RESEARCH ARTICLE

Development and psychometric assessment of a survey to measure specialty care coordination as experienced by primary care providers

Varsha G. Vimalananda MD, MPH^{1,2} | Mark Meterko PhD^{3,4} | Shirley Qian MS¹ | Jolie B. Wormwood PhD^{1,5} | Amanda Solch MSW¹ | Benjamin Graeme Fincke MD^{1,4}

¹Center for Healthcare Organization and Implementation Research (CHOIR), Edith Nourse Rogers Memorial VA Medical Center, Bedford, Massachusetts

²Section of Endocrinology, Diabetes and Metabolism, Boston University School of Medicine, Boston, Massachusetts

³VHA Office of Reporting, Analytics, Performance, Improvement and Deployment (RAPID – 10EA), Field-Based at the Edith Nourse Rogers Memorial VA Medical Center, Bedford, Massachusetts

⁴Department of Health Law, Policy and Management, Boston University School of Public Health, Boston, Massachusetts

⁵Department of Psychology, University of New Hampshire, Durham, New Hampshire

Correspondence

Varsha G. Vimalananda, MD, MPH, Center for Healthcare Organization and Implementation Research (CHOIR), Edith Nourse Rogers Memorial VA Medical Center, 200 Springs Road (152), Bedford MA 01730. Email: varsha.vimalananda@va.gov

Funding information

VA Health Services Research & Development (HSR&D) Career Development, Grant/Award Number: 5IK2HX002137-04

Abstract

Objective: To assess the psychometric properties and construct validity of a survey of primary care providers' (PCPs') experience of specialty care coordination, which is a counterpart to our existing survey ("CSC-Specialist") that measures specialists' experience of specialty care coordination.

Data Sources: We surveyed PCPs from Veterans Health Administration medical centers and community-based outpatient clinics nationwide ($N = 1576$) in April 2018.

Study Design: We developed candidate items through literature review, existing surveys, PCP interviews, and expert opinion. We used exploratory and confirmatory factor analysis to develop scales and multivariable linear regression to determine their association with PCPs' overall experience of coordination.

Data Collection: The online survey included 23 candidate scale items about specialty care coordination and a single item asking respondents to rate their overall experience of specialty care coordination on a 0-10 scale. All VA PCPs were eligible. We sent survey invitations to PCPs following local Section Chiefs' email introduction ($N = 926$) and by directly emailing two random samples ($N = 400$ and $N = 6653$), overall response rate across the three nonoverlapping samples = 24 percent.

Principal Findings: Analyses identified 20 items forming 6 scales with strong psychometric properties and predictive power for overall coordination. Two scales are identical to CSC-Specialist scales: "Communication" ($k = 3$, $\alpha = 0.87$) and "Data Transfer" ($k = 2$, $\alpha = 0.92$); one is similar: "Relationships and Collaboration" ($k = 6$, $\alpha = 0.90$). The three remaining scales address the PCP's unique perspective: "Role Clarity" ($k = 3$, $\alpha = 0.85$), "Role Agreement" ($k = 3$, $\alpha = 0.75$), and "Making Referrals" ($k = 3$, $\alpha = 0.75$). The six scales together explained 67 percent of the variance in PCPs' overall coordination experience with specialists.

Conclusions: The Coordination of Specialty Care-Primary Care Provider Survey (CSC-PCP) is a novel 20-item survey that can be used in quality improvement or health services research, alone or in combination with the CSC-Specialist, to evaluate coordination of care as experienced by either or both participants.

KEYWORDS

consultation, coordinated care, primary care, psychometrics, specialty care, survey research

1 | INTRODUCTION

Primary care serves as a central point for coordinating patient care across a variety of health care settings.¹⁻³ Over 100 million primary care visits yearly result in referrals to specialty care.⁴ Each referral initiates a link between primary and (sub)specialty care. These then require coordination between clinicians to transfer information from the primary care provider (PCP) about the reason for referral and prior workup; to transfer specialist recommendations back to the PCP; and to obtain agreement between the PCP and the specialist about the management plan and role of the specialist in ongoing care.⁵

A shared EMR may ameliorate obstacles to coordination, but not eliminate them. In the Veterans Health Administration (VA), for example, PCPs and specialists share an electronic health record (EHR) but report lack of clarity and agreement on roles and responsibilities, difficulty in timely direct communication, and disagreement on the need for prereferral tests.⁶ The shared EHR is insufficient for negotiating these disagreements and for communicating about urgent or complex issues.^{6,7}

Current measures of specialty care coordination are limited. We are unaware of any that are specific to the specialty care referral process, assess more than one stakeholder's perspective, and assess coordination itself (as opposed to its consequences or the presence of mechanisms meant to promote it).^{8,9} These shortcomings limit existing measures' comprehensiveness and ability to pinpoint specific targets for action.

The PCP, the specialist, and referred patients themselves (the "specialty care triad") are most directly involved in coordination and best situated to assess it. As per McDonald,⁸ measurement of coordination should account for the overlapping and the unique needs, values, and priorities that are determined by each participant's role in the process. For this reason, we are developing a family of three related questionnaires—one for each member of the specialty care triad. We previously published a 13-item measure of care coordination from the specialist's perspective.¹⁰ The patient measure is under development. Here, we report on the development and psychometric assessment of the Coordination of Specialty Care-Primary Care Provider Survey (the CSC-PCP).

2 | METHODS

2.1 | Approach to measure development

We aimed to construct a reliable, valid, and comprehensive measure of the PCP's experience of care coordination with specialists that also identifies problems amenable to remedy. By measuring clearly defined experiences rather than general satisfaction, survey results help identify what should be done differently to ensure well-coordinated care.

What this Study Adds

- Measures of care coordination must account for the unique perspectives of each participant
- A measure is needed to assess coordination with specialists as experienced by primary care providers
- We developed and conducted psychometric assessment of a 20-item survey of specialty care coordination: The Coordination of Specialty Care-Primary Care Provider Survey (CSC-PCP)
- The CSC-PCP can be used alone or paired with our companion survey for specialists (the CSC-Specialist) in research or quality improvement focused on specialty care coordination

A secondary objective was to use items as similar as possible to the existing CSC-Specialist survey so as to yield parallel measures of specialty care coordination across these two stakeholders, while recognizing that some concepts would be unique to the PCP experience and others might be similar but seen from a different perspective by PCPs.

To develop a conceptual framework for survey development, we previously used literature review, existing surveys, and interviews with PCPs and specialists to identify four key care coordination constructs: mutually respectful and collaborative relationships, clear roles and responsibilities, clear and timely communication, and timely and accurate data transfer.¹⁰

2.2 | Selection, modification, and refinement of existing items and scales

We developed a set of draft items in four steps. First, we reviewed 101 existing surveys to identify those that (a) could measure coordination from the physician perspective, (b) focused on the respondent's experience of coordination, (c) were independent of a patient's diagnosis, (d) were applicable to outpatient care, (e) were independent of practice setting, and (f) provided empirical evidence of reliability and validity. Our sources included the 2010⁸ and the 2014¹¹ AHRQ Care Coordination Atlases, the National Quality Forum,¹² the Consumer Assessment of Healthcare Providers and Systems family of surveys,¹³ the American College of Physicians Neighbor¹⁴ and National Committee on Quality Assurance tools,^{15,16} and a 2013 systematic review of care coordination surveys.⁹ Five surveys met all six criteria.¹⁷⁻²¹ Each of these surveys omitted at least a substantial part of one or more domains.

From the five surveys, the principal investigator (VV) identified 23 potentially relevant candidate items and mapped these to our conceptual framework. Three investigators independently reviewed these items and rated the most relevant items for

each construct. When possible, we retained intact scales from the source surveys for consideration. We developed new items as necessary to ensure 3-5 items for each construct to balance brevity in the final measure with comprehensive coverage of each construct. We also aimed to use language parallel to the CSC-Specialist survey.

We refined items for clarity and relevance with input from an eight-member expert panel: two each of VA PCPs, non-VA PCPs, medical specialists, and health care coordination subject matter experts. Finally, we conducted cognitive interviews with three VA and two non-VA PCPs (not previously interviewed) to further refine item wording, and then tested the revised items with the same five informants.

The draft CSC-PCP survey had 23 items representing the four constructs in our framework describing the key dimensions of care coordination between PCPs and specialist (mutually respectful and collaborative relationships, clear roles and responsibilities, clear and timely communication, and timely and accurate data transfer). Twenty of the items used a seven-point frequency scale (1: Never; 2: Rarely—less than 10 percent of the time; 3: Occasionally—about 30 percent of the time; 4: Sometimes—about 50 percent of the time; 5: Frequently—about 70 percent of the time; 6: Usually—about 90 percent of the time; 7: Always).²² The remaining three items used a five-point scale (1: Strongly Disagree; 2: Disagree; 3: Neither agree nor disagree; 4: Agree; 5: Strongly Agree). We also asked respondents to rate, on a 0-10 scale, their overall experience of coordination with specialists.

We included other items that might be useful in further understanding any observed patterns in the data. These included questions about demographic and practice characteristics, aspects of appointment scheduling and patient preparation, and questions about the perceived impact of recent reorganization of VA primary care clinics. We included three-item measures of both burnout and of job satisfaction²³ for use as control variables in our preliminary test of construct validity. We also included several items about specific mechanisms used to coordinate care and PCPs' perception of their helpfulness. The final survey consisted of 62 items in total.

We aimed to understand PCPs' experiences with a broad range of VA medical specialty services. We instructed respondents to select the medical specialties to which they referred at least twice monthly. Of those specialties selected, respondents were asked to indicate those for which most referrals were seen by specialists within VA rather than in the community. An algorithm presented the respondent's own list of specialties meeting both criteria in a random order. Respondents were asked to check the first specialty on the list and then instructed to respond to the remainder of the survey with respect to that specialty. This process ensured that we would obtain evaluations of coordination with a broader range of specialties than would have been obtained if PCPs had simply been allowed to focus on the specialty to which they referred the most patients.

2.3 | Survey administration

We administered the survey online to a national sample of VA PCPs using the SurveyMonkey platform in April 2018.

We tested two recruitment strategies. At 10 sites, our survey invitation was preceded by an introductory email by the Primary Care Section Chief. We "replied all" to the Chiefs' email with the invitation ($N = 926$ recipients). As a second, less labor-intensive approach, we sent survey invitations directly to a random sample of 400 PCPs identified using VA Corporate Data Warehouse (CDW) data. Response rates were 33 and 24 percent, respectively, for the Chief introduction and direct contact approaches. Based on time and resource considerations, we opted to pursue the less labor-intensive approach for the remainder of the national survey administration.

For the planned exploratory factor analysis, we required at least 10 respondents per each of the 23 coordination-related items; a total of 460 to constitute both derivation and validation samples. To ensure an adequate sample size for this analysis, we emailed survey invitations directly to a third random national sample of 6653 VA PCPs, excluding those at facilities where the Chief had sent an introduction email; the response rate was 22 percent. Nonrespondents were all emailed a total of 3 reminders at 4- or 5-day intervals. In total, we sent survey invitations to 7979 email addresses.

2.4 | Statistical analysis

We examined item-level descriptive statistics for each survey question, including item missing rate, mean, standard deviation, skew, and kurtosis. We randomly split the sample evenly into derivation and validation samples.

We examined patterns of missing data among the 23 candidate coordination scale items using the entire sample ($N = 1576$). We computed correlations and t tests to explore the relationships between all 14 demographic and practice characteristics and all 23 hypothesized scale-related items to identify potential auxiliary variables for use in multiple imputation of missing values. We also examined the relationship between demographic and practice characteristics and missingness on the candidate scale items.

To identify the latent constructs underlying the response patterns in the data, we conducted exploratory factor analyses (EFA) in the derivation sample using the full information maximum likelihood (FIML) method in SAS PROC CALIS to output an item covariance matrix based on the total dataset, both complete and incomplete observations, which then served as the input to the EFA.²⁴ We used principal axis factoring for initial factor extraction and the promax method to rotate and clarify factor loadings.²⁵ The goal of the EFA was to identify a structure that was simple, interpretable, and maximized the opportunity to compare similar scales between the new CSC-PCP and the existing CSC-Specialist surveys. We used factor loadings of ≥ 0.40 as the criterion for assigning items to factor-based scales.²⁶⁻²⁸

We tested the EFA factor solutions using confirmatory factor analysis (CFA) with FIML in the validation sample. CFA provides multiple empirical estimates of the goodness of fit between the proposed item-to-scale structure and the actual relationships observed in the data.^{29,30} We examined the overall chi-square test, the standardized root mean residual (SRMR), the root mean square error of approximation (RMSEA), the comparative fit index (CFI), and the Tucker-Lewis fit index (TLI). We considered the evidence provided by all these fit indices to select a final factor structure.

After deciding on an item-to-scale structure, we used data from the combined sample to calculate scale descriptive statistics, internal consistency, and interscale correlations for the final model. Scale scores were computed as the mean of the relevant items. We used multiple imputation^{27,31} to account for missing scale items. The average missing was 21.1 percent (median 21.5 percent). We performed 20 iterations, consistent with recommendations for 20 imputations for 10-30 percent missing information.³²

We then conducted a preliminary assessment of construct validity using multiple regression to assess the ability of the scales to predict a measure of overall PCP-specialist coordination after controlling for other predictors, including some for which the coordination scales might serve as proxies. We used data from all subjects in the combined sample for these analyses. The outcome measure was provided by a single survey item "All things considered, how would you rate the overall quality of coordination between you and specialists in this service over the last 3 months?" Responses could range from 0 (worst coordination possible) to 10 (best coordination possible).

We considered for inclusion in the model other factors that might affect overall perceptions of coordination or survey responses in general. Candidates included respondent demographics (gender, age, years in clinical practice, years in VA); practice characteristics (hours salaried for VA work, percent of VA time allotted to clinical care, average number of outpatients seen per week, number of other PCPs at the facility); job satisfaction (overall job satisfaction, degree of satisfaction with people worked with in the clinical setting, degree of satisfaction with organization); and burnout (frequency of feeling burned out from work, frequency of worry that job causing emotional hardening, frequency of accomplishing many worthwhile things in job). We included items in the model that were either correlated with the scale-related items or demonstrated significant ($P < .05$) correlations with the outcome. We imputed missing values for the variables to be used in the regression model. We then took a sequential approach to building the prediction model, adding potential confounding predictors in blocks first. We added the coordination scales, allowing the model-building algorithm to empirically select the order in which the coordination sales were included based on their strength as predictors of the variance remaining in the outcome in the context of the already-included confounders.

3 | RESULTS

Of 7979 potential respondents, 1876 (24 percent) responded. Of these, 300 were disqualified on the basis of initial screener items related to their clinical role or spending 0 percent of time seeing VA outpatients. Characteristics of the remaining analytic sample ($N = 1576$), representing 129 facilities, are presented in Table 1. Females accounted for 61 percent of respondents and 59 percent were aged 50 or older. Physicians were 64 percent of the sample. Forty-nine percent primarily saw patients in a community-based outpatient clinic setting and 41 percent saw most of their patients in a medical center setting. Most respondents were full-time VA employees (89 percent), and the vast majority spent more than three-quarters of their time providing clinical care (93 percent).

Item descriptive statistics are in Table 2. We reverse-coded four items (Q13, Q15, Q23, Q30) so that higher scores consistently indicated a more positive experience of coordination. Responses on the coordination-related items demonstrated considerable variation, with top box percentages ranging from 8.6 to 45.2 percent overall and from 28.0 to 45.2 percent among the 5 items with the highest such percentages. The three items with the most missing data (Q35, Q36, and Q37) were only relevant to PCPs who had tried to contact the specialist or the specialist's office for assistance.

The two commonest patterns of missing data were none missing (49 percent) and all missing (8 percent). Aside from data missing due to allowed skips and screeners, patterns appeared to be arbitrary rather than following a pattern (eg, monotone missing).³⁸ There were no statistically significant correlations between demographic or practice characteristics with either the original scale items or dummy variables representing scale item missingness, with the exception of gender. For gender, four of the differences in scale items and also in item missingness were significant ($P < .05$), but effect sizes for all of these were very small (Cohen's d statistic, maximum 0.17 vs. criterion of 0.20 for small effect size³³). Based on these findings, we did not include any demographic or practice characteristics as auxiliary variables in the imputation of missing data on candidate scale items.

EFA using FIML suggested a five-factor model. No items loaded ≥ 0.40 on more than one factor. However, in the five-factor model, thirteen of the 23 items were distributed across just two factors, giving those scales a heterogeneous content that was difficult to interpret (Appendix S1).

We also estimated a six-factor model (Table 3). Three of the resulting factors (*Data Transfer*, *Role Clarity*, and *Making Referrals*) were identical to three in the five-factor model. The remaining three factors in the new model (*Relationships and Collaboration*, *Communication*, and *Role Agreement*) appeared more homogeneous in content and were more readily interpretable than the two large factors from the five-factor model. Appendix S2 shows the factor structure of the two models side-by-side.

We carried both the five- and six-factor models forward into the next phase of analysis in which we applied CFA with FIML to the data in the independent validation sample. Values for key fit

TABLE 1 Characteristics of VA primary care providers (N = 1576)^a

	N	%
Gender (N = 1145)		
Female	700	61.1
Male	445	38.9
Age (N = 1149)		
Prefer not to say	39	3.4
Less than 30 y	6	0.5
30-39 y	136	11.8
40-49 y	278	24.2
50-59 y	395	34.4
60 y or older	295	25.7
Years worked as a primary care provider in VA, including as a trainee (N = 1155)		
Less than 1 y	59	5.1
Between 1 and 5 y	444	38.4
Between 5 and 10 y	227	19.7
More than 10 y	425	36.8
Professional discipline (N = 1576)		
Physician	1011	64.2
Physician Assistant	94	6.0
Nurse Practitioner	471	29.9
Setting where most patients seen (N = 1576)		
VA Medical Center	647	41.1
Community-based Outpatient Clinic	778	49.4
Home-based Primary Care	122	7.7
Other	29	1.8
Hours per week salaried to work at VA (N = 1159)		
Up to 5 h (1/8th)	2	0.2
6 to 10 h (2/8th)	3	0.3
11 to 15 h (3/8th)	4	0.4
16 to 20 h (4/8th)	23	2.0
21 to 25 h (5/8th)	30	2.6
26 to 30 h (6/8th)	19	1.6
31 to 35 h (7/8th)	37	3.2
36 to 40 h (8/8th)	1041	89.9
Percent of VA time allocated to providing clinical care (N = 1159)		
Less than 10%	16	1.4
10%-24%	64	5.5
25%-49%	64	5.5
50%-74%	161	13.9
75%-90%	269	23.2
More than 90%	585	50.5
Average number of VA outpatients seen per week, including while precepting (N = 1158)		
Less than 10	103	8.9

(Continues)

TABLE 1 (Continued)

	N	%
10-19	99	8.6
20-29	92	7.9
30-39	123	10.6
40-49	229	19.8
50-59	264	22.8
60 or more	248	21.4

^aN for each item varies due to missing data.

statistics including SRMR, RMSEA, TLI, and CFI for the two models were very similar and met thresholds indicative of reasonable to good fit. We selected the six-factor model as our preferred solution based on interpretability and the potential for greater differentiation among dimensions of coordination using that model. The final scales were *Relationships and Collaboration*, *Data Transfer*, *Role Clarity*, *Communication*, *Role Agreement*, and *Making Referrals*. CFA results for the five- and six-factor models are reported in Appendix S3.

Descriptive statistics are in Table 4. Multiple imputation resulted in a dataset with mean scale scores from 1452 respondents. The highest average scale score was observed for *Data Transfer* (6.06, SE 0.03), likely because the sample was from a health care system with an integrated EHR accessible by both PCPs and specialists.

Table 5 reports scale internal consistency reliabilities (Cronbach's alpha coefficients) interscale correlations. Interscale correlations ranged from 0.23 to 0.76, with all of the 15 values below the criterion of ≥ 0.80 indicative of highly redundant variables.³⁴ The highest correlation (0.76) occurred between *Relationships and Collaboration* and *Communication*, which suggests about 55 percent shared variance. However, alpha coefficients were higher than the interscale correlations in all cases. This pattern of relationships is consistent with reliable scales that measure distinct but related concepts.³⁵

As a preliminary examination of construct validity, we regressed the PCP's rating of overall coordination on the six scales purporting to measure different key aspects of coordination. The mean response on the overall PCP-specialist coordination item was 7.7 (SD 2.1) with skew of -1.37 . We applied the square transform (which reduced the item skew to 0.59) to that variable for use as the dependent measure. Of the candidate control variables, only job satisfaction and burnout variables were significantly correlated with the outcome at $P < .05$. Based on this finding and considerations of colinearity among the candidate predictors, we retained two out of three items to constitute a job satisfaction block (overall job satisfaction, satisfaction with people worked with in the clinical setting) and two items of three to constitute a burnout block (worry about emotional hardening, and accomplishment of worthwhile things). We forced the entry of these two blocks sequentially into the prediction model first and together they accounted for only 4.6 percent of the variance in overall PCP-specialist coordination. All six coordination scales were entered into the model next and increased the

TABLE 2 Item mean, standard deviation, and percentage top box^a (N = 1576)

	N	Mean	SD	Percentage Top Box
Q11. Specialty services may have specific expectations about what conditions are appropriate for referral and/or what workup should be completed beforehand. Please indicate the extent to which you agree or disagree with this statement: "This specialty service has <u>clearly described</u> any such expectations." ^a	1441	3.50	1.05	12.2
Q12. Please indicate the extent to which you agree or disagree with this statement: "Any such expectations <u>align with my own standards</u> for what conditions are appropriate for referral and what workup should be completed beforehand." ^a	1427	3.46	1.15	13.9
Q13. How often do you ultimately decide <u>not to refer</u> for a face-to-face visit due to <u>perceived differences of opinion</u> between you and the specialty service about what conditions are appropriate for referral and/or what workup should be completed in primary care beforehand? (<i>score reversed</i>)	1448	5.87	1.10	34.0
Q14. Specialty services may have specific expectations for which elements of the patient's history, physical exam, or prior testing should be included in the consult request itself. Such expectations may differ by condition. Please indicate the extent to which you agree with this statement: "This specialty service has <u>clearly described</u> any such expectations." ^a	1395	3.40	1.00	8.6
Q15. When referring patients to this specialty, how often do you perceive a difference of opinion between you and the specialty service about the type or extent of information that should be included in the consult request itself? (<i>score reversed</i>)	1397	5.58	1.18	19.3
Q21. How often was the specialist's initial consultation note sufficiently thorough?	1278	5.59	1.41	25.0
Q22. At the time of the patient's first return visit to you, how often did you feel that the specialist had adequately evaluated the patient's condition?	1281	5.76	1.06	23.5
Q23. How often did the specialist recommend a medication that you felt was contraindicated for any reason? Reasons may include medical contraindications, medication interactions or duplications, allergies, prior adverse drug effects, prior failures of treatment, or other such considerations. (<i>score reversed</i>)	1271	6.32	0.82	45.2
Q24. At the time of the patient's first return visit to you, how often was the specialist's recommended plan for your patient's care clear to <u>you</u> ?	1259	5.76	1.03	21.8
Q27. At the time of the patient's first return visit to you, how often were you clear on the division of responsibility between you and the specialist?	1239	5.05	1.43	12.9
Q28. For patients that saw the specialist more than once for the same referral problem, how often were you clear on the division of responsibility between you and the specialist <u>over time</u> ?	1237	5.09	1.41	13.0
Q29. When the specialist asked you to carry out tasks related to the referral problem, how often did you find these appropriate to be carried out in your primary care clinic?	1184	4.77	1.55	11.4
Q30. How often did you feel that you and the consulting specialist had <u>conflicting expectations</u> of each other's roles in caring for patients? (<i>score reversed</i>)	1240	5.26	1.46	17.6
Q31. How often did you feel that you and the consulting specialist <u>worked well together</u> in caring for patients?	1231	5.44	1.24	18.1
Q32. How often did you feel that the consulting specialist <u>valued your contribution</u> in caring for patients?	1226	4.65	1.67	13.3
Q33. How often did you have <u>confidence and trust</u> in the specialists in this consulting service?	1227	5.75	1.15	28.0
Q34. How often did the consulting specialist involve you in important decision-making about your patients' care <u>when you thought they should do so</u> ?	1226	4.47	1.86	13.3
Q35. When you tried to <u>communicate directly</u> with the consulting specialist, how often could you reach the specialist <u>in a timely manner</u> ?	1017	4.75	1.71	14.3
Q36. How often was the consulting specialist <u>helpful</u> in providing you further information or other assistance when you requested it?	991	5.42	1.45	24.7
Q37. When you needed help from the consulting specialist's office staff or clinic staff, how often were you able to get the help you needed in a <u>timely manner</u> ?	999	4.61	1.70	11.9

(Continues)

TABLE 2 (Continued)

	N	Mean	SD	Percentage Top Box
Q39. How often have you felt informed and up-to-date about the care your patients received from the specialists in this service?	1209	5.21	1.44	15.3
Q40. At the time of the patient's first return visit to you, how often did you have access to the most recent relevant information from the specialist's practice?	1195	6.08	1.03	40.1
Q41. For patients who saw the consulting specialist <u>more than once</u> for the same referral problem, how often did you have access to the most recent relevant information from the specialist's practice <u>when you needed it</u> over time?	1194	6.06	1.01	37.8

^aAll items with theoretical range of 1-7, except for Q11, Q12, and Q15 which each has a theoretical range of 1-5.

percent of overall coordination variance explained to 71.2 percent ($F(10,949) = 232.69, P < .0001$) (Appendix S4).

4 | DISCUSSION

We developed and evaluated the psychometric characteristics of the CSC-PCP: a reliable 20-item, six-scale survey of PCPs' experience of care coordination with medical specialists. Its six scales measure coordination with respect to relationships and collaboration, data transfer, role clarity, communication, role agreement, and making referrals. The CSC-PCP is a novel approach to measuring and improving specialty care coordination because it is comprehensive, evaluates experience (rather than satisfaction), and has been designed as a companion to the CSC-Specialist survey, thereby permitting assessment of coordination from the clinicians at both ends of the referral process. The scales assess key aspects of coordination, while the individual questions within each scale provide a detailed map of strengths and weaknesses.

Cumulative empirical support for the six-factor model was strong. The CSC-PCP demonstrated high internal consistency reliability. Multiple measures of goodness of fit supported the model among a large national sample of VA PCPs. Less than 5 percent of the variance in PCP-specialist overall coordination was explained by a model that included only job satisfaction and burnout. When the six CSC-PCP scales were added in sequential models, the percent of variance explained rose above 70 percent, supporting construct validity. Results are also consistent with the scales serving as potential mediators of the relationship of job satisfaction and burnout to overall coordination. After the scale scores were added to the model, job satisfaction and burnout were no longer significant predictors of overall coordination. This suggests that they do not uniquely explain any variance in overall coordination above and beyond what is explained by the scales.

The relationships scale demonstrated the strongest association with overall coordination and data transfer scale the least. The weaker association was expected given that the data transfer scale has two items, a high mean score, and low variation. Greater variation in responses may be observed in a system without a shared EHR. Sensitivity of the data transfer scale would benefit from augmentation by additional items.

The CSC-PCP scale structure is highly consistent with existing literature on the key aspects of interclinician coordination. Interclinician working relationships are critical to successful coordination when organizational barriers impede it, but such relationships are often absent.³⁶ Referring providers and specialists commonly lack clarity or disagree about their respective roles and responsibilities.^{6,7,37,38} Access to data is often poor, with PCPs reporting a lack of timely information from the specialist and vice versa.^{36,39} Ease of communication with specialists varies widely in PCPs' experience.⁴⁰

The CSC-PCP offers benefits over and above existing measures of coordination that we reviewed.^{8,9,11-13,15,16} It is the only rigorously developed PCP measure that is specific to specialty care referrals. It measures 6 highly relevant dimensions that enable a more comprehensive assessment of the PCP experience of specialty care coordination than that offered by other measures.¹⁷⁻²¹ For example, it is the only measure that evaluates the clarity of and agreement with referral criteria and whether tasks that the specialist delegates to the PCP are appropriate to the primary care clinic. These PCP-specific issues are particularly relevant to health care systems that have a shared EHR. In the VA, for example, incoming electronic consult requests may be denied by specialty services entirely or triaged to electronic consultation rather than an in-person appointment if specific criteria are not met.^{6,40} Also, delegating follow-up tasks to the PCP through the EHR is a common practice.⁶ These practices may compromise the PCP experience of coordination when they either do not know about or disagree with delegated tasks.

Another strength of the CSC-PCP is its parallel structure with the previously published CSC-Specialist (Appendix S7). The two measures were developed using the same conceptual framework, with attention to creating items with comparable language to facilitate interpretation of the results in relation to one another. Psychometric analyses conducted separately on each measure revealed two scales that were identical in content: interclinician communication and data transfer. A third, addressing relationships and collaboration, was similar. The remaining three scales—role clarity, role agreement, and making referrals—included PCP-specific items addressing the domain represented by a single scale (*Roles and Responsibilities*) in the CSC-Specialist. These findings are consistent with our conceptual framework as described in the methods and confirm that there are both congruent and divergent issues of importance for PCPs and specialists.

TABLE 3 Clinician-level exploratory factor analysis, specifying 6 factors (N = 788)

Item description	Factor 1: Relationships and collaboration	Factor 2: Data transfer	Factor 3: Role clarity	Factor 4: Communication	Factor 5: Role agreement	Factor 6: Making referrals
Q34. Specialist involved PCP in decision-making	76	-7	0	14	-19	10
Q32. Specialist valued PCP contribution	76	-10	1	20	-9	4
Q33. Confidence and trust in specialist	61	11	7	1	19	-1
Q22. Specialist adequately evaluated patient	53	17	5	-11	29	-6
Q31. Worked well together with specialist	46	8	13	12	21	2
Q39. Informed and up-to-date about specialists' care	43	20	19	16	-8	7
Q40. Access to relevant information from specialists at patient's first return visit	-6	89	2	6	-2	3
Q41. Access to relevant information from specialists over time	3	86	6	2	-2	1
Q28. Clear division of responsibility over time	-5	7	86	7	-5	-1
Q27. Clear division of responsibility at patient's first return visit	4	6	85	0	-4	1
Q29. Specialists' requests of PCP are appropriate	17	-8	42	11	27	-2
Q35. Could reach specialists in a timely manner	7	4	3	73	1	1
Q37. Got help from specialists' staff in a timely manner	7	-4	12	68	7	-3
Q36. Specialists were helpful in providing further assistance to PCP	25	1	-3	60	20	-6
Q13. Did not refer due to differences of opinion about appropriate referrals and primary care workup (<i>reverse coded</i>)	-10	15	-13	9	63	13
Q15. Difference of opinion about information to be included in consult request (<i>reverse coded</i>)	0	-7	6	13	63	8
Q30. Conflicting expectations of each other's roles (<i>reverse coded</i>)	10	-12	36	-4	51	4
Q11. Specialty services' expectations about appropriate referrals and primary care workup are clear	10	0	-5	-9	0	68
Q14. Specialty services' expectations about information to be included in consult request are clear	-5	6	2	7	5	58
Q12. Agreement with specialty service expectations about appropriate referrals and primary care workup	1	-6	7	-3	30	50
Orphan items						
Q21. Specialists' consultation notes were thorough	29	14	-15	13	20	-8
Q23. Specialists recommended a contraindicated medication (<i>reverse coded</i>)	28	33	-3	-20	21	-7
Q24. Specialists' recommended plans were clear	32	32	6	12	14	1

Items in bold represent the strongest factor loading for each item

The decision to use the CSC-PCP alone or together with the CSC-Specialist depends on the goals of evaluation. Results of this study suggest that the CSC-PCP could be used effectively along or together with the CSC-Specialist. Each survey can be used alone to measure, then identify the causes and consequences of, coordination for each clinician. Using both surveys together provides a more

comprehensive assessment of the points of failure. For example, while specialist survey results may indicate that consult requests frequently lack sufficient history, PCP survey results may indicate that specialists' expectations regarding the history to be included are unclear. Here, a PCP survey finding would offer a target for improvement efforts (ie, clarifying what historical information is

	Number of items per scale	Mean (SE)	Percent at ceiling ^a	Observed range
Relationships and collaboration	6	5.20 (0.03)	11.99%	1.00-7.00
Data transfer	2	6.06 (0.03)	31.98%	1.00-7.00
Role clarity	3	4.96 (0.03)	7.68%	1.00-7.00
Communication	3	4.94 (0.04)	9.26%	1.00-7.00
Role agreement	3	5.58 (0.03)	17.07%	1.00-7.00
Making referrals	3	3.45 (0.02)	7.87%	1.00-5.00

^aCeiling = mean scale score ≥ 6.5 for all scales except Making Referrals, where ceiling = mean scale score ≥ 4.5 .

TABLE 4 Descriptive statistics for final scales of the coordination of specialty care-PCP survey (CSC-PCP) (N = 1452)

TABLE 5 Correlations among scales of the coordination of specialty care-PCP survey (CSC-PCP)^a (N = 1576)

	Relationships and collaboration	Data transfer	Role clarity	Communication	Role agreement	Making referrals
Relationships and collaboration	(0.90)					
Data transfer	0.55	(0.92)				
Role clarity	0.73	0.45	(0.85)			
Communication	0.76	0.47	0.64	(0.87)		
Role agreement	0.63	0.31	0.62	0.55	(0.75)	
Making referrals	0.45	0.23	0.43	0.40	0.45	(0.75)

^aInternal consistency reliability (Cronbach's alpha coefficients) in parentheses in the diagonal entries and interscale correlations in the off-diagonal entries.

needed for a given referral condition) that may improve experience as measured by the specialist survey.

As health care systems continue to bring referring and consulting providers under the same organizational roof^{41,42} and implement methods such as care coordination agreements and referral criteria,^{43,44} concerns about coordination for referred patients are likely to arise more often. Managers can use the CSC-PCP to measure the extent of those problems and identify issues for improvement. Researchers can use the CSC measures to "look back" to identify and compare the aspects of structure and process that foster successful coordination as experienced by each clinician type, and "look forward" to see how the unique experience of each correlates with outcomes.

Future work will include validating and improving the CSC-PCP through expansion of the data transfer construct, establishing the CSC-PCP's psychometric characteristics in non-VA settings, and longitudinal studies to examine sensitivity to change. Because there is no existing reference standard for the PCP experience of specialty care coordination, establishing criterion validity will rely on demonstrating the association of the scales with clinical, cost, and utilization outcomes of interest. Our future work also includes psychometric testing of the complementary CSC-Patient, which is in development.

Our study has limitations. Our response rate of 24 percent is similar or better to that achieved in other online surveys of VA clinicians^{10,45,46} and represents a similar demographic profile to that of respondents to another national VA survey of PCPs⁴⁷ but raises

the possibility of nonresponse bias. It is possible, for example, that our respondents represent those who have particularly good or poor experiences of coordination.

Second, the measure was developed and tested in the VA, in which PCPs and specialists share an organizational structure and EHR. Organizational structure, technology infrastructure, culture, and provider behavior in VA may be dissimilar to those of even other highly integrated delivery systems. It is possible, for example, that items related to relationships and collaboration will be less relevant to PCPs in other settings or that items from scales with higher interscale correlations (such as Relationships and Collaboration and Communication) would be re-assigned in another practice context. In developing the measure, we took several steps to ensure relevance to the non-VA setting. We relied on both VA and non-VA sources throughout survey development, including both VA and non-VA literature to identify the domains of coordination, reviewing existing VA and non-VA measures, and including both VA and non-VA providers in our cognitive interviewing and item refinement steps. Nonetheless, we recommend testing the instrument in other types of health care systems to confirm its relevance, scale structure, and validity.

Third, we tested construct validity using a common data source for the outcome of overall coordination and for the predictors, which raises the possibility of common method bias as an explanation for the associations observed. However, the addition of the CSC-PCP scales offered a dramatic improvement in the percentage of variance

in overall coordination explained after controlling for job satisfaction and burnout, suggesting that the confounding influences, such as a "halo effect" of the overall work environment or shared methods variance, were minimal.

As specialty care referrals continue to increase in number,⁴ there is a growing need to prevent adverse outcomes related to fragmented care. These include waste within the medical system and worse health outcomes^{48,49} and, importantly, extend to the patient experience of care.^{45,49} Coordination between clinicians is central to success in this effort, and appropriate measures are needed. The CSC-PCP is an internally valid and reliable multi-dimensional measure that assesses interclinician coordination through direct assessment of the PCP experience. The 20-item online CSC-PCP can be administered alone, embedded in other surveys, or used in parallel with its companion CSC-Specialist in more comprehensive research and quality improvement efforts to coordinate specialty care.

The CSC-PCP items with response options and scoring instructions are available in Appendices 5 and 6, respectively. Tables comparing the CSC-PCP and the CSC-Specialist scales are included in Appendix S7. Additional information may be obtained by contacting the first author.

ACKNOWLEDGMENT

Joint Acknowledgment/Disclosure Statement: This work was supported by a VA Health Services Research & Development (HSR&D) Career Development Award 5IK2HX002137-04 (Dr Vimalananda).

Disclaimer: The contents do not represent the views of the US Department of Veterans Affairs or the US Government.

CONFLICT OF INTEREST

None.

ORCID

Varsha G. Vimalananda <https://orcid.org/0000-0003-0738-672X>

REFERENCES

- Olmos-Ochoa TT, Bharath P, Ganz DA, et al. Staff perspectives on primary care teams as de facto "hubs" for care coordination in VA: a qualitative study. *J Gen Intern Med*. 2019;34:82-89.
- Stille CJ, Jerant A, Bell D, Meltzer D, Elmore JG. Coordinating care across diseases, settings, and clinicians: a key role for the generalist in practice. *Ann Intern Med*. 2005;142(8):700-708.
- Kringos DS, Boerma WG, Hutchinson A, van der Zee J, Groenewegen PP. The breadth of primary care: a systematic literature review of its core dimensions. *BMC Health Serv Res*. 2010;10:65.
- Barnett ML, Song Z, Landon BE. Trends in physician referrals in the United States, 1999–2009. *Arch Intern Med*. 2012;172(2):163-170.
- Mehrotra A, Forrest CB, Lin CY. Dropping the baton: specialty referrals in the United States. *Milbank Q*. 2011;89(1):39-68.
- Vimalananda VG, Dvorin K, Fincke BG, Tardiff N, Bokhour BG. Patient, primary care provider, and specialist perspectives on specialty care coordination in an integrated health care system. *J Ambul Care Manage*. 2018;41(1):15-24.
- Hysong SJ, Esquivel A, Sittig DF, et al. Towards successful coordination of electronic health record based-referrals: a qualitative analysis. *Implement Sci*. 2011;6:84.
- McDonald KM, Schultz EM, Albin L, Pineda N, Lonhart J, Sundaram V. Care Coordination Atlas Version 3 (Prepared by Stanford University under subcontract to Battelle on Contract No. 290-04-0020). AHRQ Publication No 11-0023-EF. 2010.
- Schultz EM, Pineda N, Lonhart J, Davies SM, McDonald KM. A systematic review of the care coordination measurement landscape. *BMC Health Serv Res*. 2013;13(1):119.
- Vimalananda VG, Fincke BG, Qian S, Waring ME, Seibert RG, Meterko M. Development and psychometric assessment of a novel survey to measure care coordination from the specialist's perspective. *Health Serv Res*. 2019;54:689-699.
- McDonald K, Schultz E, Albin L, Pineda N, Lonhart J, Sundaram V. *Care Coordination Atlas Version 4* (AHRQ Publication No. 14-0037-EF). Rockville, MD: Agency for Healthcare Research and Quality; 2014.
- National Quality Forum. Effective Communication and Care coordination. http://www.qualityforum.org/Topics/Effective_Communication_and_Care_Coordination.aspx. Accessed November 2, 2019.
- Agency for Healthcare Research and Quality. CAHPS Surveys and Tools to Advance Patient-Centered Care. <https://www.ahrq.gov/cahps/index.html>. Accessed November 2, 2019.
- Physicians. ACo. The Patient-Centered Medical Home Neighbor: the Interface of the Patient-Centered Medical Home with Specialty/Subspecialty Practices. 2010 https://www.acponline.org/system/files/documents/advocacy/current_policy_papers/assets/pcmh_neighbors.pdf. Accessed November 2, 2019.
- National Committee on Quality Assurance. *Standards and Guidelines for PCSP 2013 Recognition*. Washington, D.C.: National Committee on Quality Assurance; 2017.
- National Committee for Quality Assurance. *Standards and Guidelines for NCQA's Patient-Centered Medical Home (PCMH)*. Washington, D.C.: National Committee for Quality Assurance; 2011.
- Birnberg JM, Drum ML, Huang ES, et al. Development of a safety net medical home scale for clinics. *J Gen Intern Med*. 2011;26(12):1418-1425.
- Gittel JH, Fairfield KM, Bierbaum B, et al. Impact of relational coordination on quality of care, postoperative pain and functioning, and length of stay: a nine-hospital study of surgical patients. *Med Care*. 2000;38(8):807-819.
- Hess BJ, Lynn LA, Holmboe ES, Lipner RS. Toward better care coordination through improved communication with referring physicians. *Acad Med*. 2009;84(10):S109-S112.
- Shi L, Starfield B, Xu J. Validating the adult primary care assessment tool. *J Fam Pract*. 2001;50(2):161.
- Zillich AJ, Doucette WR, Carter BL, Kreiter CD. Development and initial validation of an instrument to measure physician-pharmacist collaboration from the physician perspective. *Value in Health*. 2005;8(1):59-66.
- Diefenbach MA, Weinstein ND, O'Reilly J. Scales for assessing perceptions of health hazard susceptibility. *Health Educ Res*. 1993;8(2):181-192.
- Osatuke K, Draime J, Moore SC, et al. Organization development in the Department of Veterans Affairs. In: Miller T, editor. *The Praeger Handbook of Veterans Health: History, Challenges, Issues and Developments. Volume IV: Future Directions in Veterans Healthcare*. Santa Barbara, CA: Praeger; 2012:21-76.
- Yung Y, Zhang W. *Making use of incomplete observations in the analysis of structural equation models: The CALIS procedure's Full Information Maximum Likelihood method in SAS*. Cary, NC; 2011. Contract No.: 333-2011.

25. Tabachnick B, Fidell L. *Using Multivariate Statistics*, 6th edn. Boston: Pearson; 2013.
26. Stevens JP. *Applied Multivariate Statistics for the Social Sciences*, 2nd edn. Hillsdale, NJ: Erlbaum; 1992.
27. Yuan Y. Multiple imputation using SAS software. *J Stat Softw*. 2006;46(6):1-25.
28. Tabachnik BG, Fidell LS. *Using multivariate statistics*, 6th edn. Boston: Pearson; 2013.
29. Brown TA. *Confirmatory factor analysis for applied research*. Guilford Press; 2006.
30. Hu LT, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural equation modeling: a multidisciplinary. Struct Equ Modeling*. 1999;6(1):1-55.
31. Berglund P, Heeringa S. *Multiple imputation of missing data using SAS*. Cary, NC; 2014.
32. Graham JW, Olchowski AE, Gilreath TDJPS. How many imputations are really needed? Some practical clarifications of multiple imputation theory. *Prev Sci*. 2007;8(3):206-213.
33. Cohen J. *Statistical Power Analysis for the Behavioral Sciences*, 2nd edn. New York: Routledge; 1988.
34. Midi H, Sarkar S, Rana S. Collinearity diagnostics of binary logistic regression model. *J Interdisciplin Mathemat*. 2010;13(3):253-267.
35. Hays RD, Nelson EC, Rubin HR, Ware JE Jr, Meterko M. Further evaluations of the PJHQ scales. *Med Care*. 1990;28(9 Suppl):S29-S39.
36. Byrd JC, Moskowitz MA. Outpatient consultation: interaction between the general internist and the specialist. *J Gen Intern Med*. 1987;2(2):93-98.
37. Salerno SM, Hurst FP, Halvorson S, Mercado DL. Principles of effective consultation: an update for the 21st-century consultant. *Arch Intern Med*. 2007;167(3):271-275.
38. Williams PT, Peet G. Differences in the value of clinical information: referring physicians versus consulting specialists. *J Am Board Fam Pract*. 1994;7(4):292-302.
39. Gandhi TK, Sittig DF, Franklin M, Sussman AJ, Fairchild DG, Bates DW. Communication breakdown in the outpatient referral process. *J Gen Intern Med*. 2000;15(9):626-631.
40. Zuchowski JL, Rose DE, Hamilton AB, et al. Challenges in referral communication between VHA primary care and specialty care. *J Gen Intern Med*. 2015;30(3):305-311.
41. Lesser CS, Ginsburg PB. Update on the nation's health care system: 1997-1999. *Health Aff (Millwood)*. 2000;19(6):206-216.
42. Muhlestein DB, Smith NJ. Physician consolidation: rapid movement from small to large group practices, 2013-15. *Health Aff (Millwood)*. 2016;35(9):1638-1642.
43. O'Malley AS, Tynan A, Cohen GR, Kemper N, Davis MM. Coordination of care by primary care practices: strategies, lessons and implications. 2009, 12:1-16. <http://www.hschange.org/CONTENT/1058/>
44. Carrier E, Dowling MK, Pham HH. Care coordination agreements: barriers, facilitators, and lessons learned. *Am J Manag Care*. 2012;18(11):e398-e404.
45. Mohr DC, Benzer JK, Vimalananda VG, et al. Organizational coordination and patient experiences of specialty care integration. *J Gen Intern Med*. 2019;34(Suppl 1):30-36.
46. Linsky A, Simon SR, Stolzmann K, Bokhour BG, Meterko M. Prescribers' perceptions of medication discontinuation: survey instrument development and validation. *Am J Manag Care*. 2016;22(11):747-754.
47. Zikmund-Fisher BJ, Kullgren JT, Fagerlin A, Klamerus ML, Bernstein SJ, Kerr EA. Perceived barriers to implementing individual choosing wisely((R)) recommendations in two national surveys of primary care providers. *J Gen Intern Med*. 2017;32(2):210-217.
48. Shih A, Davis K, Schoenbaum SC, Gauthier A, Nuzum R, McCarthy D. *Organizing the U.S. Health care Delivery System for High Performance*. Commonwealth Fund; 2008.
49. van Walraven C, Oake N, Jennings A, Forster AJ. The association between continuity of care and outcomes: a systematic and critical review. *J Eval Clin Pract*. 2010;16(5):947-956.

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

How to cite this article: Vimalananda VG, Meterko M, Qian S, Wormwood JB, Solch A, Fincke BG. Development and psychometric assessment of a survey to measure specialty care coordination as experienced by primary care providers. *Health Serv Res*. 2020;55:660-670. <https://doi.org/10.1111/1475-6773.13310>