Patient Education and Counseling 88 (2012) 373–380

Contents lists available at SciVerse ScienceDirect

Patient Education and Counseling

journal homepage: www.elsevier.com/locate/pateducou

A linguistic study of patient-centered interviewing: Emergent interactional effects

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ARTICLE INFO

Article history:
Received 31 January 2012
Received in revised form 2 June 2012
Accepted 8 June 2012

Keywords:
Provider–patient relationship
Patient-centered interviewing linguistics
Sociolinguistics
Discourse analysis
Communication

ABSTRACT

Objectives: To evaluate interactional effects of patient-centered interviewing (PCI) compared to isolated clinician-centered interviewing (CCI).
Methods: We conducted a pilot study comparing PCI ($N = 4$) to CCI ($N = 4$) for simulated new-patient visits. We rated interviews independently and measured patient satisfaction with the interaction via a validated questionnaire. We conducted interactional sociolinguistic analysis on the interviews and compared across three levels of analysis: turn, topic, and interaction.
Results: We found significant differences between PCI and CCI in physician responses to patients' psychosocial cues and concerns. The number and type of physician questions also differed significantly across PCI and CCI sets. Qualitatively, we noted several indicators of physician–patient attunement in the PCI interviews that were not present in the CCI interviews. They spanned diverse aspects of physician and patient speech, suggesting interactional accommodation on the part of both participants.
Conclusions: This small pilot study highlights a variety of interactional variables that may underlie the effects associated with patient-centered interviewing (e.g., positive relationships, health outcomes). Question form, phonological accommodation processes, and use of stylistic markers are relatively unexplored in controlled studies of physician–patient interaction.
Practice implications: This study characterizes several interactional variables for larger scale studies and contributes to models of patient-centeredness in practice.

1. Introduction

Patient-centered interviewing (PCI) has been extensively studied, with recent work specifically defining PCI behaviorally and providing evidence that it is effective in improving patient outcomes [1–5]. This paper describes the emergent linguistic effects that distinguish standard clinician-centered interviewing (CCI) from a well-established, evidence-based method that integrates PCI and CCI, summarized in Table 1.

RCTs based on behaviorally defined interviewing methods have focused on indirect measures of the method's effect including: patient satisfaction [6–10], use of health services [9,11], health status outcomes [12–17], and quality of life metrics [16,18]. While these measures demonstrate validity, they do not represent the direct effects of a given method on the provider–patient interaction (PPI). The field needs direct measures to provide explanatory data about the mechanism(s) of successful interviewing methods. For valid methods like the PCI method studied here, the next step is to achieve understanding of the intervening factors between PCI behaviors, patient perceptions, and outcomes.

Recent research highlights the ways in which purely outcome or interaction-based research can be misleading: providing incomplete or incorrect characterizations of the relationship between an intervention and its effects [19,20]. These findings point to a need a mechanistic understanding of patient-centeredness. For example, using the Roter Interactional Assessment System (RIAS [21]), Roter and Cooper [13,14] studied links between PCI and health outcome/satisfaction measures, triangulating the method, the intermediary mechanism, and patient outcomes. However, RIAS codes operationally define communication behaviors that can overlap with PCI methods, complicating the process of defining the predictor and the predicted. Though we do not claim to have solved this problem, we focus on stylistic (i.e., phonological, structural, and organizational) features that are not part of the PCI method. Patient/physicians' use of these linguistic features is largely subconscious and independent from the behavioral steps of the PCI.

Instead of applying the RIAS or other communication-behavior coding system, we turned to the discourse analytic approach of interactional sociolinguistics [22–24] to identify direct measures of patient-centeredness, stylistic rather than behavioral features of the PPI. Stylistic markers are also relatively unexplored in medical

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http://dx.doi.org/10.1016/j.pec.2012.06.005

Table 1
An outline of the 5-step, 21-substep patient centered interviewing method. These steps represent our behaviorally defined PCI intervention.

Patient-centered interviewing method (5-steps, 21-substeps)
Step 1 – Setting the stage for the interview 1. Welcome the patient 2. Use the patient's name 3. Introduce self and identify specific role 4. Ensure patient readiness and privacy 5. Remove barriers to communication 6. Ensure comfort and put the patient at ease
Step 2 – Chief complaint/agenda setting 1. Indicate time available 2. Indicate own needs 3. Obtain list of all issues patient wants to discuss; e.g., specific symptoms, requests, expectations, understanding 4. Summarize and finalize the agenda; negotiate specifics if too many agenda items
Step 3 – Opening the HPI 1. Open-ended beginning question 2. 'Nonfocusing' open-ended skills (attentive listening): silence, neutral utterances, nonverbal encouragement 3. Obtain additional data from nonverbal sources: nonverbal cues, physical characteristics, autonomic changes, accouterments, and environment
Step 4 – Continuing the patient-centered HPI 1. Physical story – obtain description of the physical symptoms [Focusing open-ended skills] 2. Personal story – develop the more general personal/psychosocial context of the physical symptoms [focusing open-ended skills] 3. Emotional story – develop an emotional focus [emotion-seeking skills] 4. Empathic responses – address the emotion(s) [emotion-handling skills: name, understand, respect, support (*NURS*)] 5. Expand story and responses – expand the story to new chapters (focused open-ended skills, emotion-seeking skills, emotion-handling skills)
Step 5 – Transition to the doctor-centered process 1. Brief summary 2. Check accuracy 3. Indicate that both content and style of inquiry will change if the patient is ready

communications literature, especially in controlled, experimental settings. We offer this perspective as another approach to describing mechanisms because it allows for some quantitative assessment of the PPI while still providing the qualitative context necessary to interpret such findings. In the tradition of medical discourse analysis [25–27], we take the *turn-at-talk* as a primary unit of analysis, with *topic* and *interaction* as additional foci. Our technical definitions and hypotheses for each of these analytic units are specified in Table 2. Generally, compared to CCI, we predict that the PCI, always integrated with CCI, will produce a more patient-oriented dialog.

Since physician–patient dialog involves two participants, a physician and a patient, both of them contribute to constructing the patient–driven interaction. Importantly, the phonological, structural, and organizational features that we expect to occur in patient–driven dialog are understood to be sub-conscious [28–30]. They are not stipulated as part of the PCI method. Thus, we consider both physician and patient language in our study, despite the fact that the physician is "performing" a patient-centered or clinician-centered interview. Interviewers' use of linguistic resources to build patient-centeredness and/or clinician-centeredness provides insight on the mechanism of the PCI method.

Our hypotheses, and the assumptions that underlie them, apply sociolinguistic adaptations of Communication Accommodation Theory [31] and Positioning Theory [32]. These theories claim that speakers create/maintain identities in interaction. They can position themselves with or against each other in every conversational turn, where turns represent tests of their interpersonal relationship [33]. Accommodation is a sub-conscious process by which a one speaker does or does not "follow the lead" of another (i.e., converge), thereby modulating interpersonal closeness [33]. This is accomplished by the use of meaningful sociolinguistic features. Our hypotheses propose potential linguistic indices of patient trust (e.g., provision of psychosocial content) and physician support (e.g., space provision) as evidence of convergent accommodation [34]. In testing these hypotheses, the current pilot study hopes to characterize mechanisms of patient-centeredness.

2. Methods

Each patient participated in a medical interview where the behaviorally defined steps of the interviewing process varied across interview type. The control group received a traditional problem-focused assessment (i.e., a CCI, see Section 2.3). The experimental group received a CCI preceded by the PCI's 5 steps and 21 substeps (Table 1). Successful implementation of the PCI approach was independently determined by: (i) a blinded rater

Table 2
An outline of our hypotheses across three levels of analysis: the overall interaction, the topic of discussion, and the conversational turn. Predicted effects are stated with respect to the intervention group, the group that received PCI as opposed to CCI.

Level of analysis	Hypothesis	Predicted effect of PCI
a. **Turn** – i.e., turn-at-talk, a single instance of a given speaker holding the conversational floor	The PCI will show evidence of turn-turn convergence, where the physician and patient linguistically mirror each other in terms of phonological, lexical, or discourse-level processes	• Evidence of co-constructed discourse routines (e.g., expanded question-answer sequences) • Shared syntactic, lexical, or phonological features across turns
b. **Topic** – a unit of conversation within the interaction, defined based on the subject matter under discussion	The patient will play a more active role in determining the topics of discussion in the PCI than in the CCI, introducing content without being specifically prompted to do so. The physician will support the patient's agenda	• Higher proportion of patient-elicited cues and concerns out of the total patient cues and concerns • Higher proportion of linguistically open-ended questions out of total physician questions • Higher proportion of space providing (topic-continuing) physician responses to patient cues and concerns out of total physician cue/concern responses
c. **Interaction** – the entire discourse between two participants, defined in this study as a single patient-centered or clinician-centered interview	The patient will contribute more to PCI interactions than CCI interactions (e.g., taking longer conversational turns). The physician will provide more opportunities for patient participation	• Greater mean patient words-per-turn • Greater mean number of patient cues and concerns per patient turn • Greater mean number of physician questions per physician turn

using a procedure that evaluates the interviewer's success in addressing all five steps and 21 substeps [4]; and (ii) patient responses to our validated questionnaire assessing satisfaction with the PPI [4]. Linguistic analyses were performed independently by one of the authors (AH) who has training and considerable experience in a variety of sociolinguistic methods. She used interactional sociolinguistic methodology [22–24] with measures specific to three units of analysis: *turn*, *topic*, and overall *interaction*. She was blinded to interview type (PCI or CCI).

2.1. Subjects

Subjects were a subset of the patients recruited for an fMRI study of PCI and pain tolerance via advertisement at an Internal Medicine clinic. Of 9 total subjects in the fMRI study, one was pseudo-randomly excluded (without review) in order to create a balanced sample of PCI and CCI interviews ($N = 4$/interview type). The videotapes studied for our analysis were obtained before patients were assessed for pain tolerance and placed in the fMRI machine. They were recorded with a portable Camcorder in a simulated physician's office. Subjects were females between 25 and 61 years of age ($N = 8$). Exclusions for the fMRI project were any prior history of a neurological disorder, the use of psychoactive medications, or prominent pain symptoms. Patients signed informed consent and were paid $100 to participate. The study was approved by the Michigan State University institutional review board. Patients knew only that they were to be interviewed by a doctor before the fMRI and pain tolerance study. They did not know the type of interview (PCI or CCI) that they were to receive. Patients were matched for age and socioeconomic status and randomly assigned to PCI/CCI groups. They were fully debriefed following completion of their fMRI study.

2.2. Measures

Our measures were designed to (i) confirm successful delivery of PCIs in the experimental group; (ii) test for clinical correlates of patient-centered care (i.e., patient satisfaction); and (iii) test for interactional effects of the PCI (direct measures).

2.2.1. Ensuring the effectiveness of the PCI method

Derived from an earlier RCT [4], we simplified our research rating procedure for one independent rater to evaluate the interviewer's success in achieving the 5 steps and 21 substeps in the patient-centered approach (Table 1). We counted the interviewer's performance of each substep for every interview, awarding one point for all substeps in Table 1 except for substeps 2–5 in step 4 which were given five points, thus heavily weighting this core PCI material.

2.2.2. Indirect measures of interactional effects

We measured patient Satisfaction with the PPI [4,36,37] using a reliable, valid 25-item questionnaire with a 4-factor structure: (1) open-endedness (alpha 0.82), 7 items; (2) empathy (alpha 0.89), 11 items; (3) confidence in the doctor (alpha 0.84), 4 items; and (4) general satisfaction (alpha 0.71), 3 items. From a 7-point Likert scale, we created a summary score.

2.2.3. Direct measures of interactional effects

We applied a combination of code-based methods to the data: the VR-CoDES [38–40] and a pragmatic coding scheme for questions [41]. The *VR-CoDES* provides a typology for patient cues/concerns and their associated physician responses. The scheme was not applied in its most detailed form due to overlap of some categories with the PCI (e.g., the physician response of "provide empathy" maps directly to the NURS format for supporting emotions in the PCI method, see Table 1). Instead, higher order VR-CoDES categories were used to capture the overall classification of a conversational turn. For example, "provide empathy" was coded as "provider response, space providing". These categories were distributed over two dimensions: patient cues/concerns and physician responses, with individual codes for each dimension (see Table 3).

Similarly, our *question coding* represented a simplified version of Stiver's question typology, focusing on the dimensions of question form (e.g., "polar", "content") and question function (e.g., "request information", "rhetorical"). Of the four possible question forms, the two forms that elicit the largest set of possible answers (content and informal) were designated as *linguistically* open-ended. Conversely, the question forms that produced the fewest possible answers, polar (i.e., yes-no) and alternative questions, were treated as linguistically closed-ended. It is important to note that these are purely structural distinctions, where the "open-ended" questions in the PCI are defined in terms of a goal – to promote patient contribution. No explicit structural constraints are provided as a part of the PCI method. The specific coding categories that were used for patient cues/concerns, physician responses, and questions are given in Table 3 along with transcript examples.

In addition to the code-based measures, a words-per-turn metric (i.e., transcribed words/conversational turn) was calculated as a measure of patient participation.

2.3. Interviews

One of the authors (RS), an expert in medical interviewing, conducted either a PCI or an isolated CCI for 20–25 videotaped minutes. The PCI was the 5 step, 21 substep behaviorally defined method (Table 1) [4], while the CCI represented a standard interview, focusing on possible disease diagnoses and omitting personal/emotional information.

2.4. Data treatment

Our methods of processing and analyzing the linguistic data were based on the nature of the data (i.e., videotapes) and the size of the sample (i.e., pilot-scale). Processing and analysis were conducted by the same author (AH) in independent steps.

2.4.1. Processing

All of the interviews were manually transcribed into NVivo 9 [43], a software package for qualitative data manipulation. Transcription conventions followed those described by Heritage and Maynard [25], with some simplification (e.g., pauses were not quantified).

2.4.2. Analysis

The quantitative measures (VR-CoDES, question function/form codes, patient words-per-turn) were summed for each interview type (PCI and CCI) and subjected to bivariate analysis. Two proportion or two sample *T*-tests were used as appropriate to compare PCI and CCI groups. These calculations were done using Microsoft Excel with supplemental statistical analysis packages. Though multivariate modeling is generally preferred for quantitative sociolinguistic analysis, this method could not be applied due to our pilot-scale sample. To avoid sample determination error, we assigned a relevant sample population (N) for each direct measure by its level of analysis. This is in accordance with the general sociolinguistic principle of accountability [44], where the analytic denominator (N) represents the instances in which a linguistic variant *could* have been observed (i.e., [total occurrences of X/possible occurrences of X]). Thus the total N for

Table 3
The direct, interactional measures used across PCI and CCI groups. Each measure is divided into its respective dimensions (indicated along the right side of the Measure column), where the codes in each dimension may only apply to a certain participant (physician vs. patient) or test non-overlapping aspects of the same feature (function vs. form). Individual codes are defined and illustrated in (an) example(s) from our data. ‡ and † designate question codes that were included in the linguistically closed-ended and linguistically open-ended question groups, respectively. Transcriptions are orthographic.

Measure	Code	Explanation	Transcript example(s)
VR-CoDES			
Patient	Patient elicited cue	Non-explicit indication of underlying psychosocial issue without preceding physician prompt	PT: Yea the he grew up always knowing that we were a medical household and ya know he grew up always knowing that so, DR: Medical household meaning? (interview 1, PCI)
	Patient elicited concern	Explicit mention of a psychosocial issue without preceding physician prompt	PT: So I'm thinking if I'm gonna live to ninety some and I'm nothing but a crippled wreck uh, uh, I'm not too happy about the whole idea (interview 4, PCI)
	Physician elicited cue	Non-explicit indication of underlying psychosocial issue with preceding physician prompt	DR: Like why is that a big- PT: Well actually my mother died of colon cancer like at 47 so I've already outlived her... (interview 2, PCI)
	Physician elicited concern	Explicit mention of a psychosocial issue with preceding physician prompt	DR: And h-h-how do you feel about that you can't garden you can't bend over? PT: I'm sick about it. (interview 4, PCI)
Physician	Space providing	Encourages further discussion of a patient cue/concern	PT: It was it was fun it was hard like in the beginning it was really hard DR: How so, hard? (interview 3, PCI)
	Space reducing	Discourages further discussion of a patient cue/concern	PT: I mean I can handle it but it's not fun. DR: Um any blood in the stool? (interview 5, CCI)
Question coding			
Form	Polar‡	Defines a binary set of possible answers (yes or no)	DR: D'ya – do you smoke? PT: Yes sir. (interview 7, CCI)
	Alternatives‡	Defines a limited set of possible answers	DR: So you've got what, a BS or a BA? (interview 1, PCI)
	Content†	Defines the type of information to be contained in the answer, usually through the use of a question word (e.g., use of *when* asks for an answer that references time)	DR: Where's the pain? (interview 7, CCI) DR: And when was that done? PT: Tuesday of last week, yea. (interview 3, PCI)
	Informal†	Solicits an answer, but does not provide well-defined constraints on possible answers, may be in the form of a statement (aka, indirect question)	DR: Ok they've had all their shots and everythin'. PT: Yes they have a great pediatrician. (interview 5, CCI)
	Multiples	Two or more questions asked in the same utterance [*Note*: this code was treated independently from the other form-based codes in order to capture the structure of its constituent questions. For instance, the example was coded as "polar, multiple"]	DR: Did ya – are ya – did I ask you there are you allergic to anything? (interview 6, CCI)
Function	Request information	Contributes to the informational exchange between the physician and patient	DR: An how did you find this irregular heartbeat if if you didn't notice it? PT: I was getting dizzy I would just be- (interview 8, CCI)
	Repair	Clarifying questions (e.g., "Huh?", "What?"), including partial repeats of previous turn in question form	PT: ...when he became disabled I became his guardian. DR: And became disabled? (interview 2, PCI)
	Request confirmation	Seek agreement with (non-evaluative) information provided in the question	PT: ...they have proceeded cautiously for the last twenty thirty years however long that was. DR: So it's been thirty years or so? PT: Mm hm. (interview 8, CCI)
	Assessment	Seek agreement with an evaluation provided in the question	DR: It looks like you have some allergic stuff huh? (interview 7, CCI)
	Suggest/offer/request	In question form, but performs another function in the conversation or interaction more generally (i.e., speech act)	DR: Yea and you said long term relationship can you say more about that? (interview 2, PCI)
	Rhetorical	May elicit response, but does not define a desired answer	PT: Everybody's like yea oh it's gonna be excrutiating pain and four days later I was like ok whatever I'm fine DR: No kidding? That's usually a- (interview 3, PCI)

interaction-level phenomenon was 8 (representing 8 interviews). For topic or turn-based processes, the total *N* (or analytic denominator) represented the number of turns in which a given phenomenon could have occurred; (e.g., (number of linguistically open-ended questions)/(total number of questions)).

Qualitative analysis was conducted by means of an iterative, data-driven approach [23,24,45]. This involved multiple passes through the data, where each pass sought to identify either phonological, lexical, or discourse-level similarities between physician and patient speech. These observations were considered

along with qualitative interpretations of previously quantified coding patterns (VR-CoDES, question coding) and compared across CCI/PCI.

3. Results

We report results that confirm successful implementation of the PCI method (Section 3.1) along with indirect (Section 3.2) and direct measures (Section 3.3) of interactional effects.

3.1. Rating of the interviews

The PCI interviews had a significantly higher PCI index score [4] than the CCI interviews ($p < 0.01$, $N = 4$ interactions/interview type), indicating that the interviewing methods were delivered as planned.

3.2. Satisfaction survey

Mean patient satisfaction was significantly higher for the PCI than the CCI ($p < 0.01$, $N = 4$ interactions/interview type) with scores of 4.51 (SD = 0.279) and 3.00 (SD = 0.326), respectively. This shows that the interview type affected the patient outcome of satisfaction with the PPI.

3.3. Interactional sociolinguistic analysis

Our linguistic results are organized with respect to the three interactional levels outlined in our hypotheses (see Table 2). The quantitative results as summarized in Table 4.

3.3.1. Interaction

Quantitatively, we compared the mean number of patient cues/concerns per total number of patient conversational turns as well as the mean number of physician-produced questions per total number of physician turns across PCI and CCI sets. Though we coded cues and concerns separately, they are treated as a single category in the analysis. The mean number of cue/concerns produced by the patient per total patient turns was non-significantly greater in the PCI set than in the CCI set ($p = 0.44$, $N = 4$ interactions/interview type). The mean number of questions produced by the physician per total physician turns was significantly greater in the CCI than in the PCI ($p = 0.03$, $N = 4$ interactions/interview type).

Silence emerged in the qualitative analysis as a major differentiating factor between the PCI and CCI. Though the amount of silence (measured as video-time) varied considerably between interviews, the quality of silence differed consistently across the PCI and CCI sets. Long periods of silence characterized the CCI, while silence in the PCI tended to be interspersed throughout the interaction. Eye contact was generally maintained during the PCI silences, but not in CCI silences. CCI silences involved physician-oriented tasks such as writing notes. Furthermore, the physician would claim the conversational floor by initiating his turn prior to the onset of silence. He would produce an introductory utterance (e.g., "all right then") and allow from 10 to 40 s to elapse before continuing.

3.3.2. Topic

The topic-level quantitative measures included patient vs. physician elicited cues/concerns, space-providing vs. space-reducing physician responses, and question types. The proportion of patient elicited cues/concerns was non-significantly higher in the PCI sample than in the CCI sample ($p = 0.47$, N = number of cues/concerns, 115 PCI and 38 CCI). The proportion of space-providing responses compared between PCI and CCI sets was significantly different, with a higher proportion of space-providing responses in PCI interviews than CCI interviews ($p < 0.01$, N = total number of physician responses to patient cues/concerns, 115 PCI and 38 CCI). Similarly, the proportion of linguistically open-ended questions was higher in PCIs than in CCIs ($p < 0.01$, N = total number of physician questions, 314 PCI and 299 CCI). Question function could not be qualified due to the irregular distribution of question tokens across the six function-based coding categories.

Qualitatively, information-oriented question routines dominated the CCI, the vast majority of questions being "information requests". By contrast, questions in the PCI interviews were more interaction-oriented, with a substantial portion being "request confirmations", "assessments", and "repair" type-questions. As opposed to "request information" questions, these question-types are used to manage the conversation, supporting topics and managing speech rather than introducing new information. In a related pattern, PCI exchanges tended to be more interactive than CCI sequences, flowing from one topic to another without well-defined topic boundaries. Overall, the PCI interviews were characterized by expanded sequences/co-constructed topics, producing a more conversational tone than the CCI method.

Interestingly, the cues/concerns produced by patients in both interview groups illustrate the difference in "tone" between the two interviewing methods. As shown in Fig. 1, the PCI patients, especially interviews 1, 2, and 4, produced cues and concerns throughout the visit. This behavior persisted even after the visit had transitioned to the biomedically focused portion of the interview (approximately the last quarter of the visit). By contrast, the CCI patients, especially interviews 5, 6, and 8, stopped referencing psychosocial content after the first two-thirds of the visit.

3.3.3. Turn

Words-per-turn was our only turn-internal quantitative measure, with the interaction as its analytic denominator. Comparing PCI and CCI sets, PCI patient words-per-turn was non-significantly higher than the CCI patient words-per-turn ($N = 4$ interactions/interview type, $p = 0.06$).

Table 4
A summary of the quantitative results organized by level of analysis (interaction, topic, turn). For each measure, the type of measure, analytic denominator (N), and effect is noted.

Level of analysis	Measure	Number of observations	Effect
Interaction	Mean patient cues/concerns per patient turn	4 Interactions/intervention	PCI > CCI
	Mean physician question per physician turn	4 Interactions/intervention	PCI < CCI[a]
Topic	Proportion of patient elicited cues/concerns per total cues/concerns	115 Cues and concerns in PCI, 38 cues and concerns in CCI	PCI > CCI
	Proportion of space providing responses per total physician responses	115 Responses (to cues and concerns) in PCI, 38 responses in CCI	PCI > CCI[a]
	Proportion of *linguistically* open-ended questions per total physician questions	314 Questions in PCI, 299 questions in CCI	PCI > CCI[a]

[a] Designates effects that are statistically significant (alpha = .05) based on a 2-sample or 2-proportion T-test (based on the type of measure).

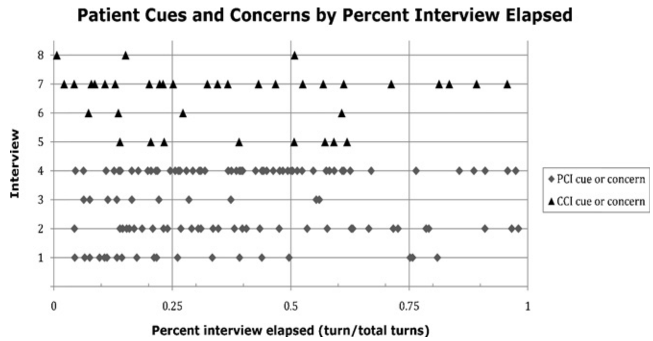

Fig. 1. Patient cues and concerns based on their position in the interview ([turn with cue or concern]/[total turns]). Cues and concerns in PCI interviews (1–4) are distinguished from cues and concerns in CCI interviews (5–8), represented with a gray diamond and a black triangle, respectively. PCI interviews transition to biomedically focused questions for approximately the last quarter of the visit.

Qualitatively, three patterns emerged at the turn level, summarized with definitions and examples in Table 5. Speech quality accommodation, backchannel modulation, and discourse marker salience were not hypothesized, but became evident through the qualitative analysis. Speech quality accommodation, which refers to the mirroring of speech tone or amplitude across a turn boundary (between participants), was apparent in PCI interviews but not in CCI interviews. For example, when a patient lowered her voice (i.e., quiet voice) in the discussion of a sensitive topic, the physician also lowered his voice. Similarly, there were several instances in which the patient or physician's voice acquired a warm, encouraging tone that could be (but need not have been) associated with the act of smiling (i.e., smile voice). In the PCI interviews, participants tended to reciprocate in the following turn (see example in Table 5). In terms of backchannel responses, minimal responses that play a supportive role in conversation (e.g., "uh-huh"), the physician tended to use more emphatic, affirming backchannels in the PCI interviews (e.g., "sure", "right"), while almost exclusively using neutral backchannels (e.g., "uh-huh") in CCI interviews. Linguists have suggested that the former type of backchannel performs an aligning function in the discourse, indicating agreement or affiliation in addition to supporting the speaker's contribution [46,47]. Patients also seemed to have a different style in the PCI interviews, producing a more casual tone using discourse markers. Discourse markers are words that do not contribute to the meaning of an utterance, but instead, modulate its stylistic character (e.g., "like" in "I *like* screamed"). Impressionistically, patients made more apparent use of discourse markers ("like", "y'know") in the PCI than in the CCI. Though this observation would benefit from quantification, age is known to affect discourse marker use [48] and this variable could not be controlled in our small, pilot sample.

4. Discussion and conclusion

The major finding of this work is that the PCI method, a replicable behaviorally defined patient-centered interview, has a measurable effect on the physician–patient interaction itself as well as upon patient outcomes; i.e., satisfaction in this study. Though this was suspected based on the nature of the interviewing method, it had yet to be rigorously demonstrated.

4.1. Discussion

Quantitatively, despite the small sample size, we were able to show significant effects on the physician's emergent, linguistically defined conversational style. The physician produced proportionally more space-providing turns in response to patient cues/concerns and generated more linguistically open-ended questions in the PCI as compared with the CCI interviews. These findings are in line with our hypotheses such that space-providing responses and open-ended questions conversationally encourage patient participation in the PCI interviews. The fact that the physician asked significantly more questions in the CCI interviews seems surprising at first. If one treats all questions as invitations for patient participation, the PCI interviews would be expected to have a higher proportion of questions. However, the question's form determines what kind of answer is relevant, where some types of questions allow for broader sets of possible answers, promoting a richer patient contribution. From this perspective, our results suggest that the high proportion of linguistically closed-ended questions in the CCI interviews control the dialog by limiting patient responses. This work further contributes to our understanding of physician questions by identifying specific coding categories as direct measures of the PCI's interactional effects: "content" and "indirect" questions, those that allow for the largest set of possible patient answers.

This study also highlights a number of qualitative findings that lend themselves to quantifying in a larger scale study. Generally, PCI interviews were more oriented toward the interaction, while CCI interviews were more oriented to the

Table 5
A summary of qualitative results organized by observed feature. The feature is defined and related to an observation from our dataset. Illustrative examples from our intervention group are shown. Transcriptions are orthographic unless additional detail is needed to show the effect, in which case the following conventions are used:° for markedly soft or quiet speech, (.) for a pause, _: for falling intonation.

Feature	Definition	Observation	Example from PCI
Speech quality	Variations in speech that represent non-articulatory manipulations of sound (i.e., tone changes, pitch/amplitude variation)	Participants tended to mirror speech quality (e.g., smile voice, quiet voice) across turn boundaries in the PCI interviews	PT: I di̲:d (.) he passed away um (.) uh (.) almost a year and a half ago (.) °now° DR: °Oh I'm sorry to hear that° PT: °Thank you° (interview 1, PCI)
Backchannels	Minimal responses (e.g., "uh-huh", "sure", "right") used to support or acknowledge another participant's speech	The physician tended to use affirming backchannels in the PCI interviews (e.g., "right", "sure") rather than neutral backchannels (e.g., "uh-huh")	PT: . . .I was exercising I either got it in my uh tendonitis in my hip- DR: Yea PT: Or when I worked in the O.R. in opening those trays I got. DR: Hm yea (interview 4, PCI)
Discourse markers	Words (or sounds) that do not contribute to the content of a speaker's utterance, but may be used to construct conversational style (e.g., "like", "and all that", "ya know")	Patients tended to make more conspicuous use of discourse markers in the PCI interviews than in the CCI interviews	PT: But I mean prostate cancer is so common ya know I mean it's good they caught it when they did ya know- (interview 2, PCI)

flow of information. In terms of Fischer's [49] categories of discourse function, ''interaction-oriented'' can be treated as a combination of interpersonal rapport-building, speech management, textual organization, turn management, and speech management: functions that do not contribute to information transfer, but contribute to the speaker's clarity/likability. The interactionally oriented questions found in the PCI interviews, for example, were used to repair speech errors (i.e., disfluencies), confirm understanding, and elicit agreement between speakers. Conversely, questions in the CCI interviews were used to probe the patient for information, focusing on the physician's need to acquire a complete history. The findings with respect to silence can also be viewed in this framework. Silence in the PCI interviews was used to manage turn-taking routines and facilitate topic shifts. By contrast, silence in CCI interviews represented physician-centered information management, providing time for the physician tasks. The physician's pre-silence utterances (e.g., ''just a second now'') claimed the conversational floor, indicating that the patient would be risking an interruption if she introduced a new topic.

We demonstrated the effects of the PCI's interactional orientation in Fig. 1, showing that patients consistently contributed cues and concerns throughout the PCI interviews. This finding, along with a suggestive (statistically non-significant) trend toward higher patient words-per-turn in PCI interviews, supports the assertion that PCI encourages patient participation and contribution of psychosocial information. Even in the biomedically focused segment of the PCI interviews, patients continued to provide psychosocial context for their experiences, presenting an integrated biopsychosocial self even once the physician had shifted away from psychosocial topics. In a larger sample, this finding could be tested quantitatively by tracking the number of cues and concerns per length-adjusted-minute of the interview.

Micro-features of the PCI interviews further illustrated convergent stylistic accommodation on the part of the physician and patient. From a phonological to a lexical level, PCI interviews showed physician attunement to the patient's psychosocial needs [24,50]. Lexically, the physician's use of more emphatic backchannels in PCI interviews suggests alignment with the patient's contribution and evidence of implicit support for the patient's perspective. Similarly, patients' overt use of discourse markers in the PCI interviews contributed to a relaxed conversational tone, a tendency that indicates an accommodation to the physician's informal style. On a phonological level, our findings demonstrate convergence by the physician in PCI interviews – alignment with the stylistic quality of the patient's speech. Though phonological accommodation is a relatively unexplored dimension of the PPI, speech quality has been shown to mark speaker identity [51,52]. Based on our results, voice quality, backchannel type, and discourse marker use should be further studied as potential correlates of patients' conversational identity. Collectively, our study suggests that these features underlie the interactive tone of PCI.

4.1.1. Limitations

This study was designed as a pilot to identify key linguistic measures for inclusion in future quantitative, interventional studies of PCI As such, it was not designed for generalizability. With a total sample size of 8 interviews, our findings cannot be generalized to clinical populations. Moreover, our experimental design was not intended to model naturalistic practice conditions. For example, we used a single physician to limit variability in our data. One physician is not representative of the physician population. Similarly, we selected a restricted set of patients (middle-aged females interested in a pain study). These patients might have been more willing to share psychosocial concerns than the general population. Though we attempted to minimize the study-internal influence of patient characteristics via control matching, these patients were clearly non-representative of the larger patient pool.

Furthermore, our pilot-scale sample limited our use of statistical techniques. Application of multivariate statistics, for example, would have been inappropriate under these circumstances.

Through our measure selection, we tried to eliminate conflation between emergent linguistic effects and the behavioral steps of the PCI. However, we acknowledge that there may be conceptual overlap between the PCI method and space provision in the VR-CoDES resulting in co-variation. Future studies should test this possibility.

4.2. Conclusion

The PCI has a direct effect on the interaction. These effects, measured in terms of patient and physician-oriented interactional variables, warrant further investigation as potential mediators of the increased patient satisfaction and improved health outcomes associated with the PCI.

4.3. Practice implications

The direct implications of this study are to raise awareness of the interactional effects of PCI methods. For providers who do not regularly apply a validated PCI method, this study suggests interactional features that may be related to the patient satisfaction and outcome effects associated with such methods. In order to refine these measures, the findings in this work should be explored in a larger scale studies.

Quantitative sociolinguistic methods are especially well-suited to this task. In particular, sociophonetic techniques [51,52] should be used to study phonological accommodation. Additionally, patient discourse markers and physician backchannels should be treated as discourse-pragmatic variables [53]. Collectively, quantitative outputs of such work could be coupled with turn-based coding schemes (e.g., the VR-CoDES) and subjected to more rigorous analyses: correlations with health outcomes and comparisons across specialties/patient populations. In interventional settings, these statistics, which abstract away from the behavioral dimension of the PPI, could be used to compare behaviorally defined PCI methods. In practice, quantitatively scaled, direct measures of patient-centeredness can bring us closer to a method of assessing physician–patient interactions, one that can be used to identify patient-centered care and tailor interventions for improving patient-centeredness.

Role of funding

Our sponsors did not have any role in data collection, analysis, and/or generation of this manuscript.

Conflict of interest

We have no conflicts of interest to report.

Acknowledgments

We would like to thank Allison Gardner for her subject recruiting and technical assistance. This project was supported by a Research Enhancement grant from the Michigan State University Graduate School and with support from the Michigan State University Dept. of Radiology.

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