Identifying the mechanisms of patient-centred communication in secure messages between clinicians and cancer patients☆

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ABSTRACT

Objective: Identify how patients and clinicians incorporate patient-centered communication (PCC) within secure messaging.

Methods: A random sample of 199 secure messages from patient portal communication between patients and clinicians were collected and analyzed. Via manual annotation, the task of tagging target words/phrases in text, we identified five components of PCC: information giving, information seeking, emotional support, partnership, and shared decision-making. Textual analysis was also performed to understand the context of PCC expressions within messages.

Results: Information-giving was the predominant (n = 346, 68.1%) PCC category used in secure messaging, more than double of the other four PCC codes, information-seeking (n = 82, 16.1%), emotional support (n = 52, 10.2%), shared decision making (n = 5, 1.0%), combined. The textual analysis revealed that clinicians informed patients about appointment reminders and new protocols while patients reminded clinicians about upcoming procedures and outcomes of test results conducted by other clinicians. Although less common, patients expressed statements of concern, uncertainty, and fear; enabling clinicians to provide support.

Conclusion: Secure messaging is mainly used for exchanging information, but other aspects of PCC emerge using this channel of communication.

Innovation: Meaningful discussions can occur via secure messaging, and clinicians should be mindful of incorporating PCC when communicating with patients through secure messaging.

1. Introduction

eHealth, or using the internet and other technology for health-related care [1], can enhance the patient-clinician relationship and is increasingly being utilized in healthcare. eHealth empowers patients to become more involved and activates them to easily ask questions [2]. An example of eHealth is telehealth. In a survey of more than 1000 U.S. health center respondents, 95% used telehealth services in 2020 [3]. The patient portal is a vital component of telehealth and eHealth in general. Patient portals are secure online websites that give patients 24-h access to personal health information, allowing patients to view lab results, schedule appointments, and asynchronously communicate with clinicians, also known as secure messaging (SM) [4]. The use of SM can improve patient satisfaction [5] and is favored over telephone and face-to-face interactions for medical-related inquiries,

such as obtaining general medical information from clinicians. In particular, patients with cancer favored SM as their preferred method of communication over phone and in-person [6].

Since effective communication between patients and clinicians increases patient knowledge, patient empowerment, and shared understanding of risks, benefits, and treatment options [7], it is imperative that high-quality communication occurs in the context of eHealth. Clinicians' use of patient-centered communication (PCC) has been endorsed by the Institute of Medicine Committee on Quality of Health Care in America, making PCC an integral component of high-quality health care [8]. Epstein and Street define PCC as containing three factors: 1) eliciting and understanding patient perspectives; 2) understanding the patient within his or her unique psychosocial and cultural contexts; 3) reaching a shared understanding of patient problems and the treatments that are harmonious with patient values [9]. Specific aspects of PCC include partnership building [10],

information exchange (i.e., seeking/giving) [11-13], emotional support [14], and shared decision-making [15], among others. Partnership building is when clinicians inquire about patients' opinions or expectations and check for understanding, contributing to patients taking a more active role in the interaction [16]. The quality of the clinician's information-giving about medical concerns is an important component of PCC [17], and when clinicians respond to patients' health information-seeking behaviors with high levels of PCC, patients perceive higher health care quality [2]. Statements of reassurance, empathy and sensitivity are forms of emotional support [18], which is rated as an important factor to enhance patient-clinician communication [19,20]. Shared decision-making, the practice of involving patients as active partners with the clinician [21] corresponds to satisfaction with healthcare [22,23] and higher medication adherence [24,25].

Literature on how PCC is or is not incorporated into SM is scant. One study found that clinicians rarely include patient-centered language [26], and messages sometimes appeared written in a hurried manner [27]. PCC is important to include because patients believe it positively influences the quality of care [6]. In our previous work, patients selected the following attributes of PCC as most preferred in SM: support, partnership, and information-giving [28]. To broaden the understanding of PCC within SM, our objective was to identify the practices used by both patients and clinicians communicating via SM that signify PCC. As part of a larger machine learning study that collected messages from May 2013 – September 2020, a random sub-sample of messages between patients with cancer and clinicians was generated and analyzed for instances of PCC. Data from this study will be used to establish a baseline for the larger machine learning study that will utilize natural language processing.

2. Method

2.1. Setting

This study was conducted using SM data sent by patients and clinicians via the patient portal at between 2013 and 2020. This study was approved by the Yale New Haven Hospital's Institutional Review Board. All procedures were performed in accordance with the relevant guidelines and regulations. The Yale New Haven Hospital has over 1500 beds, more than 4000 medical staff employees, and has nearly 1.5 million outpatient encounters annually. It is located in an urban area and is an ideal hospital system for research studies because it serves an extremely diverse patient population. The hospital is in New Haven, Connecticut, which ranks among the poorest cities in the US with poverty rate of 25.6%. The city is racially and ethnically diverse. 44% are White, 37% Black, and 21% Hispanic [29].

2.2. Data collection

The patient portal, MyChart, is offered to all patients at the hospital and allows for telehealth, prescription renewals, viewing test results, and messaging with clinicians. Consistent with other studies, [30] Yale New Haven Hospital has higher MyChart usage among younger and white patients, Patients are typically informed about the portal through flyers in examination rooms and discussions with nurses. It can be accessed via the web or a mobile device and is embedded with the clinician's health record. A random selection of de-identified messages, using random number generator, in one clinic from the portal sent in the first six months of 2020 were extracted. We wanted to restrict messages to a similar time frame so that analysis would be consistent and not influenced by events during intervals. Messages were eligible for inclusion if they were written by or sent to a patient with a cancer diagnosis. Messages encompassed the correspondence between patients and cancer care providers such as nurses and clinicians (oncologists).

2.3. Data analysis

As a first step, the research team discussed the meaning and interpretation of terms related to PCC, such as words related to emotional support and

partnership, and deliberated about how they may transpire within SM. Next, two members of the research team (SF, JA) independently read a sub-sample of messages to identify concepts of PCC. We developed an initial codebook containing preliminary codes related to PCC based on previous literature (partnership building [10], information exchange (i.e., seeking/giving) [11-13], emotional support [14], and shared decision-making [15]). The research team discussed the initial codes and formulated an operational definition for each listed. Once a codebook was finalized (Table 1), two coders (AR, JA) conducted a content analysis by independently coding and annotating target words and phrases in messages to establish interrater reliability. The text management software Atlas.ti 9 [31] was used to code the data, and two rounds of independent coding occurred, by which 30% ($n = 60$) of the messages were coded in total [32]. Between the rounds of coding, the research team discussed differences in codes and clarified the meaning of PCC terms. Holsti's coefficient [33], a variation of percentage agreement, was used to assess reliability. Percentage agreement and Holsti's method would be the same if both coders coded units that were the same [34]. Holsti's method was more applicable than other reliability statistics to the current study because it can be used in situations when two coders code different units of the sample. Because codes consisted of individual words and phrases that represented a category of PCC, the inclusion of one additional word that did not influence an occurrence of PCC did not negatively affect the reliability statistic. Interrater reliability results are in Table 2. We achieved acceptable levels of reliability in both rounds, even though in the second round we had decreased reliability scores for some categories. Categories were not mutually exclusive, meaning that multiple codes could have been used on the same set of words or phrases.

After the content analysis, we performed a textual analysis to gain a better understanding of words and phrases indicative of PCC in SM. This type of qualitative content analysis identifies core consistencies and meanings through identifying themes or patterns [35]. Textual analysis was performed to examine the deeper meaning and to "make sense" of the way patient-centered communication is enacted when patients and clinicians communicate electronically [37]. Textual analysis has been used to uncover the meaning of language, such as online consumer health reviews [38], finding trends in electronic health records [39], and by identifying how health issues are framed in the media [40].

Secure messages were analyzed independently, meaning that even though messages could have been related to other messages in the form of replies, no context from previous messages was included while examining a given message. The content analysis included individual words and phrases from each SM as the unit of analysis. Rather than evaluating a complete sentence or entire SM for its overall meaning, we examined words and phrases as cues of PCC.

2.3.1. Quantitative analysis of SM PCC codes

To understand the relationship between the code and the message sender, the c-coefficient function was computed, using Atlas.ti software. A coefficient is produced ranging from 0 to 1. A 0 means that two codes do not co-occur and 1 means two codes co-occur wherever they are used in the text. The c-coefficient represents the frequencies of a given code co-occurrence (e.g, information giving, and emotional support), which are "similar to a correlation coefficient statistic" [41]. The calculation of the c-coefficient is based on approaches borrowed from quantitative content analysis. It is calculated as follows: $c = n12 / (n1 + n2 – n12)$, where $n12$ = number of co-occurrences for code $n1$ and $n2$. The calculation derives from quantitative content analysis, but it is not the same as a Pearson correlation coefficient, and therefore, *p*-values are not provided.

2.3.2. Qualitative analysis of SM PCC codes

Two members of the research team (AR, JA) conducted a textual analysis and manually identified and listed the most frequently used words and phrases from each category. This resulted in four lists of words and phrases for each category. We performed primary-cycle coding [42] by labeling general impressions and initial themes from the lists. Primary-cycle coding

begins by assigning labels to the words or phrases that capture what is present in the data [42]. Discussions took place, which contributed to the creation of additional codes, collapsing codes, and finally, general summaries. To ensure qualitative rigor, we discussed themes with the senior author until consensus was reached [43].

3. Results

3.1. Sample characteristics

A total of 199 messages were collected and reviewed for analysis (Fig. 1). Most messages ($n = 97$; 49%) were authored by patients, while a total of 60 messages (30%) were from clinicians, such as physicians and nurse practitioners. The remaining messages ($n = 42$; 21%) were system-generated automated messages sent by the health system. System-generated messages contained information such as the location of the appointment, the date of the appointment, and the name of the clinician. System-generated messages tend to be longer than messages written by patients or clinicians, since they include detailed information about the location of appointments, instructions to download the MyChart mobile application, and COVID-19 regulations. Among messages we collected, the word count for automated messages was 96, ranging from 20 to 160, while all other message types averaged 38 words, ranging from 1 to 172.

3.2. Prevalence and relationships of PCC codes

The highest coefficient was 0.77 among SM sent by patients within the information-seeking category, indicating a strong relationship. A somewhat strong relationship was also present between contents of automated messages in the information-giving PCC code. The highest coefficient among clinician messages was associated with information-giving (0.31), followed by emotional support (0.23), but neither suggests a strong relationship.

Out of the 508 observed instances reflecting one of the five PCC codes assigned to SM, the majority (68%, $n = 346$) were designated as information-giving. Every automated SM sent from the health system consisted of information-giving, making up 39% ($n = 136$) of the codes. Information-giving was the most frequently applied code to patient messages, comprising 33% ($n = 113$), and 28% ($n = 97$) of information-giving codes were written by clinicians. Patient messages were coded in every PCC code, with information-seeking the second most coded ($n = 78$) following information-giving. Third was emotional support

Fig. 1. Number and percentage of the messages by sender type.

($n = 31$), followed by partnership ($n = 15$), and shared decision-making ($n = 2$). Information-seeking was primarily used by patients compared to clinicians, but among clinicians, emotional support was the second most frequent PCC code ($n = 21$), followed by partnership ($n = 8$). Table 3 has a summary of frequencies and coefficients of PCC codes.

3.3. Textual analysis

We show how each PCC code was enacted by clinicians, patients, and automated messages. Quotes from messages are included exactly as they were written, with minor edits made to improve readability.

3.3.1. Information-giving

The content of information-giving within automated messages mostly comprised of instructions for patients before their consultation. For instance, messages included reminders about appointment times, the location of the appointment, and prompts to download the patient portal application onto mobile devices. Patients provided information to clinicians by reminding them about upcoming procedures that were not yet scheduled and the outcomes of recent test results. For instance, a patient wrote, "*I had my blood testing done yesterday at [location], results associated with the liver were elevated. Just want to be sure you or your staff received my results.*" Patients also updated clinicians about their interactions with other clinicians to ensure that all members of their care team were properly informed. This occurred in the following example: "*Dr. [name] has called to let me know I'm not eligible for the immunotherapy clinical trial at this time. He thinks I might be eligible for a different trial this fall.…*" Clinicians offered information mainly in the form of advice and alerting patients about administrative issues. It was common for clinicians to write, "*I will put in the lab orders,*" "*I just sent the script request,*" and "*The results are not back yet.*" In response to patients' providing information received during other visits, clinicians often replied by attempting to make clarifications and offering their perspective. For example, a clinician wrote, "*If they need you to stop [the medication] prior to the test, that's OK because it is a blood thinner, and they may need you to be off of it for the test.*"

Clinicians expressed information-giving with statements beginning with "I," such as "*I will prescribe you,*" and variations of "*I will ask the doctor*" and "*I will give this to the doctor.*" Patients described medical problems they were experiencing, such as the presence of blood in their urine and stool. Secure messaging was also used by patients to verify the information in their medical records. SM included statements notifying clinicians that certain medications or injections were missing. They also made clinicians aware of potential errors to avoid issues with their insurance company. For example, a patient wrote, "*I just noticed that my upcoming CT scan on [date] does not include the chest. Want to be sure proper insurance approvals are in place.*"

3.3.2. Information-seeking

Information-seeking mostly comprised of patients asking clinicians about various issues, such as medication refills, appointment schedules, health concerns, medical tests, and insurance/billing. When seeking information pertaining to concerns about health or a specific test result, patients tended to describe the context in which they were seeking the information. For example, a patient wrote:

I just was told my child will be getting treated for [disease] tonight and has to stay out of school for 24 h…I wanted to check to see if there are any issues I should be concerned about this weekend or if I should not take her this weekend since I might have a weakened immune system. If there is nothing to worry about, please let me know so I can set my ex-[spouse's] mind at ease about this weekend.

Clinician messages about information-seeking were about test scheduling. Queries about test results and schedules were made in the context of coordinating care with other clinicians the patients were seeing. For example, a clinician messaged their patient about getting certain tests done to facilitate the patient's upcoming meeting with another clinician by writing, "*Were you able to get these done? She will need to see the labs before you start the medication.*"
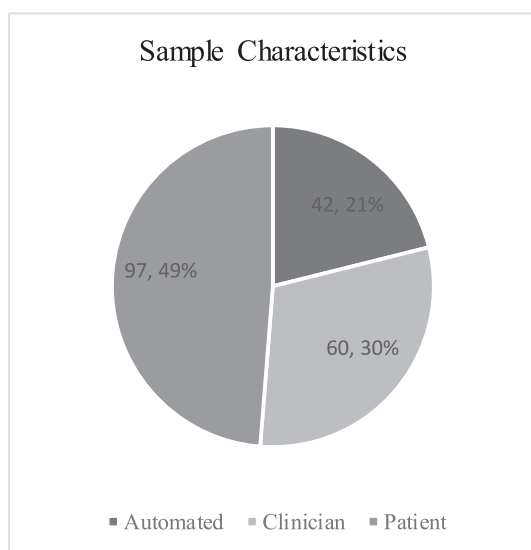
3.3.3. Emotional support / cues to emotional support

Emotional support was indicated by patients' cues, allowing clinicians to respond with expressions of emotional support. Patient cues comprised of statements or questions that included concern, uncertainty, or fear. For instance, a patient expressed fear by writing, *"the wait is driving me nuts."* Patients also expressed emotion in the form of gratitude when they had received assistance from clinicians in getting a procedure done or receiving a timely prescription. For instance, a patient thanked their clinicians by saying, *"you will never know how grateful I am to you and your entire team. Thanks for EVERYTHING."* Patients were also mindful of clinicians' time. A patient wrote to their clinician after asking for a revised letter, *"I am really sorry for the trouble."*

Clinician messages were coded for emotional support when the clinician actually expressed emotional support for the patient, mainly in the form of providing reassurance and comfort. For instance, a clinician provided information about the effectiveness of a certain medication by beginning their statement with, *"Hi, am hoping [you] may find below reassuring..."* Another way clinicians expressed emotions was to validate patients' expressions of emotions by empathizing with them. For example, a clinician said, *"I understand your concern"* when letting the patient know about the unavailability of an appointment. Clinicians also apologized when writing a delayed response to a patient's query.

3.3.4. Partnership

Partnership was expressed by creating opportunities for patients to equally participate in their care. Clinicians did so by providing medical information to patients and by encouraging them to ask questions. For example, a clinician encouraged a patient to keep reaching out to them by writing, *"Please do bother us directly … You couldn't bother us if you tried:)."* Partnership from clinicians also transpired in the form of checking patients' understanding regarding medications or medical procedures. For example, a clinician first clarified whether they were talking about the right medication before explaining its effects and dosage to the patient, *"I think you must mean [medication]."* Patients expressed partnership by being engaged and active in the interaction. They reminded clinicians about things that may have lapsed, followed up about the next steps that doctors mentioned, and alerted clinicians when labs were elevated. Patients used first-person plural pronouns (i.e., "we"), expressing an equal status, such as, *"I am writing to see how we should proceed."*

3.3.5. Shared decision-making

In rare instances of shared decision-making, patients initiated it by offering opinions about their treatment. For example, a patient wrote, *"Can we possibly worry about the colonoscopy once these other potential issues are resolved?"* Clinicians expressed shared-decision making by being receptive to patient suggestions, stating their recommendations, but also asking for the patient's opinion. In response to the patient's message above about delaying the colonoscopy until the other issues are resolved, the clinician replied: "That sounds reasonable."

4. Discussion & conclusion

4.1. Discussion

We identified the frequency of PCC codes within SM and analyzed how they transpired among patients with cancer and clinicians. Information-giving was the most frequent PCC code, contained within automated messages, as well as written by both patients and clinicians. Information-giving was used by automated messages to provide information about appointments; patients provided clinicians with reminders about prescription refills and scheduling procedures; clinicians informed patients about the meaning of test results and confirmed scheduling laboratory tests. We also found that information-seeking and emotional expressions were the next two most frequently used PCC codes. Other PCC attributes like partnership and shared decision-making were less frequent but did occur within messaging. A characteristics like shared decision-making can

be difficult to incorporate into SM, in which succinct responses are customary. However, the very act of using SM increases communication, thereby strengthening the patient-provider relationship, which is an essential aspect of shared decision-making. Overall, our results indicate that SM is a method of communication that supports Epstein and Street's [3] components of PCC, including understanding patient perspectives and aligning patient values.

Our findings related to information-giving and information-seeking were consistent with the literature about access to electronic health records. Patients reviewed the information in their chart to contact clinicians about potential errors and keep them up-to-date about appointments with other clinicians. When patients have access to their clinicians' notes, they can help identify possible medication mistakes, report existing health problems, and inform clinicians about current symptoms [44]. Accessible health records positively contribute to patient-centered care because they empower patients, inform patients about their health, and involve patients in their own care. Access to health records via the patient portal is a relatively easy way for a patient to view their own record from the convenience of their home. By doing so, patients can read a summary of their last visit, which can be shared with others [46] and allows for patient autonomy [47]. In doing so, patients can immediately contact clinicians through SM if there are things they do not understand or need more information about. Hence, SM facilitates PCC by providing patients with a means of quickly addressing health issues and allowing patients to initiate discussions about their health [39].

Previous studies, however, found that PCC in the form of supportive talk and partnership building did not often occur within SM [26]. Although patient messages expressed concern, sought medical solutions, and requested assistance with administrative tasks, clinician replies did not include language reflective of partnership or support [26]. In the current study, we broadened the attributes of PCC compared to the prior study to include information-seeking/giving, emotional support, shared decision-making and partnership. As SM utilization has increased over the past few years, accelerated by COVID-19, [48] perhaps communicating using PCC has also evolved. Our analysis of SM communication found 31 instances of emotional support within patient messages. Interestingly, patients provided cues for emotional support and did not necessarily explicitly express the attribute. As a result, clinicians may recognize the cues and respond appropriately. However, it can be difficult for patients to express such feelings and challenging for clinicians to identify them and respond. In focus groups conducted among patients with cancer, they expressed difficulties crafting secure messages and cited the need for instruction [6]. Just as communication skills training have enhanced patient and clinician face-to-face communication [49], an educational program for SM is needed. The ability to ask questions and effectively communicate with clinicians is challenging. For example, training programs have been developed to educate patients about engaging with clinicians toward shared decision-making, which increased patients' desire to have more responsibility in treatment decisions [50]. Patient interventions have also included question prompt lists, which facilitate communication in general, surgical, and palliative oncology settings [51]. Perhaps there was a lack of partnership and shared decision-making within SM interactions because patients did not know how to initiate them. The dyad of information-giving and seeking is at the core of PCC. But what makes PCC different from paternalistic models of patient-clinician communication is the incorporation of partnership, shared decision-making, and emotional expressions.

4.2. Innovation

Our analysis elucidates how PCC is applied in SM between patients and clinicians by identifying common phrases in which each of the five PCC strategies was applied. We were able to identify parts of messages that may contribute to PCC occurring within SM. These phrases can be used to enrich patients' messages in the future as well as incorporating them into system-generated automated messages. While the goal of automated messages was to provide information about appointments, it was a missed opportunity to include aspects of patient-centeredness. A study that followed

up with patients by using automated telephone calls found that there was a greater level of patient satisfaction among those who received calls that included patient-centered attributes [52]. Similarly, in the Veterans Health Administration, an automated text-messaging system was introduced to offer support, coaching, and education outside of clinical encounters [53].

The findings from this study are evidence that PCC is abundant in SM, although it differs from traditional notions of PCC. The act of giving information or seeking information does not seem novel using SM, because that is one of the main intentions of the technology. However, expressing aspects of PCC in SM may be another way of strengthening the connection between patients and clinicians. There is a need to understand the prevalence and magnitude of PCC within SM on a larger scale. Natural language processing technology may be a solution, as it has the ability to synthesize large data sets. As a result, it is possible to use the technology to better understand PCC using large scale data. We have aggregated words and phrases associated with each PCC category that can be used to develop NLP in this area (Table 4). Using artificial intelligence, medical students communicated with a Conversational Virtual Patient for training decision-making skills regarding thromboembolism [54]. Identifying the textual mechanisms through which components of PCC are expressed in SM is significant to train machine learning algorithms. As we have identified common phrases used by clinicians and patients to express the different components of PCC, these phrases can be taught to a machine learning system to address patients' concerns and to communicate empathically.

4.3. Conclusion

A limitation of our study is that the messages were coded individually without accounting for replies and previous messages. Hence, the greater narrative in which the messages were exchanged between clinicians and patients was not contextualized. Furthermore, although we identified messages as having characteristics of PCC, we do not know whether the message receiver interpreted the message as such. Also, we were not able to distinguish how many messages were from unique users. Further, our sample size was small and from one health center. Therefore, we are unable to generalize that our findings would be applicable in other regions or health centers. Future research should code the entire interaction to identify conversation initiations, the responsiveness of the clinicians to emotional cues provided by patients, and dialogical exchanges for shared decision-making. In addition, the length of messages should be examined to determine how it influences accomplishing PCC in messages.

This study analyzed the mechanisms and frequencies of five components of PCC in SM between clinicians and patients. We found that information-giving is the most frequently used PCC element within SM, while other elements, such as emotional expression, partnership, and shared decision-making, are sparsely applied. The study also illuminates the textual mechanisms through which each element can be identified, especially patients' cues for information, emotional support, partnership, and shared decision-making.

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Declaration of Competing Interest

The authors do not have any conflicts of interest to report.

Appendix

Table 1
Codebook.

Category	Operational definition
Partnership [16]	Requests for opinion, checking understanding, and facilitating patient participation by equalizing status
Emotional Support [14]	Statements of reassurance, support, empathy, and other displays of sensitivity, as well as questions/inquiries that provide an opportunity for such expressions to be made
Information-Giving [11]	Information provided in response to statements, questions, emotional expressions, or spontaneous information unrelated to previous statements or inquiries
Information-Seeking [12,13]	Obtaining knowledge of a specific event or situation to attain, clarify, or confirm information
Shared Decision-Making [15]	Statements or questions that express an opportunity for a two-way exchange of information and/or preferences so that all parties can contribute in some way to the decision-making process

Table 2
Interrater reliability.

Round 1 ($n = 40$)	Holsti coefficient
Partnership	0.75
Emotional Support	0.889
Information-Giving	0.867
Information-Seeking	0.813
Shared Decision-Making	0.667

Round 2 ($n = 20$)	Holsti coefficient
Partnership	1.00
Emotional Support	0.837
Information-Giving	0.821
Information-Seeking	0.80
Shared Decision-Making	1.00

Table 3
C-Coefficient results.

	Automated messages (n = 42)		Messages sent by clinicians (n = 60)		Messages sent by patients (n = 97)	
	Count	*Coefficient*	*Count*	*Coefficient*	*Count*	*Coefficient*
Partnership (n = 23)	0	0.00	8	0.11	15	0.14
Emotional Support (n = 52)	0	0.00	21	0.23	31	0.26
Information-Giving (n = 346)	136	0.54	97	0.31	113	0.34
Information-Seeking (n = 82)	0	0.00	4	0.03	78	0.77
Shared Decision-Making (n = 5)	0	0.00	3	0.05	2	0.02

Table 4
PCC phrases.

Information-Giving	Information-Seeking	Emotional Support	Partnership	Shared Decision-Making
Please make sure	I wanted to ask	I appreciate	We discussed	Sounds reasonable
Please complete	I was wondering	Feeling better	Our treatment plan	We can try
The plan is	What is	Here if you need us	When we spoke	Sounds good
I refilled	I am unsure	Sending our thoughts	Will keep you posted	Discuss with
Please contact	Can you provide	I'm really sorry	I'll confirm	

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