ORIGINAL RESEARCH

Provider Practice Characteristics That Promote Interpersonal Continuity

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Purpose: **Becoming certified as a patient-centered medical home now requires practices to measure how effectively they provide continuity of care. To understand how continuity can be improved, we studied the association between provider practice characteristics and interpersonal continuity using the Usual Provider Continuity Index (UPC).**

Methods: **We conducted a mixed-methods study of the relationship between provider practice characteristics and UPC in 4 university-based family medicine clinics. For the quantitative part of the study, we analyzed data extracted from monthly provider performance reports for 63 primary care providers (PCPs) between July 2009 and June 2010. We tested the association of 5 practice parameters on UPC: (1) clinic frequency; (2) panel size; (3) patient load (ratio of panel size to clinic frequency); (4) attendance ratio; and (5) duration in practice (number of years working in the current practice). Clinic, care team, provider sex, and provider type (physicians versus nonphysician providers) were analyzed as covariates. Simple and multiple linear regressions were used for statistical modeling. Findings from the quantitative part of the study were validated using qualitative data from provider focus groups that were analyzed using sequential thematic coding.**

Results: **There were strong linear associations between UPC and both clinic frequency ($\beta = 0.94$; 95% CI, 0.62–1.27) and patient load ($\beta = -0.37$; 95% CI, −0.48 to −0.26). A multiple linear regression including clinic frequency, patient load, duration in practice, and provider type explained more than 60% of the variation in UPC (adjusted $R^2 = 0.629$). UPC for nurse practitioners and physician assistants was more strongly dependent on clinic frequency and was at least as high as it was for physicians. Focus groups identified 6 themes as other potential sources of variability in UPC.**

Conclusions: **Variability in UPC between providers is strongly correlated with variables that can be modified by practice managers. Our study suggests that patients assigned to nurse practitioners and physician assistants have continuity similar to those assigned to physicians. (J Am Board Fam Med 2013; 26:356–365.)**

Keywords: **Continuity of Patient Care, Medical Home, Patient-Centered Care**

Interpersonal continuity (IC), a fundamental principle of primary care, is defined by the Institute of Medicine as the product of "personal interactions that include trust and partnership between patients and clinicians."[1] Numerous studies have demonstrated the benefits of enhanced IC, including increased patient and provider satisfaction,[2–5] healthier patient behaviors,[6] increased receipt of preventive and screening services,[7–11] reduced hospitalization rates,[12,13] decreased emergency department and intensive care unit utilization,[14–16] decreased overall

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health costs,[17] and reduced elderly mortality.[18,19] Despite broad consensus regarding these benefits, practice characteristics that improve IC remain poorly understood, and practice trends such as remote patient interactions and team-based care are leading to new dimensions of continuity outside of traditional face-to-face encounters.[20] With the advent of formal systems to evaluate and certify patient-centered medical homes (PCMHs), primary care practices increasingly are being asked to assess and report measures of continuity of care.

Decades of research have employed a variety of ways to measure IC.[21] Before electronic health records (EHRs) there were few practical methods for collecting accurate continuity data, requiring investigators to infer continuity from chart review, claims analysis, or survey data.[22] This presented barriers to accurate measurement of IC and limited investigators' abilities to perform rigorous analyses. As a result, there is little consensus on how to improve continuity or whether a benchmark or target continuity rate exists.

The Usual Provider Continuity Index (UPC) is a measure of how often patients see their self-identified primary care provider (PCP).[21,23] It is calculated by first determining the population of active patients who are assigned to a particular provider. The monthly UPC for that provider then is defined as the number of monthly clinic visits during which these patients see the assigned PCP divided by their total visits to the clinic that month. Measures of UPC now are required for several systems of PCMH certification, suggesting that primary care practices will need to measure and improve performance in this area in the coming years.[24,25]

In 2008, the Oregon Health & Science University (OHSU) Department of Family Medicine established a system using data from EHRs for automated monthly collection of the UPC for each provider and clinic team. This has provided a robust database of prospectively collected continuity data, allowing for analyses of the determinants of continuity that were not feasible before EHR implementation. The objective of our study was to investigate whether certain provider practice parameters are associated with higher IC, thereby suggesting ways for practices to improve continuity as they transform into PCMHs.

Methods

Design

We conducted a sequential, explanatory, mixed-methods study[26] of the effects of several provider practice parameters on IC as measured by UPC. We used retrospective data from 12 monthly UPC reports and department personnel records for quantitative analysis. The monthly reports included information about panel size and clinic frequency as well as UPC data, and the personnel records contained information about provider sex and duration in practice; however, we also wanted to learn about other potential factors that might affect continuity of care. Therefore, we conducted provider focus groups under an expert panel paradigm for qualitative analysis after the quantitative analysis was complete, allowing us to ask providers about other factors that might impact the UPC score.

Setting

The OHSU Department of Family Medicine operates 4 academic family medicine clinics. These include one federally qualified health center and one rural health clinic. All the clinics are recognized as level 3 PCMHs by Oregon's designation system,[24] which is similar to that of the National Committee for Quality Assurance.[25] Each clinic is divided into care teams, which consist of physicians and mid-level providers (nurse practitioners [NPs]) and physician assistants [PAs]), residents (with the exception of the rural health clinic), nurse coordinators, medical assistants, and ancillary staff. The EPIC electronic health record is used in each of the clinics.

Two years before the start of this project, each of the clinics engaged in a comprehensive quality improvement project to ensure that the PCP field in every patient's health record was accurate and up to date. To ensure correct PCP assignment data, patients are asked to identify their PCP each time they have an encounter with the clinic, including phone calls, laboratory visits, nursing visits, and provider visits. Because of this protocol, a current and accurate PCP field is verified at every patient encounter.

One year before the project, the department began to track and report the UPC rate for every provider on a monthly basis. This provides a quantitative assessment of the availability of each provider to the patients for whom he or she is the

registered as PCP. Data are disseminated in monthly provider performance reports. Since every PCP is a member of a discrete team, the UPC for each team is also tracked monthly.

Subjects for Quantitative Analysis

The unit of analysis for this study was the individual provider, specifically the individual faculty physicians (MDs and DOs) and mid-level providers (NPs and PAs) at each of the 4 clinics. The study period was from July 1, 2009, to June 30, 2010. The inclusion criteria were faculty and clinical fellows who had documented clinic sessions at any of the 4 clinics and who had a registered patient panel for which they were the designated PCP during the study period. To identify all eligible providers, we searched department records of all providers who had documented clinic sessions at any of the 4 clinics during the study period; we expanded the search to include all faculty members identified by departmental personnel records. This yielded 124 potentially eligible providers. Of these 124 individuals, 61 were excluded for the following reasons:

1. Thirty-two faculty members were physicians without an assigned patient panel (15 consulting specialists, 7 locum tenens physicians, 5 nonclinical faculty, 3 exclusive residency preceptors, and 2 nonclinical fellows).
2. Two were physicians who had a mixed primary care and specialty sports medicine referral practice.
3. Five were nonphysician providers without a registered patient panel (ie, 2 acupuncturists, 2 clinical social workers, 1 PA who was assigned no patients).
4. Twenty-two were providers who left the department during the study period (5 physicians, 9 fellows who recently graduated, and 8 mid-level providers).

In total, the final analysis set included 63 providers comprising 45 physicians (including 6 fellows) and 18 mid-level providers. Provider data were historic in nature and de-identified before analysis; thus an exemption was granted by the OHSU Institutional Review Board.

Data Collection and Outcome Variable

System-wide EHR use allowed for continuous data collection with respect to provider panel sizes, clinic frequency, and visit volumes. Our outcome variable was the mean monthly provider UPC for each provider over the 12-month study period.

Predictor Variables

Clinic frequency, panel size, patient load, attendance ratio, duration in practice, as well as other covariates, were the practice parameters investigated as potential independent predictors of UPC.

Clinic Frequency

Clinic frequency was defined as the number of monthly half-day clinic sessions for a given provider. Providers are scheduled to work in the clinics in 4-hour blocks of time, which are referred to as half-day sessions. Counts were obtained from monthly provider performance reports and averaged over the 12-month study period to yield a single mean monthly half-day count for each provider.

Panel Size

End-of-month patient panel size for each provider was obtained from monthly provider performance reports. Panel size values were determined from the total number of patient charts in the EHR with a given provider listed in the PCP field. Patients who had not seen their PCP in 3 or more years are dropped from the provider's panel; thus end-of-month panel size reflected only active patients.

Patient Load

Defined as the ratio of panel size to clinic frequency (panel-to-half-day ratio), the patient load variable normalizes panel size for part-time providers and was obtained by dividing the mean monthly panel size by the mean monthly half-day clinic session count for each provider.

Attendance Ratio

Clinic attendance ratio was calculated for each provider by dividing the mean monthly half-day session count by the expected monthly half-day count as indicated by the provider's contracted clinical full-time equivalent. A 1.0 clinical full-time equivalent corresponds to 8 clinic half-day sessions per week for mid-level providers and 7 half-day sessions per week for physicians, who have 1 half-day per week designated for resident precepting. This measure did not discriminate by reason for absence from the clinic.

Duration in Practice

Duration in practice for each provider was defined as the total number of years practicing in OHSU Family Medicine at the end of the study period (June 30, 2010) based on department personnel records.

Other Covariates

Clinic and care team assignments for each provider were obtained from monthly performance reports. Provider type (physician vs. mid-level) and sex were obtained from departmental personnel records.

Statistical Analysis

Stata statistical software version 11.0 (StataCorp, College Station, TX) was used for all statistical analyses. Simple linear regression was used to assess the effect of each of the individual predictors on the outcome variable (UPC). One-way analysis of variance with Bonferroni-adjusted pairwise comparisons was used to assess variability in UPC by clinic and team assignments. Two-sample *t* tests were used to compare UPC and predictor variables by provider type (physician vs. mid-level) and sex. Multiple linear regression modeling was performed using the backward elimination method, Mallow's criteria, and adjusted R^2 to assess multiple predictors simultaneously and to identify the best set of independent predictors for UPC.

Qualitative Methods, Subjects, and Analysis

The qualitative portion of our study used provider focus groups under an expert panel paradigm.[26,27] We introduced our hypotheses and proposed quantitative analysis predictor variables to provider groups to solicit their expert opinions regarding our methods and quantitative aims and to generate additional hypotheses for future study. Particular attention was paid to unique characteristics of clinics or individual providers that could limit the validity of our quantitative findings, as well as provider commentary on shifting perceptions of IC. Focus groups using a standardized script were conducted and audio-recorded by 1 of the authors (TM) during scheduled faculty meetings at each of the 4 clinics. Physician and mid-level provider participants were not formally identified at the time of the focus groups. Audio recordings were transcribed by 1 of the authors (TM), with anonymity of respondents maintained. Transcripts were independently coded into themes, subthemes, and representative quotations by 2 of the authors (TM and JS), with subsequent joint reconciliation of themes.

Results

Descriptive Analysis

A total of 63 providers and 15 care teams from 4 clinics were included in our quantitative analysis. Among these providers, 21 were female physicians, 24 were male physicians, 16 were female mid-level providers, and 2 were male mid-level providers. Thus, 58.7% (n = 37) were female and 28.6% (n = 18) were mid-level providers. A descriptive summary of outcome and predictor variables is given in Table 1. There were significant differences in UPC, clinic frequency, and patient load by provider type. There were no significant differences in UPC or predictor variables by provider sex. There were no significant differences in UPC between teams in a given clinic.

Clinic 1 had a significantly lower mean provider UPC relative to the other 3 clinics (56.1% vs. 65.4%; $P < .05$). For this reason we examined whether the relationships between predictor variables and UPC differed among the clinics. Linear plots of UPC on predictor variables stratified by clinic revealed similar trends in UPC across all clinics, with the only discrepancy being a lower baseline UPC for clinic 1; thus there was no effect modification by clinic.

Univariate Analysis

Simple linear regressions of UPC on predictor variables are summarized in Table 2. Clinic frequency was significantly associated with increased UPC (Figure 1), whereas both panel size and patient load were significantly associated with decreased UPC (Figure 2). There was no significant association between UPC and clinic attendance ratio. Although there was no significant linear association between UPC and duration in practice, a strong association was observed between patient load and duration in practice ($\beta = 1.75$; $r = 0.55$; $P < .001$); thus duration in practice was investigated as a potential confounder in multivariate analysis.

Multivariate Analysis

Multiple linear regression modeling identified a set of independent predictors: clinic frequency,

Table 1. Descriptive Summary of Outcome and Predictor Variables, Stratified by Provider Type

Variable	Mean	SD	Min	Max	P*
UPC (%)†					
All providers	62.92	11.55	37.30	87.40	
Physician	60.97	9.84	37.29	78.64	.033
Mid-level	67.78	14.16	41.93	87.41	
Clinic frequency (monthly half-day clinic sessions held)					
All providers	16.83	7.27	4.92	31.30	
Physician	13.63	5.04	4.92	24.42	.000
Mid-level	24.85	5.63	15.06	31.30	
Panel size (count of patients assigned to provider)					
All providers	577.4	315.8	65	1377	
Physician	540.5	274.3	92	1288	.144
Mid-level	669.7	395.4	65	1377	
Patient load (ratio of panel size to half-day clinic frequency)					
All providers	38.21	19.96	2.40	93.67	
Physician	41.32	18.80	5.90	93.70	.049
Mid-level	30.41	21.22	2.41	72.55	
Attendance ratio‡					
All providers	1.01	0.26	0.56	2.15	
Physician	1.04	0.30	0.56	2.14	.140
Mid-level	0.93	0.13	0.68	1.29	
Duration in practice (years)					
All providers	6.35	6.38	0.42	24.92	
Physician	7.19	6.85	0.67	24.92	.099
Mid-level	4.26	4.50	0.42	16.75	

*Two-sample *t* test for difference in mean by provider type.
†Outcome variable: percentage of total clinic visits with assigned provider.
‡Ratio of actual clinic frequency to expected clinic frequency.
UPC, Usual Provider Continuity Index; SD, standard deviation.

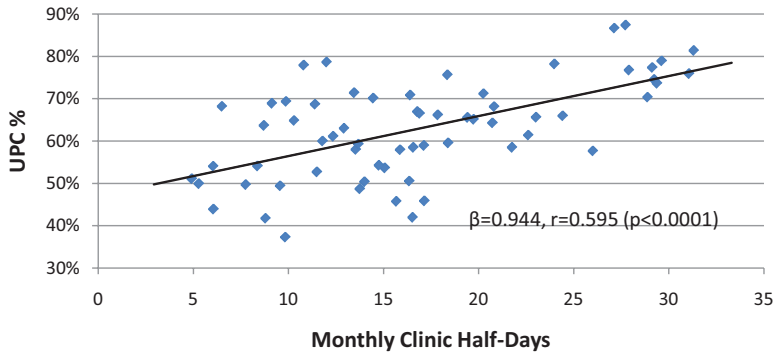
patient load, duration in practice, provider type, and interaction between patient load and provider type (Table 3). Clinic frequency and patient load were the primary modifiable predictors of UPC. Duration in practice was included as a significant confounder because of the association between UPC and patient load. Provider type was included as an effect modifier because the univariate analysis suggested potentially different associations between UPC and clinic frequency by provider type. The final model explains >60% of the variation in UPC across our

Table 2. Simple Linear Regression of Usual Provider Continuity Index* on Predictor Variables

Predictor Variable	B	95% CI	r	P
Clinic Frequency†	0.944	0.618–1.271	0.595	<.0001
Panel Size‡	−0.009	−0.018 to 0.000	0.209	.044
Patient Load§	−0.370	−0.483 to −0.256	0.639	<.0001
Attendance Ratio‖	0.050	−0.06 to 0.162	0.115	.370
Duration in Practice¶	−0.265	−0.724 to 0.193	0.146	.252

*Percentage of total clinic visits with assigned provider.
†Monthly half-day clinic sessions held.
‡Count of patients assigned to provider.
§Ratio of panel size to clinic frequency.
‖Ratio of actual clinic frequency to expected clinic frequency.
¶Duration (years) in current practice.

Figure 1. Simple linear regression of Usual Provider Continuity Index (UPC) (percentage of total clinic visits with assigned provider) on clinic frequency (monthly half-day clinic sessions held).



population of clinicians (adjusted R^2 = 0.629; $P < .0001$).

Effect modification by provider type is further represented in Figure 3, which demonstrates the differential association between UPC and clinic frequency among physician and mid-level providers, holding patient load and duration in practice constant.

Qualitative Analysis

Physician and mid-level providers (n = 35) from each of the 4 clinics participated in focus groups. Six general themes were identified during sequential coding of provider responses (Table 4). Themes 1 to 3 identify potential sources of variation in UPC that are intrinsic to specific clinics, providers, or patient populations. Themes 4 and 5 focus on alternative perceptions of IC beyond face-to-face encounters between a single patient and their personal PCP. Theme 6 addresses the potential relationship between clinic absences and IC.

Discussion

The purpose of our study was to (1) define baseline UPC measures for 63 providers in our 4 clinics after a full year of careful measurement and (2) understand differences in UPC among providers based on provider practice characteristics. Our findings should be useful to clinic managers and physician leaders seeking to improve IC within their practices, but this method of analysis is only valid when patients' PCP assignments are known to be highly accurate and frequently updated. We identified patient load and clinic frequency as major modifiable predictors of UPC, both of which can be manipulated to achieve higher UPC. Based on our model, a provider's IC as measured by UPC can be improved by adjusting how often the provider is in the clinic and the size of his or her practice panel. A physician provider near the mean of all studied parameters (clinic frequency, 14 monthly half-days; panel size, 540 patients; patient load, 38.6; duration in practice, 7.2 years) can ex-

Figure 2. Simple linear regression of Usual Provider Continuity Index (UPC) (percentage of total clinic visits with assigned provider) on patient load (panel size-to-clinic frequency ratio).

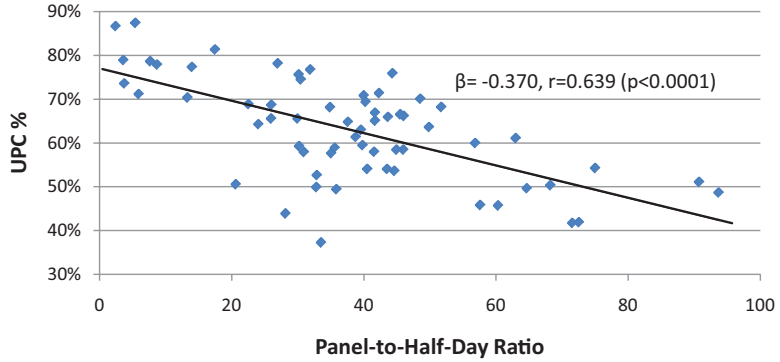


Table 3. Optimal Multivariate Linear Model for Prediction of Usual Provider Continuity Index*

Variables	β	95% CI	$P^{\dagger}$
Clinic frequency	1.52	0.84–2.19	<.001
Patient load	−0.32	−0.45 to −0.20	<.001
Duration in practice	0.61	0.27–0.95	.001
Provider type[‡]	23.01	5.62–40.41	.010
Type and patient load interaction	−0.81	−1.58 to −0.04	.039
Intercept[§]	62.91	54.74–71.07	<.001

*Percentage of total clinic visits with assigned provider.
†*P* values reflect partial F-tests for significance of individual terms within the model.
‡Reference group is mid-level providers (mid-level = 0, physician = 1).
§Data centered around mean clinic frequency of 16.8 monthly clinic half-days (mean clinic frequency for all providers).

pect a UPC of 62.0%, nearly identical to our observed mean (61.0%). If this same provider were to add 4 half-days per month without a change in panel size, UPC would increase to 67.7%. Our qualitative analysis suggests that clinic scheduling patterns (subtheme 2.5) may account for additional unexplained variability in UPC. Providers in our focus groups believed continuity was likely to be more important for visits related to chronic or ongoing care, suggesting that these visits might be evaluated differently than acute care visits when assessing UPC (subtheme 4.1).

An important finding of our study is that IC for mid-level providers as measured by UPC is at least as good as it is for physicians in this practice setting, where patients are allowed to choose physicians or mid-level providers as their PCP. Focus group participants hypothesized that intrinsic practice differences may contribute to the variability in UPC trends by provider type, including approach to patient care (subtheme 2.1), scope of practice (subtheme 2.3), and breadth of nonclinical duties (subtheme 2.4). Most of the physicians in this study perform hospital and maternity care and see patients in the office, whereas mid-level providers work only in the office setting. A specific limitation of our study is that it included only providers in academic practices, which calls into question whether our findings would be reproducible in community practices. Physicians in our practices have substantially more teaching and other academic duties than the mid-level providers. It is possible that the practices of mid-level providers in aca-

Figure 3. Multivariate prediction of Usual Provider Continuity Index (UPC) (percentage of total clinic visits with assigned provider) based on clinic frequency (monthly half-day clinic sessions held), stratified by provider type (physicians vs. mid-level providers). Predicted UPC calculated at fixed values for patient load (panel-to-half-day ratio, 38.2) and duration in practice (6.35 years). Dashed lines denote data extrapolation outside of the observed range of clinic frequency for either provider type.

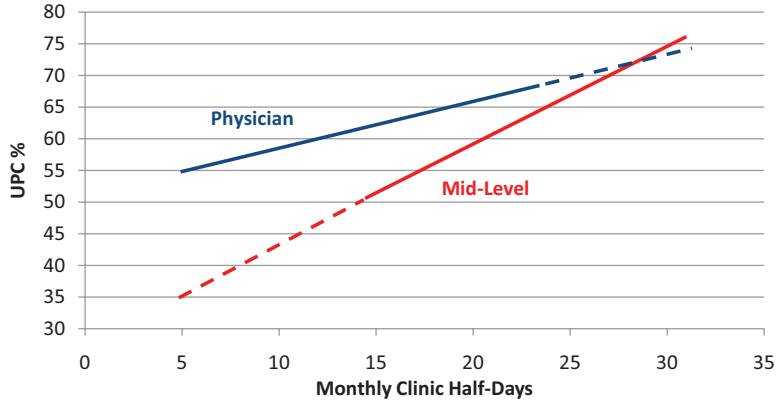


Table 4. Qualitative Data Summary from Focus Group Interviews

Themes	Subthemes	Description
1. Clinic diversity	1.1 PCP assignment accuracy	Clinics have different systems for ensuring that PCP fields are frequently updated and accurate.
	1.2 Scheduling	Clinics place variable importance on scheduling patients with their PCP rather than the first available provider.
	1.3 Location/type	University, FQHC, and rural clinics may have intrinsic differences in patient population and structure.
2. Provider diversity	2.1 Provider type	Physician (MD/DO) and mid-level (PA/FNP) providers may have differences in both scope of practice and approach to care.
	2.2 Provider sex	Female and male providers may have differences in both scope of practice and approach to care.
	2.3 Scope of practice	Providers who provide maternity care, inpatient care, sports medicine, suboxone, resident precepting, etc., may have different UPC patterns than providers who solely conduct outpatient continuity clinics.
	2.4 Nonclinical duties	Providers with more academic/administrative responsibilities may have different UPC patterns than those with strictly clinical practices.
	2.5 Clinic scheduling	Providers with more open schedules or night/weekend clinics may have different UPC patterns than those with primarily prescheduled daytime clinics.
	2.6 Location of residency	Providers who trained at OHSU may have more developed panels for their year in practice than providers who trained elsewhere.
3. Patient diversity	3.1 Panel demographics	SES, sex, race, ethnicity, age, medical complexity, visit frequency, and other panel demographics are likely to influence UPC for a given provider.
	3.2 Importance of continuity to patient	Some patients frequently change providers for a variety of reasons, making their PCP field relatively arbitrary.
4. Visit type	4.1 Acute care	Acute care visits may not be as important as chronic or ongoing care in terms of actual continuity.
	4.2 Nonoffice visits	Current calculation of UPC does not take into account phone, E-mail, or MyChart encounters, where a meaningful interaction occurs without face-to-face contact.
5. Non-PCP continuity	5.1 Team continuity	Patients may value continuity with a team of providers more than with a specific provider.
	5.2 Clinic continuity	Patients may value continuity with a particular clinic more than with an individual or team of providers.
	5.3 Family continuity	Continuity across families may be more important than continuity with individual patients.
6. Absences	6.1 Planned vs. unplanned	Are all absences from clinic a diversion from continuity (eg, deliveries, inpatient), or is it just unplanned absences (eg, illness)?
	6.2 New parent leave	Specific extended absence that may behave differently than other absences in terms of continuity.

DO, osteopathic doctor; FNP, family nurse practitioner; FQHC, federally qualified health center; MD, medical doctor; OHSU, Oregon Health & Sciences University; PA, physician assistant; PCP, primary care provider; UPC, Usual Provider Continuity Index.

demic clinics may more closely resemble community-based physician practices, where physicians are less likely to have these academic responsibilities.

Another key finding in our study was that longer duration in practice improves UPC, but this occurs only after adequately controlling for practice size because more experienced providers care for larger panels with fewer clinic sessions as their practices mature. Qualitative analysis suggested that providers with more years in practice might achieve continuity that is not accounted for in UPC calculations, such as during resident precepting (subtheme 2.3). In addition, providers with more mature relationships with their patients may be able to achieve the benefits of IC despite less frequent patient visits.

One of the more consistent themes in our qualitative analysis was a concern about variability in UPC between providers of different sexes. Female providers in particular were concerned that different rates of maternity and well-woman visits (subtheme 2.2), as well as extended absences in the form of maternity leave (subtheme 6.2), would lead to lower UPC among female providers. Instead, our

quantitative analysis found no significant differences in UPC or any of our predictor variables by provider sex.

The evolving nature of IC was discussed at length during the provider focus groups. Participants believed that efforts to quantify continuity should account for alternative forms of patient interactions, such as phone calls, E-mails, or interactions through the EHR (subtheme 4.2). These were thought to be meaningful interactions enhancing IC despite the absence of a face-to-face encounter. Providers also stated that the value of IC needed to be reassessed in light of growing reliance on team-based care (subtheme 5.1) because the PCMH model emphasizes the value of team-based care. Further research is needed to investigate the value of continuity with a team of providers versus an individual provider.

Conclusions

Our study is a novel approach to the assessment of IC in family medicine and was made possible by our system-wide EHR, a tool that is still new for many practices. Our results improve the understanding of predictors of continuity while furthering efforts to establish benchmark UPC rates. Our methods should be reproducible in similar clinics or health systems and could be helpful to practicing family physicians as they address requirements for measuring and benchmarking continuity in the certification process to become a PCMH. Further research in this area might address how IC changes over time, how quality improvement efforts might improve continuity performance, and how clinic teams can expand on the proven value of relationship-based care in family medicine. Our mixed-methods study design allowed qualitative validation of our quantitative findings and suggests a number of key elements for future study.

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