	0.75–0.89	< 0.001	—
Fit measures														
RMSEA (90% CI)	0.07	0.00–0.12	0.275	0.13	0.10–0.16	< 0.001	—	0.12	0.09–0.15	< 0.001	0.10	0.05–0.15	0.065	—
TLI	0.95	—	—	0.92	—	—	—	0.90	—	—	0.96	—	—	—
CFI	0.96	—	—	0.94	—	—	—	0.93	—	—	0.97	—	—	—
χ^2	21.43 (14 *df*)	—	0.091	67.75 (14 *df*)	—	< 0.001	—	62.04 (14 *df*)	—	< 0.001	28.93 (14 *df*)	—	0.011	—
	Race							Ethnicity						
	Black/African American (Non-Hispanic) (n = 95)			Non-Black/African American (n = 251)				Hispanic (n = 186)			Non-Hispanic (n = 160)			
	Measure	95% CI	*P*	Measure	95% CI	*P*	*P*-value Difference	Measure	95% CI	*P*	Measure	95% CI	*P*	*P*-value Difference
Cronbach α	0.88	—	—	0.89	—	—	0.92	0.88	—	—	0.89	—	—	0.91
Item factor loading														
Frequency	0.80	0.70–0.90	< 0.001	0.77	0.70–0.84	< 0.001	—	0.78	0.70–0.85	< 0.001	0.77	0.69–0.86	< 0.001	—
Timeliness	0.84	0.76–0.93	< 0.001	0.80	0.74–0.86	< 0.001	—	0.80	0.73–0.87	< 0.001	0.83	0.76–0.90	< 0.001	—
Accuracy	0.70	0.56–0.93	< 0.001	0.83	0.78–0.89	< 0.001	—	0.82	0.76–0.89	< 0.001	0.77	0.68–0.85	< 0.001	—
Problem-solving	0.81	0.72–0.89	< 0.001	0.76	0.70–0.82	< 0.001	—	0.74	0.66–0.82	< 0.001	0.82	0.76–0.88	< 0.001	—
Shared knowledge	0.76	0.66–0.86	< 0.001	0.74	0.67–0.80	< 0.001	—	0.71	0.63–0.80	< 0.001	0.78	0.70–0.85	< 0.001	—
Mutual respect	0.77	0.68–0.87	< 0.001	0.82	0.77–0.87	< 0.001	—	0.77	0.70–0.84	< 0.001	0.83	0.77–0.89	< 0.001	—
Shared goals	0.74	0.64–0.85	< 0.001	0.79	0.74–0.85	< 0.001	—	0.76	0.69–0.84	< 0.001	0.80	0.73–0.87	< 0.001	—
Fit measures														
RMSEA (90% CI)	0.13	0.08–0.18	0.008	0.10	0.07–0.13	0.008	—	0.10	0.06–0.14	0.014	0.13	0.09–0.17	< 0.001	—
TLI	0.90	—	—	0.95	—	—	—	0.94	—	—	0.91	—	—	—
CFI	0.93	—	—	0.96	—	—	—	0.96	—	—	0.94	—	—	—
χ^2	36.42 (14 *df*)	—	0.019	45.66	—	< 0.001	—	39.55 (14 *df*)	—	< 0.001	51.63 0.89	—	< 0.001	—

CFI indicates comparative fit index; CI, confidence interval; GED, general education development; HS, high school; RC, relational coordination; RMSEA, root mean square error of approximation; TLI, Tucker-Lewis index.

TABLE 5. Factorial Invariance Testing Results

	Education (Less than High School/GED vs. High School/GED or Higher)		Emotional Problems (Low vs. High)		Race (Black vs. Other)		Ethnicity (Hispanic vs. Other)	
	Measure	*P*	Measure	*P*	Measure	*P*	Measure	*P*
Model comparison χ^2 statistics:								
Metric vs. configural	7.18	0.305	7.25	0.299	12.11	0.060	6.11	0.411
Scalar vs. metric	1.30	0.972	12.79	0.047	14.10	0.029	9.56	0.145

GED indicates general education development.

can impede comprehension,[19,27] the RC instrument can be administered with patients of varying educational levels and with both Hispanics and non-Hispanics. This bodes well for including patients with limited education in future investigations using RC to measure patient-professional relationships, as well as for including the increasing proportion of Hispanics in the United States in such research.

Limitations

CFA is premised on multivariate normality, adequate sample size, and random sampling.[41] A significant *P*-value for the Dornik-Hansen test in the combined sample indicated that RC items failed to exhibit multivariate normality. Also, while the combined cohort sample size met the minimum threshold of 200, not all of the subgroups used to test factorial invariance did. Thus, this study's results should be interpreted as provisional until future analyses can be conducted on larger samples of patients. In addition, the 29% response rate raises concerns about nonrandom self-selection. Comparisons on measures available for both respondents and nonrespondents indicated that the respondents were generally representative of the sampling frame in measured attributes. Potentially greater sources of sample selection bias are patient attributes related to health insurance, given the disproportionate tendency of uninsured patients not to participate in the survey. This suggests caution in inferences until future studies can overcome this limitation.

Implications for Practice

This study suggests that the RC instrument can be used with a diverse range of patients, including those with complex medical conditions who are the focus of most care coordination, and those with limited formal education. Using the RC over the phone could enable future studies to include a broader range of patients than might be likely to complete online or written surveys. Such flexibility may be useful for reaching busy health care professionals as well. One possible approach could be to mail or email the questions in advance, inviting individuals to complete the questionnaire in writing or online if they wished, or to respond to the items on the phone with a trained survey caller. This could have the advantages of allowing participant to choose the survey modality they prefer, including the possibility of being able to see the items and response options as the surveyor reads each out loud, which might be particularly useful for individuals with any circumstances impeding comprehension. In essence, the current study offers promise that an instrument popular for assessing interdisciplinary teamwork may be used to include patient perspectives as well. More fully including the patient voice in measurement of coordination should help decision makers continue to make health care more patient-centered.

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