Relational Continuity from the Patient Perspective: Comparison of Primary Healthcare Evaluation Instruments

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Measuring Relational Continuity from the Consumer Perspective: Comparison of Primary Healthcare Evaluation Instruments

Abstract

The operational definition of relational continuity is "a therapeutic relationship between a patient and one or more providers that spans various healthcare events and results in accumulated knowledge of the patient and care consistent with the patient's needs."
Objective: To examine how well relational continuity is captured in validated instruments that evaluate primary healthcare from the consumer perspective.
Method: 649 adults with at least one healthcare contact in the previous 12 months responded to instruments that evaluate primary healthcare. Five subscales map to relational continuity: the Primary Care Assessment Survey (PCAS, two subscales); the Primary Care Assessment Tool (PCAT); and the Components of Primary Care Index (CPCI, two subscales). Scores were normalized for descriptive comparison. Exploratory (principal components) and confirmatory (structural equation) factor analysis examined fit to operational definition, and item response theory analysis examined item performance
Results: All subscales are skewed positively and normalized mean scores differ, but variance is similar between scales. All subscales load reasonably well on a single factor, presumed to be relational continuity, but the best model has two underlying factors corresponding to: 1) accumulated knowledge of the patient, and 2) relationship that spans healthcare events or tendency to concentrate care in the same doctor. Some items were problematic even in the best model. The PCAS Contextual Knowledge subscale discriminates best between different levels of accumulated knowledge, but this dimension is also captured well by the CPCI Accumulated Knowledge subscale and most items in the PCAT Ongoing Care subscale. Concentration of care is captured best by the CPCI Preference for Regular Provider subscale and to a lesser extent by the PCAS Visit-based Continuity subscale and one relevant item in the PCAT Ongoing Care subscale, but the subscales correlate only modestly with reported visits. The items function as yes/no rather than ordinal options, and are especially informative for poor concentration of care.
Conclusion: These subscales perform well for key elements of relational continuity, but do not capture consistency of care. They are more informative for poor relational continuity.

Background

The concept of continuity of care is central to the delivery of primary health care (PHC). Indeed, in a cross-disciplinary review of the literature on continuity of care, the single largest source of research reports came from PHC (Reid et al. 2002). The concept has evolved within some health disciplines but has remained stable in family medicine as referring to a provider–patient relationship over time and across different health events. This form of continuity is usually referred to as "relational continuity" and is distinct from other forms that connect services received from different providers (Haggerty et al. 2003). PHC providers see relational continuity as a distinguishing characteristic of their work and a core value of health professionals (McWhinney 1998). It is also prioritized by patients (Mainous et al. 2001; Baker et al. 2005; Turner et al. 2007; Cheraghi-Sohi et al. 2008). We would argue that in no other segment of the health care system is relational continuity of more importance.

Our consensus consultation of PHC experts across Canada unanimously identified relational continuity as an essential function of PHC regardless of organizational model (Lévesque et al. 2009). It is defined operationally as "a therapeutic relationship between a patient and one or more providers that spans various health care events and results in accumulated knowledge of the patient and care consistent with the patient's needs." (Haggerty et al. 2007)

Within primary care research, relational continuity has been inferred most commonly from the degree to which patient care is concentrated in a single physician (Steinwachs 1979; Rogers and Curtis 1980). Research evidence suggests that seeing the same provider over time for multiple health events is associated with positive outcomes, including better doctor–patient communication (Bertakis and Callahan 1992; Berry et al. 2008), greater uptake of preventive and health-promoting strategies (Ettner 1996, 1999; O'Malley 1996, 1997; Flocke et al. 1998), reduced diagnostic testing (Weiss and Blustein 1996), reduced emergency department utilization (Burge et al. 2003) and reduced emergency hospital admissions (Wasson et al. 1984).

Most often, relational continuity is conceived of as a relationship between a patient and a single provider. However, new models of PHC evolving in Canada and internationally are moving to interprofessional team-based care that may be disruptive to relational continuity (Smith 1995; Rodriguez et al. 2007), making it important to measure relational continuity in the evaluation of reforms.

Evaluating relational continuity in primary health care

Professionals and researchers in PHC have inferred relational continuity from health service use data that provide no insight into the direct experience of relational continuity. In the past decade, instruments have been developed that include assessments of relational continuity in PHC from the user perspective, but there is little comparative information about these instruments to guide evaluators in their selection of tools.

The objective of our study was to compare validated instruments thought to be most pertinent for the Canadian context, and in this article we focus on how well subscales from different instruments fit the constructs of relational continuity. Specifically, we examined the equivalence of the scores of different instruments' subscales and whether all the relational continuity subscales measure a single construct or factor. If analysis suggested more than one factor, we aimed to determine how these corresponded to the operational definition. Finally we examined

how well individual items perform in discriminating between different levels of relational continuity.

Method

The conduct of the study (Haggerty, Burge et al. 2009) and the analytic approach (Santor et al. 2009) have been described in detail elsewhere but are summarized here.

Measure selection and description

Among 13 instruments that assess PHC services from the consumer perspective, we selected six for back-to-back comparison. Among these, three have a total of five subscales that were mapped to our operational definition of relational continuity. They are summarized below in the order in which they appeared in the questionnaire.

The Primary Care Assessment Survey (PCAS) (Safran et al. 1998) has two relational continuity subscales. The two-item Visit-based Continuity subscale elicits how often the "regular doctor" is consulted for routine and sickness care. The five-item Contextual Knowledge subscale contains four items asking patients to rate on a six-point Likert response scale (1 = very poor to 6 = excellent) the doctor's knowledge of different dimensions and a single item on how well their doctor would know their wishes if they were in a coma; this latter item's response scale of 1-to-10 is collapsed to a 1-to-5 scoring.

The Primary Care Assessment Tool (PCAT) (Shi et al. 2001) has a four-item Ongoing Care subscale that elicits the probability, on a four-point Likert response scale (1 = definitely not to 4 = definitely), that the patient always consults the "primary care provider" and that asks about the provider's knowledge of the patient.

The Components of Primary Care Index (CPCI) (Flocke 1997) has two relational continuity subscales that use a six-point semantic difference agreement response scale (poles of 1 = strongly disagree and 6 = strongly agree) on various statements about the "regular doctor." The eight-item Accumulated Knowledge scale assesses the doctor's knowledge of various dimensions of the patient, including one item on the persistence of the relationship. The five-item Preference for Regular Physician subscale assesses the extent to which care is concentrated, by choice, with the regular doctor.

Concurrent validation of instruments

We concurrently administered the six instruments, including the three mentioned above, to individuals with a regular source of care who had sought health care in the previous 12 months. Each subject filled in all six questionnaires and provided information on health utilization and socio-demographic descriptors.

The sample was balanced by overall experience of health care, educational level, urban/rural context and English/French language. Questionnaires administered in Nova Scotia were all English (n = 343), and in Quebec, all French (n = 342). The study population is described in detail elsewhere; as are the descriptive statistics by health care experience, level of education, geographic contexts and language (Haggerty, Burge et al. 2009; Haggerty, Bouharaoui et al. 2009).

Analytic strategy

The distributions of responses for all the items were examined for patterns of missing values and ceiling or floor effects. We used parametric item response theory (IRT) analysis to estimate the item discrimination against the original latent variable of the instrument subscale, assuming that unidimensionality had already been demonstrated by the developer. We used Multilog (Du Toit 2003). Values >1 demonstrate adequate discrimination.

The score of each subscale was expressed as a continuous variable by averaging the component items so that the magnitude of the score reflected the values on the response scale but was not affected by the number of items. To permit comparison of subscale values between instruments, we normalized the subscale scores to a 0-to-10 scale.

We explored the construct validity by using factor analyses, as detailed elsewhere (Santor et al. 2009). We used principal components analysis to examine how well all the items load on a single factor and to explore how many underlying factors accounted for variability in responses using the criterion of eigenvalues >1 after an oblique rotation using SAS 9.1 (SAS Institute 2003). We used our judgment to fit factors to the operational definition. We then did confirmatory factor analysis with structural equation modelling (Jöreskog and Sörbom 1993) to evaluate the one-dimensional model and the suitability of the factor structure identified through the exploratory factor analysis. We assigned items to factors based on the exploratory factor analysis or, for items with ambiguous loadings, based on our judgment of fit with the operational definition. We compared the goodness-of-fit of a number of models in which we varied the correlation between factors, the attribution of items to factors and the hierarchy or order of factors. We anticipated better fit with high-order models compared to less restrictive or one-dimensional models. We eliminated all subjects with at least one missing value on any item (list-wise missing). However, because this conservative approach can introduce bias, we repeated all the confirmatory analyses using maximum likelihood imputation of missing values (Jöreskog and Sörbom 1996) to examine the robustness of our conclusions.

Lastly, we analyzed the performance of individual items against sub-dimensions of relational continuity using non-parametric item response analysis (Ramsay 2000). This fine-grained analysis is useful in determining how well response options discriminate among differences in the construct of interest without imposing any assumptions that are inherent parametric estimates of discriminatory capacity.

Results

Table 1 presents the characteristics of the study population. Our effective sample size for factor analysis was reduced from 645 to 495 by excluding respondents with at least one missing value on any item. Respondents excluded from the factor analysis were more likely to be older and to have had a chronic health problem (Table 1).

Table 1

Characteristics of the study sample and comparison of subjects included and excluded as a result of missing values on any of the 21 items

Characteristic	Total (n = 645)	Missing values		Test for Difference
		No missing: included (n = 495)	Any missing: excluded (n = 150)	
Personal characteristics				
Mean age (SD)	47.9 (14.8)	47.1 (14.3)	50.7 (16.2)	t = 2.59 p = 0.009
Per cent female	64.6% (414)	63.0% (310)	70.2% (104)	X^2 = .62; 1 *df* p = 0.10
Per cent indicating health status as good or excellent	37.6% (240)	39.2% (192)	32.4% (48)	X^2 = 2.25; 1 *df* p = 0.13
Per cent with disability	31.5% (200)	30.6% (150)	34.7% (50)	X^2 = 0.87; 1 *df* p = 0.35
Per cent with chronic health problem[1]	59.7% (379)	57.4% (281)	67.5% (98)	X^2 = 4.76; 1 *df* p = 0.02
Healthcare Use				
Regular provider:				
Physician	94.1% (607)	94.1% (466)	94.0% (141)	X^2 = .004; 1 *df*
Clinic only	5.8% (38)	5.8% (29)	6.0% (9)	p = 0.94
Mean number of years of affiliation (SD)	11.1 (9)	11.4 (9)	10.3 (9)	t = -1.20 p = 0.23
Mean number of primary care visits in last 12 months (SD)	6.2 (6.9)	6.3 (7.1)	6.2 (6.3)	t = -0.17 p = 0.86
Per cent of visits to regular provider	84.3 (24.2)	83.9 (24.8)	85.9 (22.0)	t = -0.84 p = 0.40

Comparative descriptive statistics

Table 2 presents the distribution of the responses to each item. Most respondents select positive expressions of relational continuity, especially for items in all three instruments asking whether

[1] Per cent indicating they had been told by a doctor that they had any of the following: high blood pressure, diabetes, cancer, depression, arthritis, respiratory disease, heart disease.

the same provider is consistently consulted; over 50% select the highest response option. This is expected to compromise the performance of exploratory factor analysis.

Table 2

Distribution of responses for each item in subscales measuring relational continuity in primary healthcare services and discriminatory capacity of each item within its parent subscale. Modal response is shown in bold (n = 645).

Item code	Instrument: subscale: statement	Missing values[1] % (n)	Per cent (number) by response option						Item discrimination[2]
	Primary Care Assessment Survey (PCAS): Visit-based Continuity		**1=Never**	**2**	**3**	**4**	**5**	**6=Always**	
PS_vb1	When you go for a *check-up or routine care*, how often do you see your *regular doctor* (not an assistant or partner)?	2 (10)	1 (7)	2 (12)	7 (44)	5 (29)	17 (111)	**67 (432)**	10.43 (1.36)
PS_vb2	When you are *sick* and go to the doctor, how often do you see your *regular doctor* (not an assistant or partner)?	2 (13)	2 (16)	5 (33)	9 (61)	8 (53)	25 (164)	**47 (305)**	1.76 (0.15)
	Primary Care Assessment Survey (PCAS): Contextual Knowledge		**1=Very poor**	**2**	**3**	**4**	**5**	**6=Excellent**	
PS_ck1	Thinking about how well your doctor *knows you*…								
PS_ck2	how would you rate doctor's	1 (9)	2 (14)	5 (29)	16 (105)	24 (152)	**32 (207)**	20 (129)	2.74 (0.17)

[1] Missing values: No response given to the item
[2] Discriminatory parameter less than 1.0 indicates that this item does not discriminate well between individuals with low and high values of the subscale score.

Item code	Instrument: subscale: statement	Missing values[1] % (n)	Per cent (number) by response option						Item discrimination[2]
	knowledge of your *entire medical history*?								
PS_ck3	how would you rate doctor's knowledge of your *responsibilities at work or home*?	2 (15)	5 (31)	10 (63)	17 (108)	26 (166)	**27 (174)**	14 (88)	3.85 (0.21)
PS_ck4	how would you rate doctor's knowledge of what *worries* you most about your health?	2 (10)	3 (21)	7 (43)	21 (133)	**29 (188)**	25 (164)	13 (86)	4.57 (0.26)
	how would you rate doctor's knowledge of *you as a person* (your values and beliefs)?	2 (12)	7 (42)	12 (77)	19 (125)	**24 (157)**	24 (152)	12 (80)	4.35 (0.26)
			1=Strongly disagree	**2.25**	**3.5**	**4.75**	**5=Strongly agree**		
PS_ck5	If I were unconscious or in a coma, my doctor would know what I would want done for me.[3]	1 (6)	15 (97)	16 (101)	**39 (254)**	19 (121)	10 (66)		1.35 (0.12)
	Primary Care Assessment Tool (PCAT): Ongoing Care		**1=Definitely not**	**2**	**3**	**4=Definitely**	**Not sure / Don't remember**		
PT_oc1	When you go to your Primary Care Provider, are you taken care of by the *same* doctor or nurse each time?	2 (10)	4 (23)	7 (47)	17 (108)	**70 (454)**	0 (3)		0.74 (0.12)

[3] Item expressed as agreement on a 1 to 10 scale; distribution shows transformation to scoring suggested by the developer.

Item code	Instrument: subscale: statement	Missing values[1] % (n)	Per cent (number) by response option						Item discrimination[2]
PT_oc2	If you have a question, can you call and talk to the *doctor or nurse who knows you best*?	2 (13)	12 (78)	15 (94)	32 (205)	**33 (213)**	7 (42)		1.46 (0.13)
PT_oc3	Does your Primary Care Provider know you very well as a *person,* rather than as someone with a medical problem?	2 (13)	12 (76)	17 (110)	28 (182)	**38 (247)**	3 (17)		2.97 (0.22)
PT_oc4	Does your Primary Care Provider know what problems are most important to you?	3 (17)	7 (46)	14 (89)	37 (239)	**38 (244)**	2 (10)		3.58 (0.28)
	Components of Primary Care Index (CPCI): Accumulated Knowledge		**1=Strongly disagree**	**2**	**3**	**4**	**5**	**6=Strongly agree**	
CP_ak1	This doctor knows a lot about my family medical history.	2 (11)	8 (52)	8 (50)	8 (53)	14 (89)	19 (120)	**42 (270)**	2.54 (0.18)
CP_ak2	This doctor clearly understands my health needs.	2 (12)	3 (21)	5 (30)	8 (53)	13 (87)	23 (151)	**45 (291)**	5.80 (0.41)
CP_ak3	This doctor and I have been through a lot together.	3 (19)	16 (105)	13 (82)	11 (69)	13 (86)	17 (111)	**27 (173)**	2.18 (0.16)
CP_ak4	This doctor understands what is important to me regarding my health.	2 (14)	4 (25)	7 (43)	11 (69)	14 (93)	25 (163)	**37 (238)**	4.95 (0.31)
CP_ak5	This doctor does not know my medical history very well.	2 (16)	**46 (295)**	15 (94)	9 (58)	9 (56)	9 (59)	10 (295)	2.22 (0.17)

Item code	Instrument: subscale: statement	Missing values[1] % (n)	Per cent (number) by response option						Item discrimination[2]
	(reverse coded)								
CP_ak6	This doctor always takes my beliefs and wishes into account in caring for me.	2 (16)	4 (23)	5 (33)	11 (68)	16 (100)	25 (159)	**38 (246)**	2.35 (0.17)
CP_ak7	This doctor knows whether or not I exercise, eat right, smoke, or drink alcohol.	2 (15)	5 (30)	6 (36)	6 (38)	12 (77)	24 (155)	**46 (294)**	1.28 (0.13)
CP_ak8	This doctor knows a lot about me as a person (such as my hobbies, job, etc.).	2 (15)	14 (88)	11 (71)	13 (87)	16 (100)	19 (124)	**25 (160)**	2.80 (0.18)
	Components of Primary Care Index (CPCI): Patient Preference for Regular Physician		**1=Strongly disagree**	**2**	**3**	**4**	**5**	**6=Strongly agree**	
CP_prp1	If I am sick, I would always contact a doctor in this office first.	3 (22)	11 (68)	4 (25)	4 (26)	6 (39)	20 (128)	**52 (337)**	1.31 (0.14)
CP_prp2	My medical care improves when I see the same doctor that I have seen before.	4 (26)	5 (33)	6 (38)	7 (43)	14 (91)	20 (132)	**44 (282)**	2.11 (0.17)
CP_prp3	It is very important to me to see my regular doctor.	2 (13)	1 (9)	4 (24)	4 (24)	7 (45)	18 (114)	**65 (416)**	2.55 (0.22)
CP_prp4	I rarely see the same doctor when I go for medical care. (reverse coded)	4 (23)	**68 (438)**	11 (72)	5 (30)	3 (22)	3 (19)	6 (41)	1.08 (0.15)
CP_prp5	I can call this doctor if I have a concern and am not sure I need to see a doctor.	3 (20)	12 (79)	12 (80)	13 (81)	13 (83)	16 (104)	**31 (198)**	1.22 (0.12)

Table 3 presents the descriptive statistics for each subscale. The scores are skewed positively, with medians higher than means, especially for the PCAS Visit-based Continuity subscale and the CPCI Preference for Regular Physician subscale. The normalized means for the scales differ substantially from one to another, but the standard deviations are relatively similar. Of the subscales related to concentration of care, the CPCI demonstrates better distributional properties than the PCAS, but the PCAS Contextual Knowledge subscale is better than the CPCI Accumulated Knowledge subscale.

Table 3
Mean and distributional values for relational continuity subscales, showing raw and normalized subscale scores (n=645)[1]

Developer's Scale Name (# of items in scale)	Scale range	Crohnbach's alpha	Mean	SD	Quartiles Q1 (25%)	Q2 (50%)	Q3 (75%)
Raw scores							
PCAS Visit-Based Continuity (2)	1 to 6	0.67	5.17	1.05	4.50	5.50	6.00
PCAS Contextual Knowledge (5)	1 to 6	0.90	3.96	1.14	3.25	4.10	4.78
PCAT Ongoing Care (4)	1 to 4	0.73	3.15	0.70	2.75	3.25	3.75
CPCI Accumulated Knowledge (8)	1 to 6	0.91	4.50	1.24	3.63	4.75	5.50
CPCI Patient Preference for Regular Physician (5)	1 to 6	0.68	4.84	1.01	4.25	5.00	5.75
Normalized scores							
PCAS Visit-Based Continuity	1 to 10	0.67	8.35	2.11	7.00	9.00	10.00
PCAS Contextual Knowledge	1 to 10	0.90	5.92	2.28	4.50	6.20	7.60
PCAT Ongoing Care	1 to 10	0.73	7.15	2.34	5.80	7.50	9.20
CPCI Accumulated Knowledge	1 to 10	0.91	6.99	2.49	5.30	7.50	9.00
CPCI Patient Preference for Regular Physician	1 to 10	0.68	7.68	2.01	6.50	8.00	9.50

[1] Subscale scores calculated as mean of item values and were only calculated for observations where >50% of items were complete.

Table 4 presents the Pearson correlations between the relational continuity subscales and with other attributes. The PCAS Visit-based Continuity subscale does not correlate well with other continuity subscales (P = 0.24, 0.26) and the CPCI Preference for Regular Provider subscale, only modestly (r = 0.26 to 0.54). The other continuity subscales correlate highly with each other but also with subscales measuring interpersonal communication, respectfulness and trust. When correlated with the per cent of visits to the regular physician, we found no correlation with the PCAS Visit-based Continuity subscale or the PCAT Ongoing Care subscale and only weak correlations with the PCAS Contextual Knowledge (r = 0.09), CPCI Accumulated Knowledge (r = 0.12) and CPCI Preference for Regular Provider subscales (r = 0.08).

Table 4
Mean partial correlations between relational continuity subscales and other subscales included in the questionnaires, controlling for language, educational achievement, and geographic location. Only correlations significantly different from zero are provided.

Instrument subscale	PCAS Visit-based Continuity	PCAS Contextual Knowledge	PCAT Ongoing Care	CPCI Accumulated Knowledge	CPCI Patient Preference for Regular Physician
PCAS: Visit-based Continuity	1.00		0.24		0.26
PCAS: Contextual Knowledge		1.00	0.65	0.73	0.41
PCAT: Ongoing Care	0.24	0.65	1.00	0.63	0.53
CPCI: Accumulated Knowledge		0.73	0.63	1.00	0.54
CPCI: Patient Preference for Regular Physician	0.26	0.41	0.53	0.54	1.00
Accessibility:					
PCAS: Organizational Access	0.22	0.37	0.42	0.31	0.33
PCAT: First-contact Utilization	0.15	0.26	0.26	0.28	0.35
PCAT: First-contact Accessibility		0.28	0.32	0.28	0.30
EUROPEP	0.20	0.48	0.57	0.46	0.47
Comprehensiveness:					
PCAT: Services Available		0.25	0.23	0.27	0.21
CPCI: Comprehensive Care	0.16	0.49	0.45	0.71	0.55
Interpersonal communication:					
PCAS: Communication	0.14	0.61	0.44	0.54	0.39
PCAS: Trust	0.11	0.64	0.49	0.61	0.44
CPCI: Interpersonal communication		0.60	0.47	0.67	0.47
EUROPEP: Clinical Behaviour	0.13	0.69	0.57	0.69	0.51
IPC: Communication (elicited concerns, responded)	0.16	0.54	0.49	0.55	0.42

IPC: Communication (explained results, medications)	0.11	0.49	0.41	0.49	0.36
IPC: Decision-making (patient-centered decision-making)	0.09	0.52	0.39	0.48	0.34
Respectfulness:					
PCAS: Interpersonal Treatment	0.14	0.65	0.47	0.56	0.42
IPC: Hurried Communication	0.18	0.51	0.44	0.48	0.40
IPC: Interpersonal Style (compassionate, respectful)	0.11	0.59	0.50	0.57	0.44
IPC: Interpersonal Style (disrespectful office staff)	0.19	0.19	0.28	0.24	0.28
Whole-person care:					
PCAT: Community Orientation		0.34	0.30	0.32	0.21
CPCI: Community Context		0.53	0.50	0.57	0.48

We had hypothesized a priori, based on item content that the PCAS Trust and PCAT FIRST-contact Utilization subscales might relate to relational continuity. Despite high correlations with the PCAS Trust subscale, trust emerged clearly as a distinct factor in principal components analysis. The First-contact Utilization subscale, which elicits the tendency to consult first the primary care provider, neither correlates highly nor loads with continuity subscales. (It relates specifically to one item in relational continuity: "If I am sick, I would always contact a doctor at this clinic first" (CP_prp1).).

Construct validity

Most of the 21 items loaded reasonably well (>0.40) onto a single factor using principal components; exceptions were items related to concentration of care (PC_vb1, PC_vb2, PT_oc1, CP_prp1, CP_prp4). Confirmatory analysis of a one-dimensional model indicates adequate model fit, with a Root Mean Squared Error of Approximation (RMSEA) of p = 0.086 (Table 5, Model 1) and a Normed Fit Index at almost 1.0 (0.98).

Table 5

Summary of model fit statistics for various iterations of models using confirmatory factor analysis with structural equation modelling

Model number	Model description	Chi-square[1]	Df[2]	Model CAIC[3]	Normed Fit Index[4]	RMSEA[5]
1	**Unidimensional model, all items associated to one latent variable.**	1183	252	1529	0.98	0.086
2	**Multi-dimensional model, items grouped by subscales** (second-order) First-order latent variables: PCAS Visit-based, PCAS Contextual Knowledge, PCAT Ongoing Care, CPCI Accumulated Knowledge, CPCI Preference for Regular Physician. Second-order variable: relational continuity.	966	247	1348	0.99	0.077
	Multi-dimensional model, items grouped by two sub-dimensions: knowledge by provider and concentration of care					
3	Second-order model, sub-dimensions as first-order model (loading for concentration 1.00; for knowledge 0.86)	1047	251	1400	0.99	0.080
4	**First-order model, with correlations between sub-dimensions ("oblique"); correlation between dimensions 0.86**	**1047**	**251**	**1400**	**0.99**	**0.080**

[1] Lower values of nested models indicate better fit relative to the degrees of freedom.
[2] Degrees of freedom determined from the number of parameters to be estimated relative to the number of observations.
[3] Consistent Akaike information criterion; lower values indicate better fit.
[4] Should tend to 1.0.
[5] Root mean squared error of approximation; should tend to 0.050

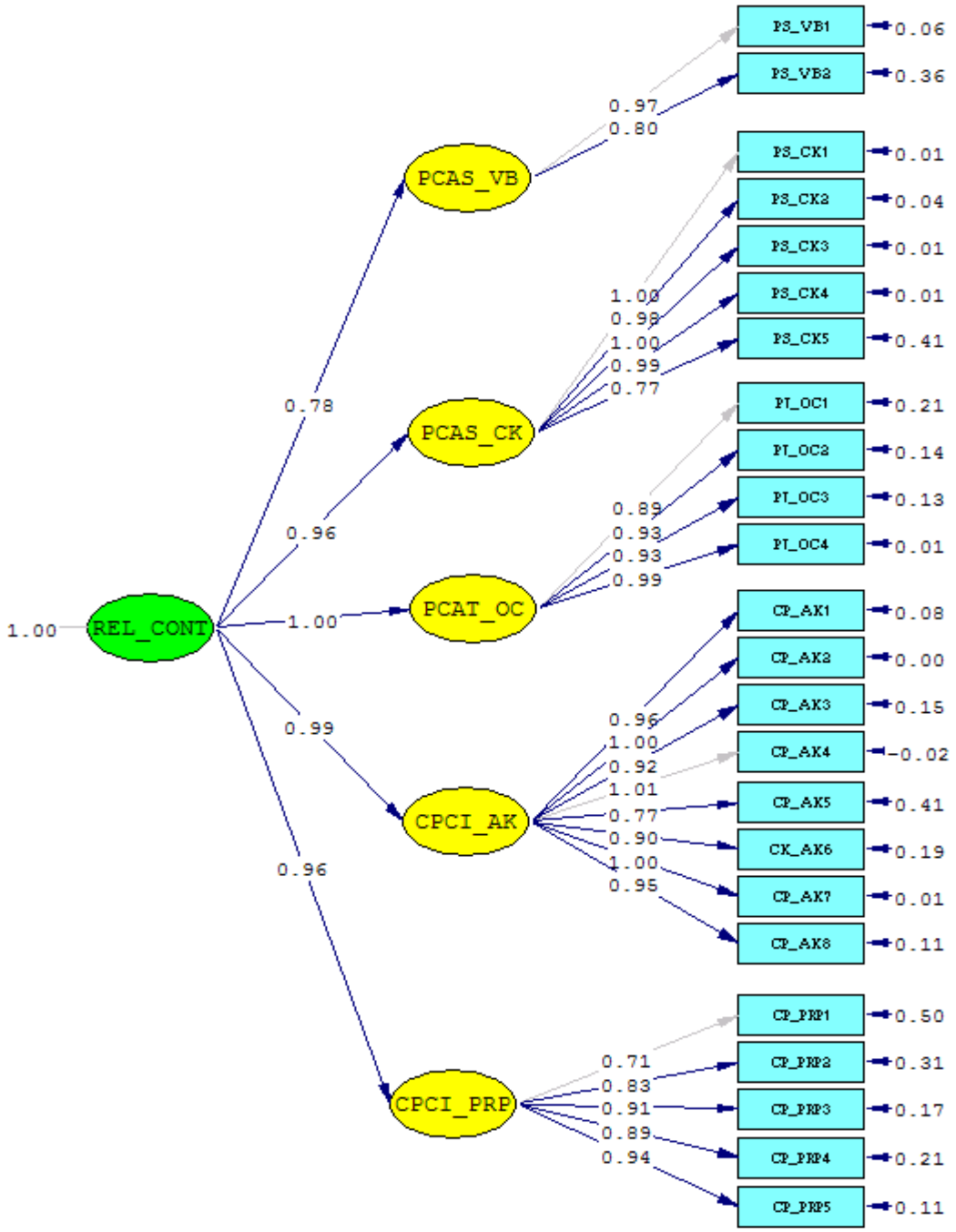
Fit with operational definitions

The eigenvalues suggest that a two-factor model best captures the item variation (results available on request). Using our operational definition as a guide, we judged that the first factor (eigenvalue = 10.19) captures knowledge of the patient and the second (eigenvalue = 1.66), "relationship ... spans various health events," focuses on concentration of care rather than on duration of relationship. Both are specific to the regular provider. No items or factors captured "experienced care being consistent with individual needs."

Some individual items had problematic loadings. PT_oc2, ability to talk to a known provider, loads weakly on knowledge (0.46) and may be related to access rather than to relational continuity. As a whole, the CPCI Preference for Regular Physician subscale fits within concentration of care, but the first two items do not load on either factor: tendency to contact own provider when sick (CP_prp1, loadings 0.21, 0.16) and perception that care improves with concentration of care (CP_prp2, loadings 0.33, 0.27). These were associated with concentration of care for confirmatory factor analysis. The item CP_ak5 loads very modestly on knowledge (0.48), but this is most likely due to its reverse wording, "doctor does not know history," rather than to poor conceptual fit.

With confirmatory factor analysis, the best-fitting model was a multi-dimensional model in which items are grouped in their parent subscales, which in turn are associated with a single construct, presumed to be relational continuity (Table 5, Model 3), as illustrated in Figure 1. The figure shows that the PCAS Visit-based Continuity subscale (PCAS-VB) has the lowest loading on the latent variable of relational continuity (0.78).

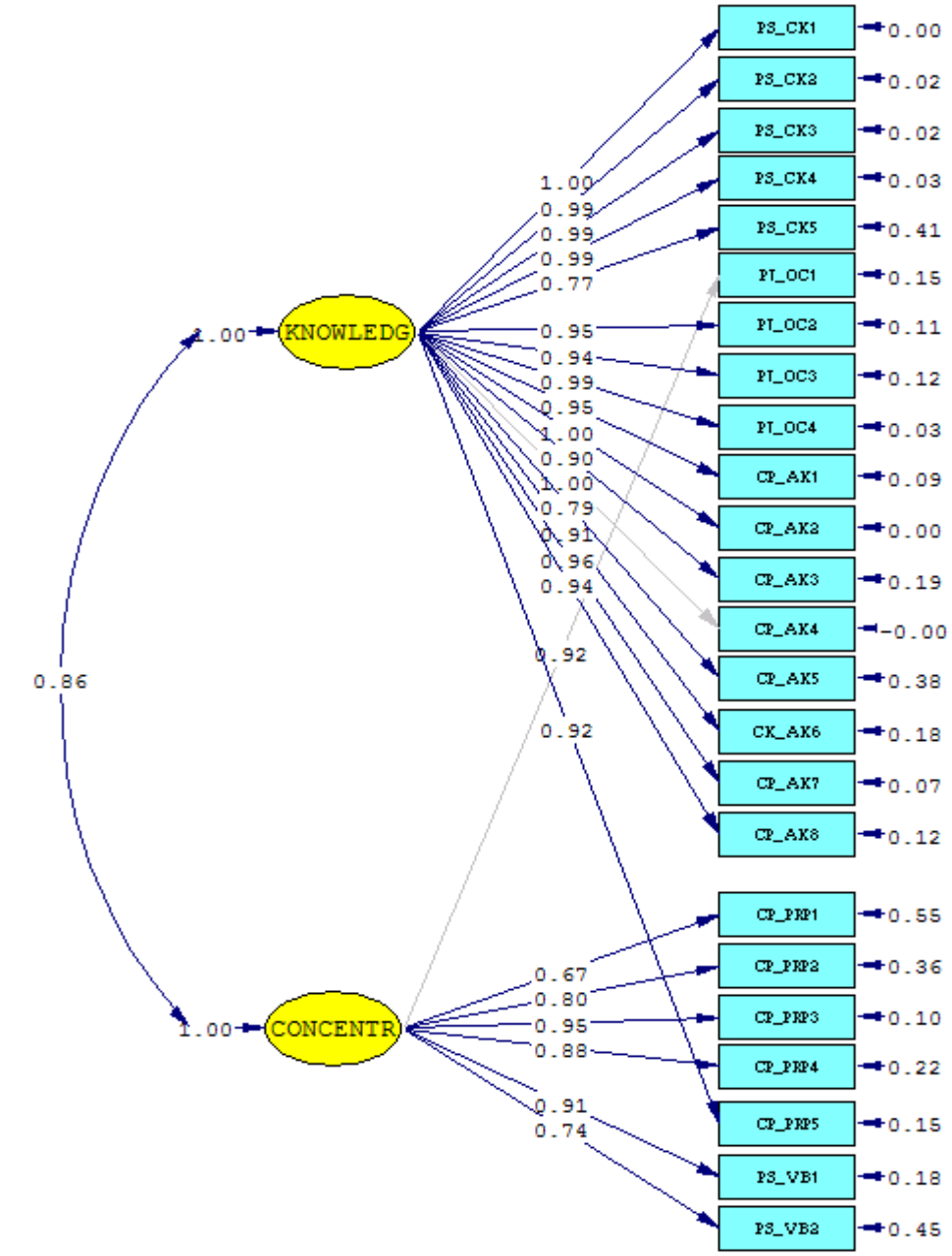
Figure 1
Parameter estimations for a structural equation model with original instrument subscales as (first order) latent variables which relate to an underlying construct (second order latent variable) presumed to be relational continuity (Model 2 - Table 5)



Chi-Square=966.36, df=247, P-value=0.00000, RMSEA=0.077

The goodness-of-fit statistics for the model in which items are grouped by sub-dimensions of knowledge and concentration of care indicate an improvement over the one-dimensional model (Table 5, Model 1 compared to Model 2/3a, change $\chi^2 = 1183\text{-}1047 = 136$, 1 df, $p<0.001$). The model and the loadings of different items on the scales are presented in Figure 2, where we can see that some items do not have high loadings on the sub-dimension and have a high proportion of residual error (shown to the right of each item). These items may be poorly related to the construct either because they are not discriminatory or because they relate better to another construct that is not part of the latent variable.

Figure 2
Parameter estimations for a structural equation model with items loading on correlated sub-dimensions of relational continuity, accumulated knowledge and concentration of care (Model 4 - Table 5)



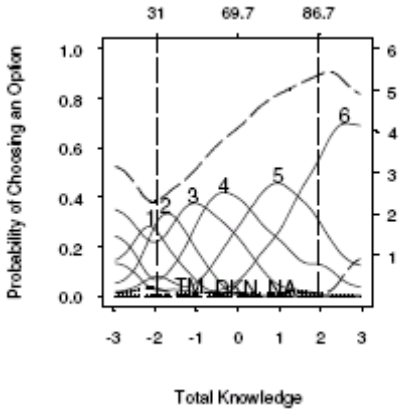
Chi-Square=1047.02, df=251, P-value=0.00000, RMSEA=0.080

Individual item performance

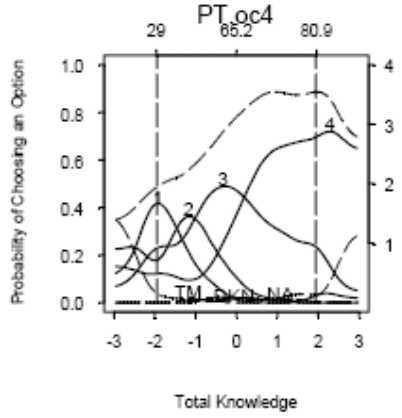
Non-parametric item response theory graphs were modelled showing the knowledge and concentration of care results. Figure 3 illustrates three items. The parametric estimates of item discrimination correspond to the slope of the expected total score (broken line) in the three illustrative items, and these are similar to the estimate against the subscale's original latent variable, shown in Table 2 (right-hand column).

Figure 3

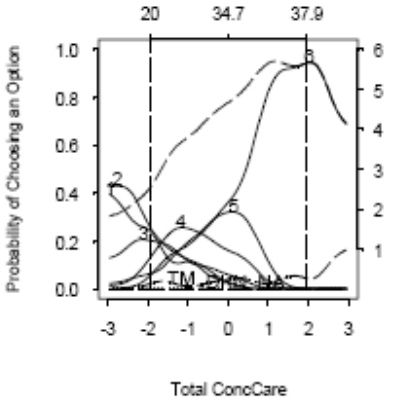
Non-parametric item response theory analysis for three items with option characteristic curves (solid lines) and expected total scores (broken line) modelled as a function of cumulative summary score (top axis) and standard normal quantiles (bottom axis) of accumulated knowledge in Graphs 3a and 3b and concentration of care in Graph 3c



3a: "Rate doctor's knowledge of what *worries* you most about your health?" (PC_ck3)
Results show that this item performs well. Option characteristic curves cover the entire range of scores and are clearly differentiated from one another and most likely to be endorsed in a distinct region which corresponds to the weight assigned to each option. The probability of true missing (TM), not applicable (NA), and don't know (DK) responses did not vary as a function of total scores.



3b: "Does your Primary Care Provider know what problems are most important to you? (PT_oc4)
Results show that this item performs relatively well. Expected total scores show good discriminatory capacity between low levels of knowledge but less in above-average levels. The option characteristic curve for option 3 ("probably") does not correspond to a distinct region of knowledge.



3c: "My medical care improves when I see the same doctor that I have seen before." (CP_prp2).
This item discriminates well between different levels of concentration of care, as shown by the steep slope of the expected total score. However, the option characteristic curves are not clearly differentiated, except for the extreme options, suggesting a dichotomous scale.

Figure 3a illustrates the best item from the PCAS Contextual Knowledge subscale (PS_ck3). The steep slope of the expected total score (broken line) demonstrates excellent capacity to discriminate between levels of knowledge. The item also shows good discriminatory performance (a = 4.57, Table 2) within its original subscale construct. The response option curves (solid lines) indicate the appropriate weighting and interval increments of the response options. The other items in this subscale also perform well, except for the item "If I were unconscious or in a coma, my doctor would know what I would want done for me" (PS_ck5); this may be due to the score transformation. The items from the CPCI Accumulated Knowledge subscale were less discriminating than items in the PCAS Contextual Knowledge subscale (as seen also in Table 2); the response option curves were distinct only at low levels of knowledge.

Figure 3b illustrates the best item from the PCAT Ongoing Care subscale, PT_oc4. While the item is generally discriminating (a = 3.58 within its original subscale), the non-parametric graph shows that it does not discriminate among individuals in the positive range of knowledge. The expected total score is essentially flat from +1 to +3 of the standardized range of knowledge. Furthermore, the probability of endorsing Option 3 ("probably") is high across all levels of knowledge, suggesting it may be eliciting something other than experience; the weight assigned to this option may not be appropriate. Other PCAT items shared this difficulty.

Finally, Figure 3c illustrates an item on concentration of care from the CPCI Preference for Regular Provider subscale (CP_prp2): "care improves when I see the same doctor." While this item is generally discriminating (a = 2.11 within its original subscale), this is achieved because the response options essentially function as dichotomous responses (yes/no), not as originally intended. The item's performance is typical for the items in the concentration of care dimension: CPCI Preference for Regular Provider, PCAS Visit-based Continuity and the PCAT_oc1. Nonetheless, the items differ with respect to the threshold of total concentration at which the positive option will be endorsed (item difficulty), so together they yield good information on the degree of concentration, especially in the low range, with reduced discrimination and information yield above the mean level.

Discussion

Our study demonstrates that these validated subscales appear to be measuring a common underlying construct of relational continuity as we conceived it. They capture two sub-dimensions: provider knowledge of the patient and concentration of care (seeing the same provider over a series of health events). Consistency of care with the individual's needs –

arguably the main benefit of relational continuity – is not captured in any of the scales we examined. It may be that this sense of "patient-centredness" is so new that questions have not yet found their way into the measurement instruments.

Provider knowledge is well-measured. The PCAS Contextual Knowledge subscale shows the best capacity to discriminate between different levels of provider knowledge over the entire range of the scale, but the CPCI Accumulated Knowledge subscale and most items in the PCAT Ongoing Care subscale also perform well. Overall, our results show that, in tracking whether health reforms have any negative impact on provider knowledge of the patient, program evaluators can count on robust measures of relational continuity. Provider knowledge is one of the characteristics patients value most.(Turner et al. 2007; Cheraghi-Sohi et al. 2008). It is also associated with safer care (Kuzel et al. 2004), including accurate diagnosis and application of wait-and-see techniques (Hjortdahl and Borchgrevink 1991; Hjortdahl 1992). However, participants in our qualitative discussion groups of the questionnaires were divided on expectations of the physician–provider relationship; several expressed discomfort with the level of knowledge suggested in the instruments and others defended this as part of patient-centered care (Haggerty, Beaulieu et al. 2009).

Concentration of care is captured best by the CPCI Preference for Regular Provider subscale and adequately by the PCAS Visit-based Continuity subscale and one relevant item in the PCAT. The items function as yes/no responses rather than the intended ordinal scales, and they are more informative and discriminatory for poor than for good concentration of care. This suggests they can be good indicators of discontinuity or care fragmentation but are less useful for measuring high levels of continuity. Their content reflects the measurement proxy that has been most used in PHC research to infer continuity: the extent to which the same provider is seen over time for a variety of consultations. However, weak correlation between concentration subscales and the percentage of visits to the regular provider as reported by respondents' raises doubts about whether relational continuity should be inferred from utilization data. Though the weak correlation may indicate that the construct is developed over longer periods than 12 months, some have questioned whether concentration of care is a good proxy of relational continuity (Reid et al. 2002) A qualitative study suggests that patients do not consider that consulting other providers necessarily diminishes their commitment to or continuity with their own physician (Roberge et al. 2001).

In the introduction, we raised concerns about relational continuity in team-based care. Rodriguez et al. (2007) found that patient assessments of all aspects of care declined when the proportion of visits to their own primary care provider declined. This seems particularly important if the teamwork is not visible to patients (Safran 2003). The new version of the PCAS, the Ambulatory Care Evaluation Survey (Safran et al. 2006), includes a subscale on team care, but it appears to measure patients' perception of teamwork rather than the experience of relational continuity with the team per se. Starfield found that outcomes associated with "site continuity" were considerably less strong than those associated with physician continuity, unless the providers shared a common approach and philosophy of care (Starfield 1998). This suggests a proxy for team relational continuity might be obtained from providers' perceptions of team cohesiveness.

Study limits

This study has several limitations. First, limiting the study to those having visited a regular provider in the previous 12 months constrains the range of relational continuity, and the resulting positive skewing of responses compromises the capacity to detect underlying factors. However, because our sampling design essentially over-sampled for persons with a poor experience of care, we may have introduced greater variance than would be found in the general population. Second, eliminating subjects with missing values not only reduced statistical power, but may have biased the final sample. However, sensitivity analysis using imputation of missing values did not alter our overall conclusions. Finally, our operational definition of relational continuity may be different from that of the instrument developers.

Conclusion

Overall, we found validated subscales perform relatively well for measuring one dimension of relational continuity: accumulated knowledge. We can recommend that this dimension be used to evaluate the impact of reforms on relationships with individual providers. Subscales measuring concentration of care are most useful for capturing fragmentation and discontinuity. The relational continuity dimension of making care consistent with patient needs is not captured in any instrument and may require further development, as would instruments measuring team relational continuity.

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