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Creating a common trajectory: Shared decision making and distributed cognition in medical consultations

Katherine D. Lippa
Wright State University, lippa2@gmail.com

Valerie L. Shalin
Wright State University, valerie@knoesis.org

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Abstract

The growing literature on shared decision making and patient centered care emphasizes the patient's role in clinical care, but research on clinical reasoning almost exclusively addresses physician cognition. In this article, we suggest clinical cognition is distributed between physicians and patients and assess how distributed clinical cognition functions during interactions between medical professionals and patients with Multiple Sclerosis (MS). A combination of cognitive task analysis and discourse analysis reveals the distribution of clinical reasoning between 24 patients and 3 medical professionals engaged in MS management. Findings suggest that cognition was distributed between patients and physicians in all major tasks except for the interpretation of MRI results. Otherwise, patients and physicians collaborated through discourse to develop a common trajectory to guide clinical reasoning. The patients' role in clinical cognition expands the concept of patient-centered care and suggests the need to optimize physician-patient distributed cognition rather than physician cognition in isolation.

Keywords

Shared decision making, patient centered care, medical consultation, Multiple Sclerosis, patient experience

Introduction

A man develops congestion and sinus pressure. After a few days he thinks he might have an infection and goes to see a physician. The physician takes a medical history, conducts a physical exam, diagnoses a sinus infection, and prescribes an antibiotic. This common scenario raises a complex question. Who makes diagnostic and treatment decisions? Patients who decide to seek care often with possible explanations for their own symptoms? Physicians who record diagnoses and write prescriptions? Physician-patient dyads who exchange information through the clinical encounter? The patient who purchases and takes the antibiotics on the prescribed schedule? All of these agents contribute to clinical cognition, the processes of thinking about illness ranging from basic issues of perception and categorization to complex problem solving[1].

Medical diagnostic and treatment decisions emerge from a complex process that includes multiple actors thinking and interacting with the physical world and with one another. In this paper, we argue that clinical cognition constitutes a distributed cognitive system centered on physician-patient interactions. We examine how this system of distributed cognition is enacted in the dialogue of physicians and patients managing Multiple Sclerosis (MS).

Integrating Patients into Medical Cognition

Traditionally, in western culture, doctors were believed to be uniquely responsible for diagnosis and treatment decisions. Patients simply complied with these decisions[2]. Recently, North American culture has shifted from this physician-centered model to a patient-centered approach[3]. Shared decision making[4] and patient activation[5] are two core components to patient centered care that significantly improve patient care[5,6]. Shared decision making has been defined in a variety of ways[7], but generally refers to an approach to medical decision making that encourages patient-physician collaboration and the incorporation of patient preferences in the decision making process. Shared decision making extends the patient's role in clinical reasoning requiring patients and physicians to discuss and evaluate complex medical information. Patient activation promotes understanding the patient's role in health care and encourages the development of patients' skills and motivation to manage their own health. This concept extends the role of the patient's contributions beyond isolated decisions to a more integrated role involving many aspects of healthcare. Both shared decision making and patient activation depend upon patient cognition on a variety of levels from the routine challenges to memory and problem solving posed by daily self-care for chronic conditions to the high stakes decision making involved in critical care.

The increase in patient participation in the health care system suggests a corresponding need to expand our

understanding of clinical reasoning beyond the traditional equation of clinical cognition with physician cognition[8,9]. Patient-centered care requires a greater integration of doctors' and patients' contributions to clinical reasoning. Physicians and patients inherently have access to different information about the patient's status and different scope for treatment activities[10]. Patients have details about their phenomenological experience and case history while physicians have abstract biomedical knowledge. Similarly, patients engage in direct self-care but only physicians have the authorization to provide access to certain treatments. Physicians' and patients' differing access to clinically relevant information and differing scope for implementing care create an inherently distributed system for clinical cognition and care.

The notion of distributed clinical cognition has been suggested for shared decision making[11] and is implicit in the concept of patient activation[5]. In addition, work in anthropology supports the idea that clinical cognition, at least in certain cultural contexts, is not equivalent to medical practitioner cognition. Findings suggest that key aspects of clinical cognition, such as problem solving and decision making, are a result of interactions amongst medical practitioners, patients and various community members[12] and that how these individuals understand illness impacts clinical interactions and care[13]. However the work in anthropology, while touching on aspects of distributed clinical cognition, tends to be more focused on the semiotics of illness and cultural practices for providing care rather than systematically examining the underlying cognition.

Little research explicitly addresses Western patients' clinical cognitive processes or how physicians and patients collaborate during clinical cognition. This paper uses a combination of cognitive task analysis and medical discourse analysis, to show how the process of medical cognition is distributed between physicians and patients. In particular, we suggest that physicians and patients use dialogue to shape a common trajectory for clinical cognition with both physicians and patients, contributing to cognitive tasks throughout the clinical encounter.

Distributed Cognition

Thought is highly contextualized; it is influenced by the physical, technical and social environment. Hence, many forms of cognition are not locked in one individual's mind but distributed between an actor(s) and the environment[14,15]. Research on distributed cognition examines cognition as a system that spans individuals and groups, humans and technical artifacts, and space and time. Individual cognition can be vulnerable to deficiencies and biases that may introduce error in performing cognitively complex tasks[16]. Similarly, distributed cognitive systems function with varying levels of efficiency and may include elements that are especially vulnerable to

introducing error. In particular, errors may occur when different portions of the system are incompatible, for example when an interface does not adequately support task performance[16,17], or when key information fails to transfer between elements in the system, for example during a shift change[18]. Distributed cognition provides a means to analyze a system as a whole to assess the strengths and vulnerabilities of the entire system.

In the medical domain, research has analyzed interactions amongst health care providers and between human actors and technical artifacts as distributed cognitive systems[19,20]. These studies identify the reliance of medical reasoning on interactions with multiple professionals, but they fail to consider the contributions of patients to clinical reasoning. As medical care becomes more patient centered, understanding clinical cognition requires incorporating patient contributions to clinical reasoning. The lack of research on the patient's role in distributed medical cognition is especially limiting in cases like MS, where patients are managing complex, chronic conditions. These patients are responsible for self-managing their care and making real time judgments when unusual events or novel symptoms occur. In these cases, patients must develop some understanding of the disorder and their own bodies in the context of the disorder. The specifics of this understanding can have a major effect on patient decisions about disease management[21,22].

Medical Discourse

The crux of physician-patient interaction is the dialogue during medical consultations. Understanding this discourse provides insight into the component thought processes of doctors and patients. Research on medical discourse has not typically addressed cognition, but certain findings suggest that how patients talk to physicians impacts both the way in which symptoms are discussed and the selection of treatments[23,24].

Roter's analyses of clinical interactions have revealed a standard structure or 'anatomy' to medical consultations: an opening to the visit, a case history, a physical exam, an education/counseling phase and a closing to the visit[25]. In the analysis below we adopt this structure as a framework for tracking the distribution of cognition between doctors and patients throughout the clinical encounter.

The Case of Multiple Sclerosis

In this paper, we bring together the study of distributed cognition and discourse analysis to examine the cognition involved in Multiple Sclerosis (MS) management. Managing MS requires a complex set of judgments and decisions about the significance of symptoms and treatment of both symptoms and disease processes. All of these processes require the active involvement of a neurologist and a patient and may involve other actors, such family and outside providers.

In order to analyze the distribution of cognitive processes in MS management, we begin by decomposing the cognitive work done during a typical MS management consultation into a series of goals and the tasks that are necessary to achieve them. We then use discourse analysis to examine the distribution of cognitive processes that occur during segments of dialogue that focus on each of the key cognitive tasks. Finally, we discuss the implications of these findings for understanding distributed cognition, medical discourse and the shared decision making paradigm.

Methods

Participants and Data Collection

Data were collected through a center specializing in MS at a Midwestern medical school. Three practitioners (two neurologists and one nurse practitioner) and twenty three patients (18-76 years old; 19 female & 4 male) participated. Patients ranged from newly diagnosed to having MS for 30+ years. Practitioners' consent was obtained during a staff meeting; while in the waiting room patients were asked to participate and sign informed consent documents approved by the IRBs of the researchers' university and the site where data were collected.

Approximately 65 hours were spent observing 29 clinical sessions at the clinic. During some sessions, data included both audio recording and field notes. In others, only field notes were used at the participants' request. To provide a rich description, all examples reported in the results are drawn from audio recorded sessions. But, the patterns they illustrate appeared in the field notes as well. Follow-up interviews were conducted with all patients to gauge their understanding of MS and probe their reasoning about symptoms reported and treatment decisions during the clinical session.

The taped clinical sessions and interviews were transcribed using literary transcription[26]. All the words spoken were transcribed verbatim, and content free utterances (e.g. 'uh,' 'mm,' laughter) were noted. No provision was made for noting pauses or intonation. Immediately after collection, field notes were elaborated by expanding notations to full sentences and filling in context.

We began the analysis by creating a cognitively oriented work analysis [27,28] that represented common tasks involved in an MS consultation. We coded each interaction line by line according to the topic (e.g., MR images) and purpose of the utterance (e.g., diagnosis). This provided a detailed sequence for each session, which we decomposed into a series of actions. Then, we used Banxia Decision Explorer to create a visual representation of the interaction by representing each action as a node and charting the connections between nodes (e.g., from reviewing test results to assessing the patients status). We then integrated the visual maps from the individual sessions to create a common concept based representation. We developed concepts by eliminating nodes that occurred in isolation and aggregating nodes that were functionally equivalent into higher level concepts (e.g. 'use of narcotics' was subsumed under 'pain management,' which in turn was categorized as 'symptom management')[29]. We traced the connections between the evolving concepts/categories in terms of information flow and pre-requisites for particular functions. Finally, we drew connections between the task analysis of MS, core constructs from cognitive science and Roter's model for the structure of clinical interactions[25].

We used discourse analysis to explore how these tasks were achieved through dialogue [30–32], focusing especially on the contributions of each actor. We selected the examples and accompanying analyses because they represented modes of interaction that occurred in multiple patient-practitioner interactions.

Results

Analyses revealed that cognition is distributed between doctors and patients throughout the clinical session, but the nature of this distribution changes across the course of the visit. To show how distributed cognition works across the course of a clinical encounter, we analyze the cognition involved in the tasks that comprise the clinical session and provide examples of how cognition is enacted through discourse during each task.

Figure 1 depicts the basic subtasks for routine MS management and how these tasks are likely to fit within the standard structure of medical consultations. The history taking and physical exam sections are combined here because even though these processes are typically separated in space, the information they produce serves the same goals so they are functionally interrelated. Task analysis showed two inter-related sets of clinical tasks in each session, one focused on the progression of the disease and the other on symptom management (see Figure 1, left and right columns respectively).

Monitoring the physiological progression of the disease depended upon using a combination of information from magnetic resonance images (MRIs), physical examination and case history discussions. This information was used to assess the physiological progression of the disease and its relationship to new or changed symptoms thereby enabling the physician and patient to form judgements about the patient's current physiological status and make treatment decisions related to managing the course of the disease. The symptom management portion of the clinical interaction also was based on information from physical exams and case history discussions, but the focus was on recent symptoms, their relationship to MS, and what treatment (if any) was appropriate.

Distributed Cognition Across a Clinical Session
Discuss Case History. The case history portion of the visit is typically discussed as a process wherein a patient presents an initial concern and the physician then takes control of the dialogue and elicits additional information as necessary to reach a diagnosis[33]. Although we found many cases where the surface structure followed this pattern, a closer look showed the patient carefully constructing a symptom presentation and/or responding to questions so as to constrain certain hypotheses or possible paths of reasoning and explore others. While patient memory is clearly at work, we also note the function of focusing the dyad's attention. The following example shows how an apparently neutral problem presentation can in fact considerably constrain the diagnostic environment and thereby focus attention.

Physician: *So, tell me how you're feeling?*
Patient[1]: *Um. Today I'm feeling fine.*
Physician: *But in general?*
Patient: *Um, two weeks ago I had a um, um I guess an episode is what you'd call it. Um, where I had a visual problem. I had kind of a backwards c shape blurry spot, you know in my vision, and it*

lasted about ten minutes. I called is it {physician's assistant name} and told her about it and um… And as I sat there I thought you know is it the right or the left, so
Physician: *[ok]*
Patient: *then I you know closed my right and checked and then closed my left and checked and it seemed like it was in both, so it didn't seem like it was in one or the other in particular. And so then I closed both eyes and you could still like when you sit down and stare at a light bulb you still got that kind of greenish. Well it was still there. I hadn't been like*
Physician: *[uh, huh] [yeah]*
Patient: *staring at a light or anything.*
Physician: *Um, hum. That's unusual.*
([1] Patient characteristics: 30s, college level education, 1-2 years with MS, minimally disabled)

This patient carefully constructs his presentation to facilitate certain ways of thinking about his symptoms and constrain others. Before he even describes the specific symptom he represents it in two ways, as an 'episode' and as a 'visual problem,' each of which place constraints on the problem space he is constructing. In using the word 'episode' he suggests that the incident was discrete in time,

Figure 1. Cognitive trajectory for MS management. Cognitive functions are displayed in rectangles with associated key cognitive elements (left) and decomposition into Roter's stages of a standard clinical session (right).
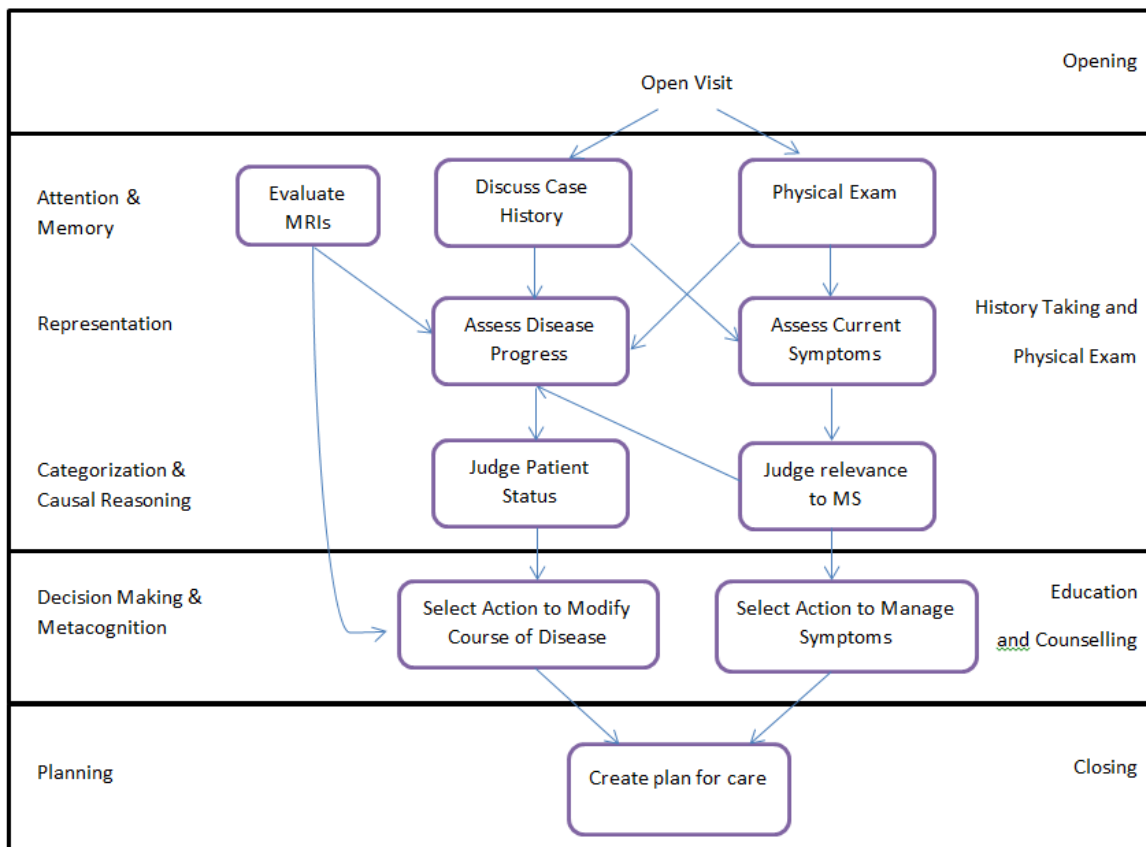
neither the worsening of a known chronic problem nor the onset of something persistent that the doctor could assess directly. By calling his symptom a 'visual problem' he constrains the problem space to the visual system and discounts the possibility that it is an artifact of some other condition like fatigue. While these dimensions may initially seem arbitrary, they are especially salient to diagnosing the problem and are discussed multiple times throughout the clinical session. At different times the physician challenges the patient about his judgment on both points. He concludes his presentation by saying that he called the (neurology) clinic about the symptom when it occurred. This suggests the patient believes that the visual loss might have a neurological basis and falls within the neurologist's expertise. Without ever saying the word 'neurological,' he constructs an argument favoring a neurological categorization, describing a kind of layman's eye exam to prove that it was not localized in either eye and making a comparison to an after image, which is a neurological phenomenon.

In this case, and many others in this data set, the patient is carefully shaping his presentation to facilitate certain diagnostic categories and limit others. He identifies critical elements of his experience and frames key parameters in his initial presentation and constructs his specific description of his symptoms in a way that suggests a broad diagnostic category. Without ever challenging the culturally endorsed prerogative of the physician to provide diagnosis he nevertheless shapes the diagnostic process by focusing attention, and representing and categorizing his experience to influence causal reasonig.

Physical Exam. Physical exams are often regarded as an activity where all the cognitive elements are performed by the physician with the patient simply complying with instructions. This view is supported by research findings that patients provide fewer comments during this portion of the exam than any other (Roter & Hall, 2006). Quite a few physical exams in this study followed this pattern, especially when the exam was routine without motivating symptoms. However, significant patient speech can occur even when the physician is doing most of the active work with little contribution from the patient. As physicians ask questions they prompt patients to create more nuanced representations of their own symptoms. These descriptions then can guide further examination by the physician. In the following case, the patient did not initially report any new symptoms. However, later during the routine questions, and prompted by filling out a form on the electronic medical record system (EMR), she mentions new pain and numbness in her shoulder and arm.

Physician: *Numbness any worse?*
Patient[2]: *This area doesn't necessarily feel more numb, but it feels like there is a tightness and loss of sensation that pretty much goes*

with the pain here. But, like, I can still feel. I don't know it's just numb on this side
([2] Patient characteristics: 30s, graduate level education, 1-2 years with MS, minimally disabled)

The patient hasn't been able to clearly represent the sensation she is experiencing. But her response to the EMR question has raised an area of concern. As a result, during the physical exam the physician supplements the routine exam with more careful attention to the potential problem area.

Physician: *Um this is on this side right?*
Patient: *Yeah*
Physician: *Is that painful?*
Patient: *Um*
Physician: *Oh this is it. This must be tender.*
Patient: *Yeah*
Physician: *Sometimes the muscle can kind of get clenched up like that; it's not, I don't think it's MS.*

The doctor's probe helps to define the scope and nature of a symptom jointly, that the patient could not otherwise clearly represent. It is pain/tenderness not numbness/lack of sensation. The patient accedes to this definition saying 'yeah,' which paves the way for the doctor to categorize the symptom as musculoskeletal rather than neurological and ultimately refer the patient for treatment at a pain clinic. This is an interesting example of distributed cognition across people and artifacts, since the initial complaint was prompted by the structure of the EMR. This technology influenced how the doctor and patient interacted on a physical level and produced a diagnosis and course of treatment that would not have occurred simply due to the isolated thought processes of either human actor.

Evaluate MRIs. MR images are the primary means of evaluating new disease activity since the technical relationship between lesions and reported symptoms is chaotic. MRIs focus attention on detected lesions. However, interpreting MR images requires highly trained professional skill, so only the physicians have access to this information. Patient participation in this portion of the clinical sessions was largely passive with only an occasional interjected question. Interpretation of MRIs most commonly functioned as a means of evaluating the efficacy of medications, as shown in the example below.

Physician: *Its 900 images. You're doing good. No new symptoms. We have to make sure though that the medication that you take helps prevent the new lesions. We have to repeat the MRI again and see if there are any new lesions. On Copaxone we don't want, if there will be new lesions what we will have to do is switch the medication...*

Here the physician represents the MRI to give the patient a sense of her current disease status and then defines decision criteria for a possible future change in medication. This type of foreshadowing of possible treatment changes based on MRI scans was fairly common. Anticipating possible future changes may allow the patient to be more prepared for and less resistant to altering medications that change patterns of self- treatment (i.e. frequency of injections) or entail possible side effects. MRIs also support patient education, especially with newly diagnosed patients, to help provide an understanding of the physiology of MS.

Judge Patient Status. In almost every session at some point the physician would provide an overall assessment of the patient's status. Sometimes this assessment was simple: 'our exam looks great, so uh, I am not concerned. You have no new symptoms, so looks good.' At other times the status summary was more complex and involved both doctor and patient participation. In the example below, the patient has recently changed medications and experienced a dramatic improvement in mobility.

Physician: *[watches patient walk across the room] Oh, my God.*
Patient[3]: *I know this right leg I could barely feel anything and now*
Physician: *I can't believe it*
Patient: *I know, I can't either. This is like the closest I've been to like my old self, you know?*
Physician: *You got lucky. I'm so happy.*
…
Physician: *Oh my god. I want to see you walking. [patient paces back and forth] Man I remember you were dragging this leg. Like you're cured.*
Patient: *Maybe I am cured. I'll just leave it at that, I'll just think I am.*
([3] Patient characteristics: 40s, level education, 3-5 years with MS, moderately disabled)

In the first part of the interchange, the patient initiates the status summary by contrasting her current level of sensation to her prior one and then making an overall summary statement that this makes her feel 'like my old self, you know?' Her query at the end of this statement is partly rhetorical, but it also creates a conversational context that invites the physician to validate her assessment. The physician does so twice. First, she provides emotional validation by expressing her gratification with the patient's improvement. Later, after observing and assessing her gait, she echoes the structure of the patient's status summary. She first makes a direct comparison between current and previous functioning and then parallels the patient's talk about being her 'old self' by saying it is 'like you're cured.' The patient picks up this validation and elaborates on the idea that she is 'cured.' She also assertively ends the status discussion saying 'I'll just leave it at that.' This status summary is interesting since the patient initiates it and defines the parameters.

The patient also ends the summary, but the doctor plays the crucial role of turning the patient's subjective sense into a socially validated reality. Of course both the doctor and patient know that she is not really 'cured' in the sense of not having MS, but the conversation marks a qualitative shift in patient status from significantly to minimally disabled.

Judge Symptom Relevance to MS. When a patient with Multiple Sclerosis presents a symptom it raises two questions: is the symptom properly categorized as MS related and, if so, is it the result of existing lesions or new lesion activity. In the case history example above, we saw how a patient can actively construct a symptom report to categorize the symptom as MS related, or at least neurological. The example below shows how patients can also participate in representing and categorizing symptoms as indicative of new lesion activity. This is especially true for patients like this one who have had MS for a long time.

Physician: *Any new symptoms since I've seen you?*
Patient[4]: *Yeah, yeah, yeah, Monday I was up here on Monday. Well when I had my cardiac. Well, uh uh I was walking a little bit in downtown [omitted] to a lunch meeting and uh … my left leg started to tingle really bad and that that usually is… is a uh they it's been called… they call it I want to say false flare up but that, that's not correct but…*
Physician: *Pseudo relapse is what we call that.*
Patient: *Or, it could be a relapse. This is usually a sign. But as I relaxed you know I stopped what I was doing I went and I lay down didn't do anything it has seemingly dissipated. I believe it was just the amount of walking I was doing.*
Physician: *Ok how long did it last in total?*
Patient: *Probably about 4 hours, 5 hours.*
Physician: *So, we wouldn't classify it as an attack, because it lasted such a short time. It*
Patient: *[right]*
Physician: *would last more than that.*
([4]Patient characteristics: 40s, college level education, 3-5 years with MS, severely disabled)

Here the patient introduces the episode and provides a brief description. Then he immediately provides his own assessment of the relevance for MS. He even tries to produce the technical term, which the doctor supplies for him. The doctor asks a question to check whether the episode fits the diagnostic criteria for an MS attack, and eventually validates the patient's self-assessment. In other cases, the physician may lead the exploration of the significance of a symptom by asking about things like time course and alternative explanations. Over time, this kind of dialogue allows patients to internalize the parameters for symptom representation so that, like the patient in this example, they can self-diagnose and present their self-diagnoses in ways that physicians can evaluate[34].

Select Disease Modifying Agent. This task is most closely aligned with treatment. Selecting a disease modifying agent is a multi-attribute decision making process. In some cases, the patient's physiological status dictates a particular treatment method but many cases allow for a variety of alternatives. In these cases, the patient's preferences (e.g. frequency of administration, side effects, and desire for more or less aggressive treatment) may determine medication selection.

In several of the examples above we saw patients who were very actively involved in cognitive processes such as representation and categorization that are traditionally attributed to physicians. Below, the patient says very little but nevertheless has a major effect on the decision making process.

Physician: *There is like you know what there is a drug named Copaxone® which does not go*
Patient[5]: *[uh, huh]*
Physician: *through the liver, does not cause flu like symptoms and that might be a good choice for you.*
Patient: *When I was here you told me about Betaseron®, when you said that that just came out*
Physician: *[yeah]*
Patient: *with new studies.*
Physician: *With new studies and in the studies Copaxone was with the Betaseron as well.*
Patient: *[ok]*
Physician: *They were comparing the two kinds when it comes to the results, the frequency of attacks, they both decrease the frequency of attacks about 60%. The Betaseron was slightly better*
Patient: *[um]*
Physician: *when it comes to the MRI outcomes. With the Copaxone it was a little bit*
Patient: *[ok]*
Physician: *worse when it comes to new enhancing lesion. But you don't have any new enhancing lesions. And because I remember you saying that you decided not to do and you were saying that you were thinking more about natural medicine. Copaxone is more like a mixture of amino acids and so its mild than Betaseron. Betaseron is like interferon. That's why it's a strong,*
Patient: *[ok]   [yes]*
Physician: *little bit more synthetic I would say.*
….
Physician: *So, you comfortable with the Copaxone or you prefer the Betaseron medication?*
Patient: *Um, I read both and the Copaxone actually sounded like in the stuff that I read sounded like something I'd rather do, because it seemed more simple and it didn't have the flu like*
Physician:*[yeah]*
Patient: *symptoms I was worried about…*
([5] Patient characteristics: 20s, college level education, 1-2 years with MS, minimally disabled)

This patient is newly diagnosed and is seeing the doctor for the second time. On her first visit she refused to begin a disease modifying therapy in favor of alternative medicine. Now she has had new lesions form and the doctor wishes to convince her to accept treatment. The doctor begins by introducing the medication and some of its advantages. The patient very briefly challenges the doctor by pointing out that her current recommendation is not consistent with the one she provided previously. The doctor responds by articulating her reasoning for the new recommendation, first by arguing that for this patient both medications might be equally effective and then by suggesting that the chemical structure of the medication is more compatible with the patient's values. Ultimately, she presents the patient with a direct choice. The patient echoes the doctor's arguments, accepting both the greater alignment with her values and the desirability of lower side effects. This is an interesting case since by refusing the initial treatment the patient has modified the set of usual decision parameters, requiring the doctor to redefine the medications in a way that incorporated a new parameter. By the end of the session, they have developed a mutual definition of drugs that includes both efficacy and 'naturalness.'

Select Method for Symptom Management. This task constitutes another treatment pathway. Since symptom management is more about comfort than managing a disease process, this was an area where the patients tended to lead decision processes. Often the physician would simply provide support for the patient to make decisions about how to control symptoms. For example in the case below, the decision is entirely the patient's and the doctor just answers questions.

Physician: *Would you like to take medication every day to prevent the headache?*
Patient[6]: *On top of the Copaxone? I don't know what is it is it a pill?*
Physician: *It's a pill, a prophylaxis to make the headaches happen less often.*
Patient: *I mean can I just try it and if I decide I don't want to do it.*
Physician: *Oh yeah no problem, no problem.*
([6] Patient characteristics: 20s, college level education, 1-2 years with MS, minimally disabled)

Yet even in cases like the one above where it appears that the patient is entirely in control, clinical cognition is still operative because the doctor presents the patient with a defined set of possibilities. Here the patient is given a choice about whether to treat at all, but is not given a choice about which treatment to take. In other cases, with a settled need for treatment the physician provided the patient with a choice of medication or with samples of multiple medications and a range of possible dosages. In the latter case, the patient takes the samples home to try out what 'works' for them, allowing a final decision to emerge through direct experimentation.

Create Plan for Care. The plan for care typically does not include new information, reasoning or decision making. Instead, discussion focuses on summarizing earlier conclusions and the logistics of implementing decisions. For example:

Physician: *So what I'm gonna do, I am gonna give you a brain, MRI. And I'm gonna see if anything comes up. I just want to be sure how the MRI looks and then think about switch medication.*

Here the doctor simply summarizes the plan for care. In some cases, the patient may also ask questions or request particular pragmatic services like having prescriptions renewed.

Conclusion

The management of Multiple Sclerosis is a distributed cognitive system, with physicians and patients as the central actors. Physician-patient interactions allow for emergent symptom diagnoses and treatment decisions. With the exception of interpreting MRIs, patients contributed significantly to all of the major cognitive activities during clinical sessions, including focusing attention, the representation and categorization of symptoms, and decision making. The decisions and representations that emerged in this way were not entirely constructed either by the doctor or the patient. These findings suggest that analyzing medical discourse requires considering the cognitive processes enacted through the dialogue. Clark's work on common ground (i.e. mutual knowledge and beliefs)[35] has shown the importance of shared understanding for effective communication. Clinical dialogues involved establishing not simply common ground but a *common trajectory* for reasoning and treatment. This was evident in the work of both patients and physicians. Patients selected and represented symptoms in a way that facilitated particular paths of reasoning or conclusions; and physicians incorporated patients' values/preferences and insured that they were aware of their current status and prepared for future decision points. Negotiation of a common trajectory across the exchange was a key element in the distribution of clinical cognition.

The need to negotiate a common trajectory for clinical cognition complements evolving notions of shared decision making and patient centered care. Shared decision making is not only a sharing of power, information, or prioritization of values. It is a portion of a larger shared, mutually determined process of clinical cognition that may be enacted in a variety of ways depending upon the circumstances and people involved.

Taking patient-practitioner interactions as a distributed cognitive system does not insure the quality of clinical cognition. Ideally, patients and practitioners construct a comprehensive view of the clinical situation and develop a coherent, common trajectory for clinical reasoning. However, in some instances the distribution of clinical cognition between patients and practitioners may introduce vulnerabilities to error, as for example, if key information is not transmitted or interpreted correctly. Future research should identify what factors make practitioner-patient cognition an *effective* system that leads to medically sound and personally desirable outcomes. On the patient side, we should learn more about how patients come to understand illness and how such understanding affects their care. On the practitioner side, we should examine how different classes of practitioners engage in clinical cognition and respond to patient contributions. In this study, we did not distinguish between the physicians and the nurse practitioner, but professional differences may have a substantial impact on clinical interactions and reasoning that should be examined in future research. Finally as an interactive process, we must study what makes patient-practitioner dialogue effective, including how each participant's contributions affect the trajectory for clinical cognition and the characteristics of effective clinical interactions in various clinical and social contexts.

On a practical level, the role of patients in clinical cognition suggests that efforts to increase patient centered care should incorporate a cognitive component. Shared decision making interventions should target tools and skills training that can increase the efficiency of distributed cognition[36,37]. Similarly, notions of patient self-care have generally been fairly narrowly focused on the enactment of physician instructions. This study suggests that patients are more involved in the cognitive work of medicine than has generally been acknowledged. Patient involvement in clinical cognition complements the broader conceptualization of the patient's role captured by constructs such as patient activation. The findings in this paper suggest the importance of recognizing the patient's role in clinical cognition and developing tools and/or training to facilitate effective patient-physician distributed cognition.

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