Visit Linearity in Primary Care Visits for Patients with Chronic Pain on Long-term Opioid Therapy

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BACKGROUND: Physicians and patients report frustration after primary care visits for chronic pain. The need to shift between multiple clinical topics to address competing demands during visits may contribute to this frustration.

OBJECTIVE: This study creates a novel measure, "visit linearity," to assess visit organization and examines whether visits that require less shifting back and forth between topics are associated with better patient and physician visit experiences. It also explores whether visit linearity differs depending on the following: (1) whether or not pain is a major topic of the visit and (2) whether or not pain is the first topic raised.

DESIGN: This study analyzed 41 video-recorded visits using inductive, qualitative analysis informed by conversation analysis. We used linear regression to evaluate associations between visit organization and post-visit measures of participant experience.

PARTICIPANTS: Patients were established adult patients planning to discuss pain management during routine primary care. Physicians were internal or family medicine residents.

MAIN MEASURES: Visit linearity, total topics, return topics, topic shifts, time per topic, visit duration, pain main topic, pain first topic, patient experience, and physician difficulty.

KEY RESULTS: Visits had a mean of 8.1 total topics (standard deviation (SD)=3.46), 14.5 topic shifts (SD=6.28), and 1.9 topic shifts per topic (SD=0.62). Less linear visits (higher topic shifts to topic ratio) were associated with greater physician visit difficulty (β=7.28, p<0.001) and worse patient experience (β= −0.62, p=0.03). Visit linearity was not significantly impacted by pain as a major or first topic raised.

CONCLUSIONS: In primary care visits for patients with chronic pain taking opioids, more linear visits were associated with better physician and patient experience. Frequent topic shifts may be disruptive. If confirmed in future research, this finding implies that reducing shifts between topics could help decrease mutual frustration related to discussions about pain.

Many clinical topics compete for limited visit time in primary care,[1–7] and effective patient-physician communication plays a key role in helping organize visits.[8, 9] Chronic pain is a common primary care topic[10] and may strain physicians' capacity to keep visits tightly organized due to competing patient and physician priorities,[11] and the high prevalence of comorbid mental and physical disorders among patients with pain.[12–14] Physicians and patients report frustration after visits for chronic pain,[12, 15–21] and the necessary multi-tasking required to address competing demands may contribute by affecting communication and increasing cognitive stress.[22, 23] Communication strategies are needed to help physicians navigate "difficult" visits to prevent physician burnout and improve patient experience.[24–29]

Health communication research has examined how many topics are addressed per visit,[30–32] how much time is devoted to each topic,[33] and when and how patients and physicians initiate topics.[1, 4, 6, 34–36] Limited research examines the effect of visit organization on physician difficulty and patient experience, particularly in challenging clinical encounters.[16, 37] In prior work,[12] more frequent patient requests for opioids and instances of patient-physician disagreement were associated with worse visit experiences.

To address these issues, we constructed a novel measure of *visit linearity* to assess visit organization, defining linearity as a unidirectional progression of topic discussion. We posed the following primary research question: are more linear visits (i.e., those involving less frequent topic shifts) associated with decreased physician difficulty and better patient experience? As exploratory questions, we asked the following: (1) what is the association of alternative metrics of visit organization (e.g., total topics, return topics, visit duration) with patient and physician

experience?; and (2) how do visit linearity and these alternative metrics differ for visits where pain is a major topic (versus not) and for visits where pain is the first topic raised (versus not)? Addressing these questions can inform research and educational efforts to identify strategies for conducting more organized visits (for pain as well as for other similarly complex chronic conditions) that could lead to improved patient care and reduced physician burnout.

METHODS

This investigation is an observational study in which office visits were videotaped between 2014 and 2016. We recruited patients and physicians from two academic primary care resident clinics. Physicians were internal or family medicine residents at the University of California Davis Medical Center and were recruited through email and clinic presentations. Patients were recruited by reviewing clinic schedules of enrolled physicians, and a research assistant either approached patients in clinic waiting rooms or mailed a letter describing the study followed by a telephone call. Eligible patients were established adult patients prescribed opioids ($\geq$1 opioid dose per day for $\geq$90 days) for chronic non-cancer pain (prevalent category of chronic pain)[38] who reported at least moderate pain intensity ($\geq$4 on a 0–10 scale) and indicated they were likely to discuss pain management during a scheduled clinic visit. Patients were ineligible if they did not speak English during visits, were getting active cancer treatment or palliative care, or were receiving an opioid prescription from someone other than their primary care physician. 75% of eligible physicians and 84% of eligible patients agreed to enroll. Three of the authors (EAMH, RLK, SGH) have served as faculty attendings in the clinic and one (EAMH) was previously a resident in the clinic. The University of California Davis Institutional Review Board approved this study. Written consent was obtained from all participants; detailed study procedures have been previously described.[12, 16]

Patient and physician demographic information were collected at enrollment. Immediately after each visit, physicians completed the 10-item Difficult Physician-Patient Relationship Questionnaire.[39] Physician difficulty scores could range from 10 to 60; higher scores represent more difficult visits. Physician-reported difficulty has been associated with worse patient experience, greater symptom burden, and higher healthcare utilization.[17] Patients completed 4 measures of patient experience as described in prior studies by Henry et. al,[12, 16]: (1) the short form of the Wake Forest trust scale,[40] (2) a 3-item measure of agreement with treatment plan,[41] (3) an assessment of physician communication skills from the Consumer Assessment of Healthcare Providers and Systems (CAHPS) Adult Visit Survey,[42] and (4) a patient version of the Difficult Physician-Patient Relationship Questionnaire.[39] Exploratory factor analysis indicated that all 4 measures assessed a single latent construct; therefore, these 4 measures were combined into a single standardized (population mean=0, standard deviation (SD)=1) composite variable (i.e., summated

rating scale)[43] measuring patient experience, with higher values indicating a better experience.[12]

Due to the time-intensive nature of coding (each visit required approximately 2 hours to code), we coded a subsample (41 of a larger 86 visit corpus) based on an estimated effect size of 0.5 for the primary outcomes with 80% power at the 0.05 level (2-sided) while accounting for clustering by physician.[44] This subsample, which included 41 patients and 35 physicians, was chosen using maximum variation sampling to include both family medicine and internal medicine resident physicians and a wide range of patient experience and physician difficulty scores.[45]

Coding

We inductively determined how to assess and define visit organization. Two authors, an internal medicine physician (EAHM) and a medical sociologist trained in conversation analysis[46, 47] (AECW), developed the coding scheme by jointly viewing and discussing an initial 10 videos. Conversation analysis is a method that analyzes the structure and impact of naturally occurring talk by looking for recurrent and systematic behaviors people use to interact with one another and has been used to study physician-patient communication.[46, 48–50] Coding jointly using the authors' complementary expertise allowed for simultaneously identifying both medical content and interactional insights,[51] which was imperative for this study. A sociologist may not recognize when one medical topic shifts to another (or is still a part of the same topic). A physician may not recognize the communicative practices speakers use to accomplish shifting from one topic to the next.[52] Supplementary Figure 1 demonstrates topic shifts in an example patient visit transcript.

We reviewed visits and transcripts to determine the nature, sequence, and number of topics discussed, and entered codes directly into Microsoft Excel. Each visit was coded from the opening statement until the resident physician left the room (which was the vast majority of visit's duration) to discuss the patient with their attending, because when attendings later joined to affirm or adjust the residents' visit plan (as is customary at the study clinics except for certain patients under the Primary Care Exemption),[53] we did not want to conflate this discussion with our counting of return topics.

After reviewing an initial 10 videos, we agreed that we had met saturation for variable definitions. We operationalized *visit linearity* as the ratio of topic shifts to total topics. This variable measures how often topics are initiated and/or returned to during a single visit, with higher ratios indicating less linear visits. Topics are defined as clinical issues raised by either patient or physician.[5] We coded the following variables for each visit: number of *total topics*, *return topics*, *major topics*, and *topics shifts*, *the visit duration*, and *time per topic*. Table 1 lists variable definitions and examples. We also assessed whether the topic of chronic pain was a *major* topic, whether it was the *first* topic raised in the visit, and how often it was *returned* to (and by whom). Disagreements were resolved by discussion then consensus.

Table 1 Definitions and Example Calculation of Coded Variables for a Single Visit

Table 1: Definitions and example calculation of coded variables for a single visit			

These example visits show who initiated each topic and the chronological order in which topics were discussed.		Ex Pat #78
		Time 0.00
		PAT: Falling
		DOC: Stomach issue
		PAT: Psychosocial
		PAT: Nerve pain
		PAT: Stomach issue
		PAT: Falling
		PAT: Chronic pain
		PAT: Care management
		DOC: Chronic pain
		PAT: Falling
		DOC: Cholesterol
		DOC: Smoking cessation
		PAT: Care management
		DOC: Smoking cessation
		PAT: Chronic pain
		PAT: Psychosocial
		DOC: Chronic pain
		Physician exits 18:22
			Ex Pt #380
			Time 0.00
			DOC: Anemia
			PAT: Chronic pain
			PAT: Anemia
			PAT: Chronic pain
			DOC: Anemia
			PAT: Chronic pain
			PAT: Anemia
			PAT: Chronic pain
			PAT: Anemia
			DOC: Chronic pain
			PAT: Blood test
			DOC: Chronic pain
			DOC: Anemia
			PAT: Chronic pain
			DOC: Vaccinations
			DOC: Abdominal
			    Aortic aneurysm
			    (AAA) screen
			Physician exits 19:00

Variables	**Definition**	**Value in example above**	**Value in example above**
Visit linearity	Ratio of topics shifts to total topics. A higher ratio operationalizes a *less* linear visit.	n=2 Topic shifts (16)/ total topics (8)	n=3 Topic shifts (15)/ total topics (5)
Alternative Metrics			
Total topics*	Count of all new topics discussed.	n=8 falling, stomach issue, psychosocial, nerve pain, chronic pain, care management, cholesterol, smoking cessation	n=5 anemia, chronic pain, blood test, vaccinations, AAA screen
Return topics	Count of all subsequently mentioned topics.	n=9 falling 2x, stomach issue 1x, psychosocial 1x, chronic pain 3x, care management 1x, smoking cessation 1x	n=11 anemia 5x, chronic pain 6x
Major topics	Count of topics that received a comprehensive discussion. Determined by MD coder, EAMH, after reviewing full visit.	n=1 chronic pain determined by video review and not by looking topic list	n=2 anemia and chronic pain determined by video review and not by looking at topic list
Topic shifts**	Count of how many topic transitions occurred. Calculate by adding total topics plus return topics minus 1.	n=16 Total topics (8) + return topics (9) - 1	n=15 Total topics (5) + return topics (11) - 1
Visit duration***	Only includes time in exam room when physician is present.	18 minutes 22 seconds	19 minutes

Table 1 (continued)

Time per topic	Visit duration divided by total topics.	18:22/8= 2:17 per topic	19:00/5= 3:18 per topic
Focused coding for chronic pain topic			
Major topic chronic pain	Chronic pain was a major topic of the visit (Y/N)	Yes	Yes
First topic chronic pain	Chronic pain was the first topic raised in visit (Y/N)	No	No
Returns to chronic pain topic by patient and physician	Distinct count of patient and physician returns to the chronic pain topic	Patient returns to chronic pain topic=1 Physician returns to chronic pain topic=2	Patient returns to chronic pain topic=3 Physician returns to chronic pain topic=2

*Patients were often accompanied to visits with companions, and when companions initiated or returned to topics, we included this behavior into the patient category.

**See supplementary materials for Figure 1, which shows the transcript for the beginning of Pt #380's visit. This transcript illustrates 3 topic shifts.

***Each visit was coded from the opening statement until the resident physician left the room (which was the vast majority of visit's duration) to discuss the patient with their attending, because when attendings later joined to affirm or adjust the residents' visit plan (as is customary at the study clinics except for certain patients under the Primary Care Exemption),[53] we did not want to conflate this discussion with our counting of return topics.

Statistical Analysis

To address the primary research question, we constructed separate linear regression models with visit linearity as the independent variable and physician difficulty and patient experience as dependent variables. We used generalized estimating equations (GEE) with robust standard errors to account for clustering of patients by physician. Models also controlled for patient age, sex, and race (white versus non-white).

We constructed separate linear regression models with visit linearity as the dependent variable and each alternative visit organization metric (total topics, topic shifts, return topics, major topics, time per topic, chronic pain major topic, chronic pain first topic, and returns to chronic pain by patient or physician) as independent variables. We controlled for patient demographics and clustering using GEE.

We compared the means of each visit organization metric for (a) visits where pain *was* versus *was not* a major topic of discussion, and (b) visits where pain *was* versus *was not* the first topic of discussion (among the subset of visits where pain was a major topic discussed). Next, we conducted multivariable regression analyses to estimate the effect of pain as major topic (and separately, pain as first topic) on the frequency of each visit organization metric. We used linear regression for normally distributed variables (visit linearity, total topics, topic shifts, return topics, major topics, time per topic, visit duration, physician difficulty, patient experience) and Poisson regression for count variables that were not normally distributed (patient returns, physician returns). We controlled for patient demographics and clustering using GEE.

In a prior study of these same data, we found that patient requests for opioids and patient-physician disagreement were associated with worse patient and physician experience.[54] Therefore, we also examined the effect of controlling for (a) any patient request for opioids and (b) any patient-physician disagreement to the linear regression models of visit linearity tested in our primary analysis, using binary variables coded from that prior study. All analyses were conducted using SAS 9.4.

Table 2 Patient and Physician Demographics

	Patients n = 41	Physicians n = 35
Age		
Mean (SD)	58.8 (10.4)	29.6 (3.8)
Sex		
Female	56%	77%
Race		
White	68%	57%
Ethnicity		
Hispanic	15%	3%
Resident training year		
2	N/A	13
3		20
4 or 5		2
Resident type	N/A	
Family medicine		16
Internal medicine		19

RESULTS

In the 41 visits examined, patients were 68% white, 15% Hispanic, and 56% female; 59% were between 50 and 64 years old. Physicians were 57% white, 3% Hispanic, and 77% female (Table 2). 83% of visits were with patients' established primary care physician. Visits had a mean of 7.4 returns to any prior topics (SD 4.13), and 14.5 topic shifts (SD 6.28) (Table 3). The mean visit length was 25.6 min (SD 7.12), and the mean time per topic was 3.6 min (SD 1.45). There was a mean of 1.9 topic shifts per topic (visit linearity measure, SD 0.62). The 41 visits had a mean standardized patient experience score of −0.16 (SD 1.09), slightly worse (i.e., about one-sixth of a standard deviation worse) than the mean experience score of zero, and a mean physician difficulty score of 28.34 (SD 11.90). Visits with a score ≥30 are typically considered difficult.[39] Chronic pain was a major topic in 31 visits (76%). Patients initiated the pain topic in 21 visits and physicians in 10 visits.

Table 3 shows the association of visit linearity with patients' and physicians' visit experiences. An increase in one point in visit linearity (a higher ratio operationalizes a *less* linear visit) was associated with a 7.28-point increase in physician difficulty (*p*<0.001), which is a 14% increase of the total difficulty scale and represents a clinically significant increase based on prior studies.[17, 55] An increase in one point in visit linearity led to a 0.62-point decrease in patient satisfaction, which is 60% of the standard deviation of the standardized patient experience score (*p*=0.03).

Table 3 shows our exploratory analysis assessing associations of alternative visit organization metrics with these post-visit outcomes. More returns to the chronic pain topic by either patient (*p*=0.004) or physician (*p*<0.0001), and more time per topic (*p*=0.001) were significantly associated with increased physician difficulty. A higher number of total topics covered was significantly associated with lower physician difficulty (*p*<0.001) and showed an association with a better patient experience that did not reach statistical significance (*p*=0.06, Table 3).

Table 4 shows the results of our exploratory analysis comparing visit organization in visits that had chronic pain as a *major* topic (*n*=31) with those that did not (*n*=10). By comparing the means, we found visits with pain as a major topic had on average 2.9 fewer topics discussed overall (*p*=0.03), 4.6 fewer returns to any topic (*p*=0.01), and 7.5 fewer topic shifts (*p*=0.004) than visits when pain was not a major topic. Visits in which pain was a major topic showed an association with worse patient experience (*p*=0.06) and with increased physician difficulty (*p*=0.08, Table 4) that did not reach statistical significance. There was no significant difference in the visit linearity measure between groups.

Table 5 shows the results of our exploratory analysis comparing visit organization in visits (with pain as a major topic) that had chronic pain as the *first* topic raised (*n*=13) versus not (*n*=18). By comparing the means, we found visits that began with the pain topic had 2.7 fewer topics discussed overall (*p*<0.001), 3.6 fewer topic shifts (*p*=0.02), over a minute of more time spent per topic (*p*=0.004), and physicians were twice as likely to return to the chronic pain topic (*p*=0.01). Pain as first topic was significantly associated with increased physician difficulty (*p*<0.001) and showed an association in the worse patient experience that did not reach significance (*p*=0.08, Table 5). Again, there was no significant difference in visit linearity between groups.

Adding to the linear regression model, (1) patient requests for opioids and (2) patient-physician disagreements had no effect on the relationship between visit linearity and physician difficulty. However, adding (1) patient requests and (2) patient-physician disagreements slightly lessened the effect of visit linearity on patient experience (*β*= −0.50; CI −1.19, −0.06; *p*=0.05 and *β*= −0.49; CI −1.03, 0.05; *p*=0.07, respectively); neither adjusted coefficient was significantly different from the unadjusted coefficients, as reported in Table 3.

Table 3 Assessing Visit Organization's Association with Patients' and Physicians' Visit Experiences (*n*=41 visits)

Variables[a]	Mean (SD)	Physician difficulty			Patient experience		
		Beta	95% CI	*p*-value	*Beta*	95% CI	*p*-value
Visit linearity[b]	1.9 (0.62)	7.28	3.02, 11.55	0.0008	−0.62	−1.19, −0.06	0.03
Alternative metrics							
Total topics	8.1 (3.46)	−1.38	−2.14, −0.63	0.0003	0.095	−0.004, 0.19	0.06
Return topics	7.4 (4.13)	0.24	−0.41, 0.91	0.46	−0.057	−0.14, 0.02	0.15
Topic shifts	14.5 (6.28)	−0.29	−0.73, 0.14	0.18	0.007	−0.03, 0.05	0.71
Time per topic	3.6 (1.45)	3.00	1.19, 4.81	0.001	−0.13	−0.37, 0.11	0.29
Visit duration	25.6 (7.12)	−0.30	−0.83, 0.22	0.26	0.02	−0.02, 0.07	0.34
Patient returns to chronic pain topic	1.1 (1.11)	3.48	1.08, 5.88	0.004	−0.28	−0.53, −0.03	0.03
Physician returns to chronic pain topic	1.6 (1.46)	3.19	1.60, 4.78	<0.0001	−0.30	−0.55, −0.06	0.01

[a]*Each variable was run as its own linear regression model. We controlled for patient age, sex, race, and accounted for clustered physicians using generalized estimating equations*
[b]*Ratio of topics shifts to total topics. A higher ratio operationalizes a less linear visit*

Table 4 Comparison of Visits When Chronic Pain Topic *Was* vs. *Was Not* Major Topic

Variables	Chronic pain *was not* major topic (*n*=10) Mean (SD)	Chronic pain *was* major topic (*n*=31) Mean (SD)	Beta[d]	95% CI	*p*-value
Visit linearity[a, c]	2.0 (0.69)	1.8 (0.60)	−0.19	−0.68, 0.30	0.45
Alternative metrics					
Total topics[a]	10.3 (4.57)	7.4 (2.74)	−3.00	−5.71, −0.29	0.03
Return topics[a]	10.9 (5.78)	6.3 (2.73)	−4.68	−8.25, −1.10	0.01
Topic shifts[a]	20.2 (8.65)	12.7 (3.99)	−6.68	−12.90, −2.45	0.004
Time per topic[a]	3.0 (1.11)	3.8 (1.51)	0.74	−0.10, 1.58	0.08
Visit duration[a]	28.1 (7.39)	24.8 (6.96)	−3.63	−8.59, 1.35	0.15
Patient returns to chronic pain topic[b]	0.5 (0.85)	1.3 (1.13)	0.95	−0.12, 2.00	0.08
Physician returns to chronic pain topic[b]	1.1 (1.66)	1.8 (1.38)	0.50	−0.48, 1.47	0.32
Physician difficulty[a]	24.6 (10.44)	29.6 (12.25)	5.79	−0.62, 12.20	0.08
Patient experience[a]	0.2 (0.56)	−0.3 (1.20)	−0.47	−0.96, 0.02	0.06

[a]*Variables visit linearity, total topics, return topics, topic shifts, time per topic, visit duration, physician difficulty, and patient experience were each run as their own model using linear regression. Models controlled for clustering of patients by physician and patient age, sex, and race*
[b]*Variables patient returns and physician returns to chronic pain topic were each run as their own model using Poisson regression. Models controlled for clustering of patients by physician and patient age, sex, and race*
[c]*Ratio of topics shifts to total topics. A higher ratio operationalizes a less linear visit*
[d]*1 = chronic pain was a major topic, 0 = chronic pain was not a major topic*

Table 5 Comparison of Visits When Chronic Pain *Was* (vs. *Was Not*) the First Topic Raised (in Subset of Visits that Had the Topic of Chronic Pain as a Major Topic (*n*=31))

Variables[a]	Chronic pain *was not* first topic (*n* = 18) Mean (SD)	Chronic pain *was* first topic (*n* = 13) Mean (SD)	Beta[d]	95% CI	*p*-value
Visit linearity[a, c]	1.7 (0.51)	2.0 (0.70)	0.35	−0.06, 0.77	0.10
Alternative metrics					
Total topics[a]	8.5 (2.77)	5.8 (1.79)	−3.31	0.51, 9.97	0.0005
Return topics[a]	6.7 (2.95)	5.9 (2.41)	−0.19	−2.18, 1.80	0.85
Topic shifts[a]	14.2 (4.33)	10.6 (2.29)	−3.27	−5.91, −0.63	0.02
Time per topic[a]	3.2 (1.13)	4.5 (1.67)	1.42	0.44, 2.39	0.004
Visit duration[a]	25:39 (8:32)	24.0 (4.67)	−1.78	−6.64, 3.08	0.47
Patient returns to chronic pain topic[b]	1.2 (1.11)	1.4 (1.19)	0.12	−0.52, 0.77	0.40
Physician returns to chronic pain topic[b]	1.4 (1.20)	2.4 (1.45)	1.07	−0.23, 1.92	0.01
Physician difficulty[a]	24.7 (12.12)	36.3 (9.04)	14.27	7.86, 20.66	<0.0001
Patient experience[a]	−0.1 (1.04)	−0.6 (1.37)	−0.73	−1.53, 0.08	0.08

[a]*Variables visit linearity, total topics, return topics, topic shifts, time per topic, visit duration, physician difficulty, and patient experience were each run as their own model using linear regression. Models controlled for clustering of patients by physician and patient age, sex, and race*
[b]*Variables patient returns and physician returns to chronic pain topic were each run as their own model using Poisson regression. Models controlled for clustering of patients by physician and patient age, sex, and race*
[c]*Ratio of topics shifts to total topics. A higher ratio operationalizes a less linear visit*
[d]*1 = chronic pain was the first topic raised, 0 = chronic pain was not the first topic raised*

DISCUSSION

This study found that more linear visits were associated with decreased physician difficulty and better patient experience. Visit linearity was the only non-pain organizational metric that was significantly associated with both patient and physician experiences. This suggests that visit linearity captures a novel aspect of visit organization. Further investigation is warranted to understand *why* visits unfold in a linear or non-linear fashion (e.g., previous visit interactions) and to validate the visit linearity ratio as a measure.

Physicians reported lower difficulty and patients reported better experience with more linear visits. Discussing one topic at a time may reduce multi-tasking and the attendant cognitive strain.[22, 23, 56, 57] Since physician burnout is linked with physicians feeling a lack of control,[58] less chaotic and more structured visits may allow physicians to feel more empowered in their work, which may decrease rates of burnout and lead to better patient outcomes. Alternatively, less difficult visits (made so by easier, less complex, or more cooperative patients) are likely easier to organize effectively, and outside factors (e.g., clinic running late) may also play a role in visit organization and perceived difficulty. As not all internal medicine residents in our study anticipated a career in primary care, resident career goals could have also influenced physician behavior and experience.[59]

In our exploratory analyses, we found that physicians and patients reported better experiences after visits during which more topics were covered. One possible interpretation is that physicians and patients feel that more is accomplished when more topics are discussed. Our findings align with research that shows that patients typically have more than one concern they wish to discuss during primary care visits[1, 6, 60–62] and physicians may also discover additional concerns they want to raise during the course of a visit.[7] Since unaddressed concerns can escalate patient anxiety, impair treatment, necessitate additional medical visits, and damage physician-patient relationships,[1] this present study reinforces that patients find more benefit in visits that adequately and succinctly cover their concerns. For our analysis, each topic was weighted equally (to account for the cognitive strain of shifting between topics) but not all topics are equally important to participants. Future studies should examine the role that topic importance plays in participant experience.

In our exploration of how visit organization differs depending on whether chronic pain is the major topic of the visit or the first topic raised, we found that visits with pain as a major topic had fewer topics discussed overall and that patients returned to the pain topic more often than physicians. This aligns with our clinical experience that the topic of chronic pain can dominate primary care visits. One factor that contributes to why chronic pain visits are described as "difficult"[12, 15–18] may be that fewer non-pain topics get addressed during visits focused on pain. An alternative explanation could be that greater time spent per topic may relate to complexity of decision making or a new problem, which could be further broken down in future studies. Other communication strategies may influence patient and physician experiences when discussing chronic pain[63, 64] and could be included in future studies. Patient requests for opioids did not affect our findings related to visit linearity.

Visits in which chronic pain was either a major topic or the first topic discussed had worse patient and physician experience scores compared to visits where pain was not the first topic. How topics unfold can demonstrate urgency and preoccupation.[5, 33] Patients often consider the first topic discussed the most important, and it is usually the topic that consumes the most visit time.[33] If pain is introduced as the first topic, this may represent prior interactions or difficulties, strong feelings about pain management, or other factors potentially affecting the patient-physician interaction.

Our study has limitations. We did not examine external features that might impact participant experience (e.g., visit frequency, online patient portal correspondence). External validity is limited by the academic setting. Resident clinics are a unique clinical setting in which visits are longer and have a higher proportion of patients dealing with chronic pain and on long-term opioid therapy,[65] and residents may have more time to discuss more topics per visit. Lastly, our study was limited to English-speaking patient-physicians interactions and did not include non-physician clinicians. Due to the racial and ethnic distribution of participants, it was not feasible for us to examine racial and ethnic concordance.

This study systematically coded the progression of clinical topics during primary care visits for chronic pain and developed a measure of visit linearity to characterize visit organization. We found that more linear visits (less frequent topic shifts) led to decreased physician difficulty and better patient experience. Our study provides preliminary evidence that frequent topic shifts are disruptive and should be avoided and that physicians should complete discussion of one topic before moving onto the next. Future research should examine how experienced physicians keep patients "on topic," potentially leading to greater efficiency and better participant experience, which may in turn help reduce physician burnout and improve patient outcomes.

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Declarations:

Conflict of Interest: *The authors declare that they do not have a conflict of interest.*

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