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Patients' Mental Models and Adherence to Outpatient Physical Therapy Home Exercise Programs

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ABSTRACT

Adherence to physical therapy home exercise programs continues to be a multifactorial and poorly understood phenomenon. Prior research suggests that some of the most salient factors affecting adherence reflect individuals' context-specific prior experiences and perceptions, which strongly influence values and expectations. Collectively known as mental models, these values and expectations guide reasoning and decision-making and show promise in better understanding factors related to adherence.

This qualitative study sought to identify aspects of patients' mental models that relate to adherence to physical therapy home exercise programs. The researcher employed a basic interpretive qualitative research design using 10 participants (mean age = 50.3 years) beginning outpatient physical therapy for an orthopedic condition. Data were collected data via two face-to-face, semi-structured interviews. Interview One focused on participants' prior experiences adhering to a regimen unrelated to their current physical therapy experience. Interview Two focused on participants' current experiences adhering to their physical therapy home exercise program. The researcher completed data analysis using a constant comparative method.

Findings showed that components of participants' mental models related to their adherence to physical therapy regimens as well as to non-physical therapy regimens. Specific themes highlight the role of realized and anticipated results of the regimen, social supports, and

convenience in terms of physical space and time in adherence. This study has direct implications for physical therapists and other health care providers who seek to understand factors that relate to patient adherence. Findings suggest that components of individuals' mental models may play an important role in adherence behaviors. A better understanding of these factors may enable providers to intervene in ways that promote patient adherence and ultimately improve patient health.

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Patients' Mental Models and Adherence to Outpatient Physical Therapy Home Exercise Programs

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Growing up, I never imagined that I would eventually earn a doctoral degree. I came from a modest "half-double" house in eastern Pennsylvania where you could hear your neighbors talking and moving through the dividing walls. At times, I was on free or reduced lunch due to financial struggles of my family. Despite that, my mom and dad worked hard and allowed me to go to the University of Connecticut even though the out of state tuition was considerably higher than a smaller, Pennsylvania school. Thanks mom and dad for taking this gamble and being supportive along the way. One of my most pivotal early moments at UConn came in my first semester. After performing poorly on my first two Chemistry exams, I studied for countless hours for the last exam and got a near perfect score. I will never forget walking away from the list of grades finally feeling confident that I could accomplish anything if I worked hard.

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CHAPTER I

Introduction

In 2002, the American Academy of Orthopedic Surgeons (AAOS) embarked on a new initiative to increase awareness of musculoskeletal disease called the United States Bone and Joint Decade. Among the reasons the AAOS assembled this panel of experts was to better monitor the "burden" (i.e., prevalence, impact, and cost) of musculoskeletal disorders and improve management of such disorders via "patient empowerment, communication, and research" (AAOS, 2011, Slide 2).

Referral to physical therapy is a common strategy in the management of persons with musculoskeletal disease. Physical therapy is a crucial treatment option for both prevention of surgery and post-operative recovery when surgery is unavoidable. In addition to office visits, physical therapists commonly ask patients to perform a home exercise program (HEP), a subset of learned exercises that is safe to perform independently between visits and after formal physical therapy concludes. The rationale behind the home exercise program is further improvement of the patient's current disorder and/or prevention of the same or additional pathology in the future.

Similar to research regarding adherence to medications, dietary changes, and weight loss (DiMatteo, 2004), patient adherence to HEPs is not optimal. Empirical studies display a range of 35-72% in HEP adherence (Alexandre, Nordin, Hiebert, & Campello, 2002; Forkan et al., 2006; Kolt & Evoy, 2003; Sluljs, Kok, & van der Zee, 1993). In a study of individuals with balance impairments, Forkan et al. (2006) found that although 90% of patients discharged from two PT clinics received "lifelong" home exercise programs for impaired balance, 37% did not continue to perform the activities after discharge. Shumway-Cook, Gruber, Baldwin, and Liao (1997)

showed that adherence to such programs is critical for intended outcomes as well as prevention of re-injury. In their study on older adults, participants who fully adhered to an exercise program displayed a 33% decrease in fall risk while those who partially adhered realized only an 11% decrease.

In studies across a variety of medical services, including physical therapy, researchers have identified over 200 factors related to adherence to medical advice (Sluijs & Knibbe, 1991; Vermeire, Hearnshaw, Van Royan, & Denekens (2001). In their meta-analysis of medical adherence literature, Vermeire et al. (2001) found several inadequacies in this body of research. The methodological quality was poor in many studies and many lacked sound theoretical frameworks. Based on their meta-analysis, Vermeire et al. (2001) posited that the most salient factors affecting adherence were likely reflective of individuals' knowledge, beliefs, and prior experiences regarding illness and medications. The authors concluded that, "if measures are to be taken to improve compliance, these should primarily be based on a closer understanding of the patients' experience with illness and medication" (Vermeire et al., 2001, p. 339).

Despite this recommendation, few authors have included prior experience and prior adherence behavior in their research regarding HEP adherence. Medina-Mirapeix et al. (2009) found that participants ($N = 34$) who reported "previous participation and adherence" and "use of a physiotherapist in previous episodes of pain" were respectively three ($ES_{OR} = 2.9$) and two times ($ES_{OR} = 2.0$) more likely to be adherent to a physical therapy home exercise program. In a study of individuals with knee osteoarthritis ($N = 439$), participants underwent 3 months of clinical exercise, followed by 15 months of home exercise (Rejeski, Brawley, Ettinger, Morgan & Thompson, 1997). Adherence was measured at 3, 9, and 16 months. Although correlations of adherence to demographic, physical, and emotional factors were generally weak, previous

behavior (adherence in the previous time interval) was strongly associated with attendance (r = .50-.58) and time spent exercising (r = .51-.84). Finally, in a study of participants with osteoarthritis (N = 115), Schoo, Morris, and Bui (2005) showed that adherence to the first 4 weeks of a HEP was the strongest predictor of adherence in weeks 5-8 (OR = 19.86; 95% CI = 4.84-81.56)

As Vermeire et al. (2001) concluded in their meta-analysis, currently no consensus exists regarding a theoretical framework for adherence study. In their comprehensive review of medical adherence literature, Van Dulmen et al. (2007) concluded that "cognitive models" (p. 64) reflecting patients' perceptions and beliefs, represent patient's "underlying theoretical perspective" (p. 64) of medical encounters, possibly making them key to adherence study. The concept of cognitive models is virtually synonymous with the concept of *mental models* used in many social science domains. According to Gentner (2002), a mental model is "a representation of a situation or domain that supports understanding, reasoning, and prediction" (p. 9683). Mental models provide the underlying structure of assumptions and expectations that guide how an individual reasons in a given situation (Gentner, 2002). Therefore, patients' mental models of their condition, physical therapy, and adherence may guide how they reason and make decisions about treatment options, including adherence to HEPs. Other authors of systematic reviews of adherence research also have concluded that patients' perspectives are key in adherence study (Jack, McLean, Moffett, & Gardiner, 2010; McLean, Burton, Bradley, & Littlewood, 2010)

Problem Statement

The challenge for physical therapists is how to improve patients' adherence to home exercise programs. Medical adherence research published over the last 30 years is inconclusive

regarding how best to identify and improve patient adherence. However, researchers point to the important role patient prior experience, values, and beliefs—all components of mental models—may play in adherence. A better understanding of the influences of patients' mental models on HEP adherence may guide physical therapists in designing interventions that more effectively promote adherence, improving patient outcomes and the reducing the "burden" of musculoskeletal disease outlined by the AAOS.

The overarching research question guiding this dissertation was: *What aspects of individuals' mental models relate to adherence to physical therapy home exercise programs?* The research included a comprehensive review and synthesis of related literature, a qualitative empirical study, and implications for research and practice.

This manuscript comprises three papers written for publication. In the first paper (Chapter II), titled *Patients' Mental Models and Adherence to Outpatient Physical Therapy Home Exercise Programs*, I proposed a conceptual framework linking prior experience, mental models, and HEP adherence that can guide physical therapists in their practice to enhance patient adherence. This paper was accepted for publication in *Physiotherapy Theory and Practice* and posted online by the journal on January 14, 2015. The second paper (Chapter III), *The Role of Physical Therapy Patients' Mental Models on Adherence to Home Exercise Programs: A Qualitative Study,* currently under review by *Physical Therapy,* describes the methods and findings of a qualitative study identifying components of physical therapy patients' mental models that related to adherence to HEP and non-HEP regimens. By synthesizing the conceptual framework and empirical findings, the third paper (Chapter IV), *Improving Self-Care Recommendations and Adherence through Articulation, Assessment, and Revision of Patients' Mental Models*, provides recommendations for a broader range of medical providers to foster

adherence to medication schedules, dietary changes, and other common medical regimens. The target journal for this paper is the *Journal of Allied Health.* The manuscript concludes with Chapter 5, drawing final conclusions regarding implications of all three papers on adult learning theory and practice as well as medical recommendation adherence.

CHAPTER II

Patients' Mental Models and Adherence to Outpatient Physical Therapy Home Exercise Programs

Introduction

The World Health Organization (2003) defines adherence as "the extent to which a person's behaviour…corresponds with agreed recommendations from a healthcare provider" (p. 3). Although the systematic study of medical adherence began in the 1950's and 60's, Vermeire et al. (2001) noted that patient adherence continues to be a poorly understood multifactorial phenomenon. Adherence to various medical therapies is only about 50% (WHO, 2003), and adherence is particularly poor long-term (McLean et al., 2010; van Dulmen et al., 2007; Vermeire et al., 2001). Consequences for the non-adherent patient include prolonged medical care and the need for repeated bouts of treatment that otherwise would be unnecessary in the adherent patient. DiMatteo (2004) estimated that the societal cost is 300 billion per year in the United States.

Within physical therapy, patient adherence usually relates to attending appointments, following advice, and/or undertaking prescribed exercise. For patients with musculoskeletal disorders, long-term physical therapy adherence often involves adherence to a home exercise program (HEP) after therapy concludes. Similar to findings for general medical adherence, researchers have found that adherence to HEPs is estimated to be between 35-72% (Alexandre et al., 2002; Forkan et al., 2006; Kolt & Evoy, 2003; Sluijs, Kok, & van der Zee, 1993).

Though physical therapists are challenged to facilitate patients' adherence to HEPs, they are in a unique position to influence the outcomes of care because they have more face-time with

patients compared to other health care providers (Dean, 2009). However, researchers do not agree upon theoretical models to guide practice in ways that enhance patient adherence. In a systematic "review of reviews" of the effectiveness of medical adherence interventions, van Dulmen et al. (2007) concluded that some interventions based on behavioral reinforcement models, such as reminders, self-monitoring, and incentives, are effective in promoting adherence, particularly in the short-term. Likewise, some educational interventions, particularly those designed to increase patients' knowledge of their conditions, can promote adherence but the effect diminishes over time.

In evaluating educational adherence interventions, van Dulmen et al. (2007) noted that, "education appears to reflect an eclectic approach" (p. 64). Such an approach makes it difficult to assess the validity of the theoretical underpinnings of the interventions. However, the authors recognized that interventions based on "cognitive models [that] emphasize patients' perceptions and beliefs" (p. 64) may play an important role in educational efforts to enhance adherence behaviors. Several other systematic reviews of adherence research have highlighted the importance of the patient's perspective on medical adherence (Jack et al., 2010; McLean et al., 2010; Vermeire et al., 2001).

Adherence Link to Mental Models

In the social sciences, a collection of an individual's beliefs and assumptions about the world around them is referred to as their *mental model* (Byrne & Johnson-Laird, 2009; Gentner & Smith, 2012; Johnson-Laird, 2006). Through experience, individuals develop mental models about all aspects of their lives (Gentner & Smith, 2012), such as family, learning, health, and exercise. At a non-conscious level, mental models represent individuals' thought processes about how the world works, including consequences of their own actions. Mental models enable

individuals to make meaning of current circumstances, form assumptions about new experiences based on similarities with prior experiences, and create mental images of the future that guide their actions (Johnson-Laird, 1994).

Because mental models are constrained by experience, some components can be erroneous, reflecting faulty assumptions (Gentner & Smith, 2012). With new experience, however, mental models can be reshaped, enabling new behaviors (Eckert & Bell, 2006; Vosniadou & Brewer, 1992). In the context of physical therapy, individuals likely bring a mental model of their condition and what it means to adhere to physical therapy based on prior experiences. This places the physical therapist in a position to provide new experiences that may effect a change in salient aspects of patients' mental models in ways that promote long-term adherence.

Investigating adherence through the lens of mental models complements work by prior researchers who stress the importance of patients' values and beliefs when addressing patient adherence (Jack et al., 2010; McLean et al., 2010). This well established construct from the social sciences (Johnson-Laird, 2010) provides a new theoretical perspective to gain additional insight as to why patients adhere or do not adhere to medical advice. The purpose of this theoretical paper is to:

1. Explain the process of mental model formation and how mental models relate to decision-making.
2. Describe relationships among mental models, prior experience, and adherence decisions in medical and physical therapy contexts.
3. Discuss issues related to mental models as they pertain to physical therapy, including the importance of articulation of patients' mental models, assessment of patients' mental

models that relate to HEP adherence, discrepancy between patient and provider mental models, and revision of patients' mental models in ways that enhance adherence.

4. Discuss practical implications of mental model assessment for the physical therapist.

Mental Model Formation and Decision Making

Mental models represent a cognitive foundation for why individuals hold certain values and beliefs, making them pivotal for everyday reasoning and decision-making (Gentner & Smith, 2012). Of interest in this theoretical perspective are relevant experiences and interactions that contribute to physical therapy patients' mental models of HEP adherence. The process of mental model formation is illustrated in Figure 1. First, an individual's unconscious comparison of past and present experiences via analogical reasoning processes results in the formation of a mental model. Analogical processes include (a) encoding sensory input representing features of a current experience, (b) mapping the encoded features to features of similar prior experiences stored in memory, and (c) forming complex mental representations (i.e., mental models) of experience, including associated knowledge, values, and beliefs in a given life domain (Gentner & Smith, 2012). Second, the individual implicitly references this mental model to make context-specific decisions. For the purposes of this paper, decisions pertain to whether or not to adhere to a physical therapy HEP.

Experience is not always an event exclusive to one individual. Shared experiences lead to *collective* or *shared mental models* (Jones, Ross, Lynam, Perez, & Leitch, 2011). Researchers have studied how mental models shared among individuals result in a common way to perceive and reason about the world in reference to cultural groups (Quinn, 2005) and organizations

(Langan-Fox, Code, & Langfield-Smith, 2000). When shared mental models are realized, members of a group better understand one another's needs and informational requirements

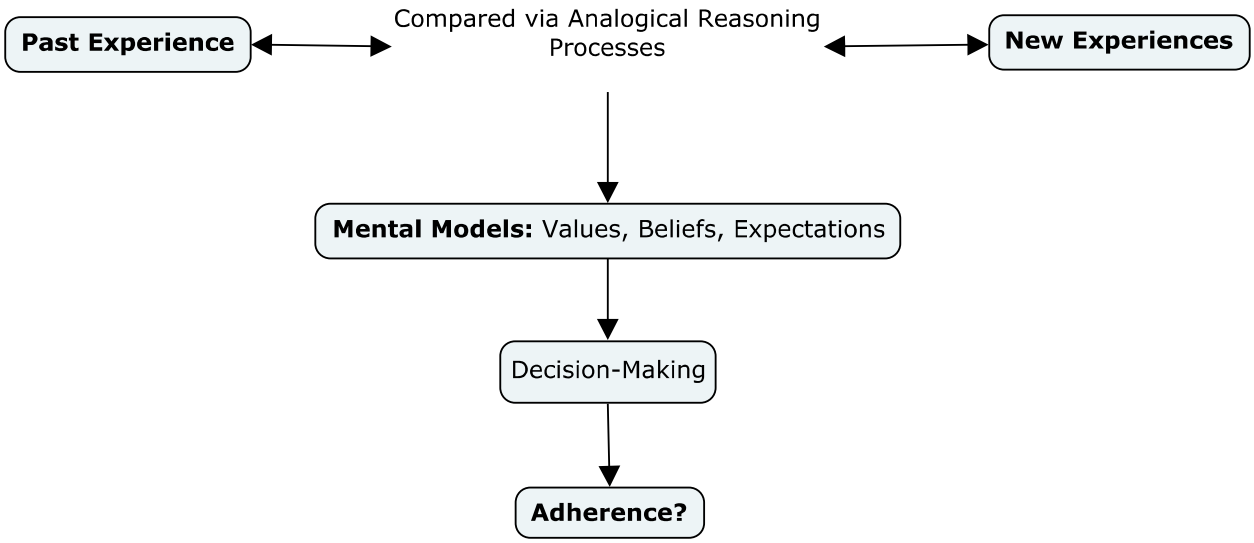

Figure 1. Mental Model Formation and Influence on Decision-Making

regarding a common task (Stout, Cannon-Bowers, Salas, & Milanovich, 1999). This has implications for mental models of adherence because individuals faced with adherence decisions may share beliefs, values, and ideas with persons close to them that influence their decisions to adhere. For example, an individual prescribed a HEP may be inspired to adhere by a family member who shares a positive experience with a HEP or is an advocate for regular exercise performance.

Research Support for Mental Models' Influence

Individuals form mental models based on interrelated prior experiences that play an important role in how they make decisions. The link between prior experiences and mental models has been demonstrated in both non-medical and medical contexts. For example, in a

study of influences on farmers' business decisions, Eckert and Bell (2005) found that farmers' tacit mental models of farming practices influenced their problem solving strategies and sometimes trumped expert advice when making farming decisions (Eckert & Bell, 2005). Bechara, Damasio, Tranel, and Damasio (1997) have highlighted the influence of mental models on decision-making between individuals with and without normal cognitive faculties. When faced with decisions in a gambling game, participants with normal cognitive functioning outperform those with cognitive impairments in memory. The authors posited that those with normal cognitive functioning performed superiorly because they were able to unconsciously reference past experiences and their mental model of similar games, while their counterparts were only capable of using present information.

Researchers in medical contexts also have demonstrated the power of mental models on decision-making. McNeil, Pauker, Sox, and Tversky (1982) asked participants to choose, in a hypothetical situation, between a conservative or an invasive medical procedure to treat cancer. The authors provided the participants with current statistical information regarding survival rates for the two treatments. Participants chose the conservative option less often (26%) when it was identified specifically as radiation, compared to when it was not identified as radiation (42%). The authors concluded that "people relied more on preexisting beliefs" (p. 1262) (a component of their mental models) rather than present day statistical information when choosing their treatment. Although there was no way to determine whether participants' beliefs were based on fact or a preconceived bias against radiation, these data exemplify the power of mental models on medical decision-making even when new, pivotal information is provided.

Mental models also influence decision-making in preventative health behaviors. In a study of 84 participants undergoing HIV testing and a test counseling session, Mattson (1999) demonstrated that following safe-sex counseling, clients decision-making related to safe-sex practices were moderated by perceptions of susceptibility of the disease ($r = .32$, $p > .05$). In other words, the participants' mental model of how likely they were to contract HIV influenced their decisions regarding use of a condom.

Finally, in a qualitative interview study exploring factors in changing health behaviors among 40-year-old males, Meillier, Lund, and Kok (1997) found that social influences and prior experiences influenced confidence, attitude, and motivation to change health practices. The authors concluded that participants seemed to rely on past experiences more heavily than "logical rational arguments" (p. 48) when considering health changes.

Application of the above findings suggests components of patients' non-conscious mental models influence their adherence decisions. However, mental model components that influence adherence can do so in positive or negative ways, promoting or degrading adherence. Powerful beliefs and assumptions that make up individuals' existing mental models can override efforts of the provider to promote adherence. Previous research demonstrates that negative beliefs and assumptions such as low self-efficacy (Medina-Mirapeix et al., 2009), perception of increased barriers (Dexter, 1992; Jack et al., 2010), and perceived increased seriousness of condition (Sluijs et al., 1993) can diminish adherence. Patients' bias for thoughts and perceptions stored in their mental models can represent a challenge for the medical provider in promoting new beliefs that positively affect adherence.

Link to Physical Therapy Adherence

Mental models influence virtually every aspect of life, guiding decision-making in both non-medical and medical contexts. Whereas some aspects of patients' mental models can diminish adherence, others can positively influence future adherence. Beliefs and expectations that foster adherence include a positive view of the exercise program and knowledge of expected results (Maziéres et al., 2008), a high level of social support (Rejeski et al., 1997; Sluijs et al., 1993), high self-efficacy for exercise (Medina-Mirapeix et al., 2009; Milne, Hall, & Forwell, 2005), and a decreased number of perceived barriers (Alexandre et al., 2002; Sluijs et al., 1993)

Although researchers have not directly investigated the role of mental models in physical therapy adherence, several studies demonstrate that prior positive experiences in physical therapy adherence foster future adherence. For example, in their study of 184 participants with neck or lower back pain, Medina-Mirapeix et al. (2009) investigated the effect of several factors on both frequency components (i.e., performing required number of exercise sessions per week) and duration components (i.e., performing required minutes per session of exercise) of a physical therapy HEP. Participants were respectively 2 and 3 times more likely to adhere to frequency components when they reported "use of a physiotherapist in previous episodes of pain" and "previous participation and adherence" (p. 159), demonstrating that previous experiences with a physical therapist and previous adherence positively influenced future frequency adherence. These factors did not relate to the duration component.

Medina-Mirapeix et al. (2009) found that frequency but not duration of exercise was affected by prior experiences may suggest that patients' experiences with a HEP informs of the importance of "day to day" program repetition but not persistence within a given exercise session. A bias for frequency adherence over duration has implications that relate to mental models. The bias demonstrates that frequency aspects of adherence may dominate participants' memories of previous physical therapy adherence, a potential reflection of the educational and

motivational efforts of the physical therapist who stresses the importance of frequency adherence over duration rather than promoting them equally.

Similar findings about the role of prior experiences on adherence to a physical therapy HEP were obtained by Rejeski et al. (1997); Schoo et al. (2005); and Alewijnse, Mesters, Metsemakers, and van den Borne (2003). In all of these studies, the authors demonstrated that previous experience adhering to physical therapy routines positively relates to adhering in subsequent episodes. Although these authors did not specifically study adherence in the context of mental models, the fact that cognitive representations of prior experience are the foundation for mental models suggests that individuals' mental models influenced the adherence behaviors of participants. Given the relationship between past experience, current experience, and mental models, the results of these adherence studies imply that patients with positive prior physical therapy adherence experiences had mental models about adherence that enabled them to make positive adherence decisions in new physical therapy episodes.

Mental Model Issues in Physical Therapy Adherence

To this point, mental models have been defined as context-specific beliefs, values, expectations, and assumptions formed from implicit reference to prior experiences that inform decision-making. In the context of physical therapy, patients' mental models of adherence to a HEP may play an important role in their adherence decisions and actions. However, not unlike the construction of mental models, a physical therapy bout typically changes and evolves over the course of several visits depending on the progression of the patient's condition, interactions with the physical therapist, and the treatments implemented. Understanding the dynamic nature of mental models and their application to physical therapy can guide clinician practice in ways that support patient adherence. Issues related to mental models in physical therapy include (a)

articulation of patients' mental models that impact adherence, (b) assessment of patients' mental models of adherence, (c) discrepancies between patient and provider mental models, (d) mental model revision, (e) comparison of the mental models approach to traditional research on patient-centered adherence influences. Each of these issues is discussed individually, followed by practical implications to guide the physical therapist who seeks to improve patient adherence. Figure 2 features a concept map highlighting these issues and educational approaches.

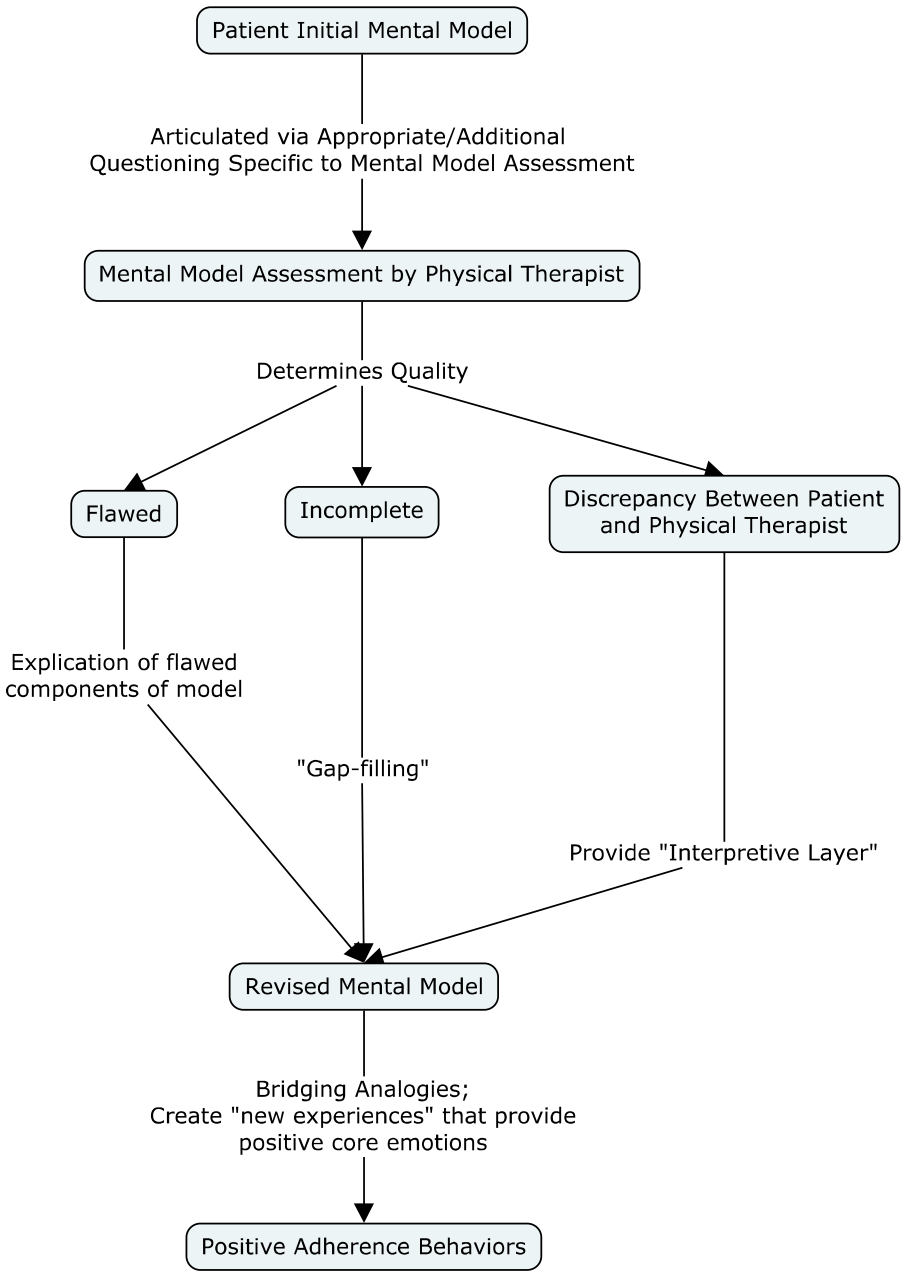

Figure 2. Mental Models of Adherence Issues and Implications in Physical Therapy

Articulating Patients' Mental Models

Physical therapists who uncover patients' mental models may be able to individualize care to promote adherence. Patients begin physical therapy with a "base" mental model of what

treatment adherence entails. Because mental models are largely tacit, patients must articulate their models in order for physical therapists to assess inaccuracies and variations from expert models (Austin & Fischhoff, 2012; Carley & Palmquist, 1992). Physical therapists can help patients to articulate their mental models with questions that reveal patients' beliefs, values, and expectations about physical therapy treatment and adherence. In fact, interview is the most common method researchers use to uncover mental models (Carley & Palmquist, 1992; Eckert & Bell, 2006; Gentner & Smith, 2012). During the initial evaluation or during subsequent visits, clinicians should encourage patients to express how their beliefs and values have guided past actions adhering to expert advice or prescribed routines. Questions such as "Can you tell me what lead you to that idea?" and "What types of things did you consider when you made that decision?" (Eckert & Bell, 2005, p. 7) can be effective in helping individuals verbalize knowledge and experiences that underlie their mental models in a particular domain. For example, the physical therapist could ask, "What lead you to the belief that massage and ultrasound treatments are most effective for your condition?" Questioning such as this may provide clues as to why a patient may reject alternative treatments (not included in the his or her mental model).

Although patients may articulate their mental models slowly over time, elicitation of mental models can occur via an "activating event" (Cranton, 2002). Activating events make individuals aware of the discrepancy between what they assume to be true and what has just been "experienced, heard, or read" (Cranton, 2002, p. 66). Physical therapists are poised to facilitate activating events that promote adherence to HEPs due to their close and frequent contact with patients. Physical therapists may provoke an activating event by being explicit about how the patients' mental model of adherence varies from expert models or ideal adherence behaviors. For

example, the physical therapist should be specific about how adherence will be defined over the treatment course, how this differs from the patient's perspective, and how outcomes might be affected by adherence.

The methods described above for articulation of mental models share some characteristics with similar approaches, such as motivational interviewing. Shared components between these two approaches include several core values as described by Scales and Miller (2003), including utilization of open ended questions, revealing patients mixed feelings about health change, and summarization of information collected from the patient by the physical therapist. However, a clinician or researcher interested in articulation of mental models is primarily concerned with *revealing prior experiences* that affect an individual's current adherence beliefs and expectations rather than motivation of patient adherence directly. Although pertinent prior experiences revealed by the patient may deal specifically with medical and physical therapy adherence, the clinician should also be interested in adherence experiences that are more general in nature. For example, an individual's decision to walk their dog every night or arrive to work early each morning may provide analogy as to why they perform home exercises on a daily basis. Articulation of factors related to mental models serves to define the individual's outlook of adherence as a general concept. Whereas motivational interviewing seeks to assess individuals' readiness for change by "first clearly [defining] the behavior in question," (Scales & Miller, 2003, p. 167), patients' articulation of their mental models serves to reveal contextually similar prior experiences (possibly unrelated to medical and physical therapy adherence) that provide clues about why the patient may adhere to any activity. Although possibly impractical for the clinical setting, medical adherence researchers may investigate the effectiveness of different methods to elicit patients' adherence mental models to discover individuals' deeply

rooted internal definitions of adherence, thus providing new perspectives to apply to medical adherence. The goal for such research is concise, practical methods for the clinician to help patients articulate components of their mental models that influence adherence.

Assessment of Mental Models

Physical therapists must make judgments about the accuracy and completeness of the mental models articulated by patients. Clinicians who assess mental models may find that patients' perceptions are not entirely consistent with scientific and medical fact, resulting in either a *flawed* or *incomplete* model (Chi, 2008). For example, some individuals' have a flawed mental model of physiological phenomenon, including the human circulatory system (Chi, 2008). When individuals possess this flawed model, they incorrectly believe that human circulation is a "single-loop" system where blood simply goes to the heart and then to the rest of the body rather than the correct "double-loop" system (Chi, 2008).

When a mental model is flawed, the individual may anticipate a successful result when they run a mental simulation of the system or event. However, the process they run is not true to the actual system. Therefore, individuals' reasoning and decision-making for future system events will be flawed because their foundational beliefs and assumptions about the system are incorrect (Chi, 2008). For example, several authors have demonstrated that adherence is particularly poor long-term (McLean et al., 2010; van Dulmen et al., 2007; Vermeire et al., 2001). Poor long-term adherence is commonly problematic because some beneficial physiological changes (such as strengthening of muscle) occur only in the long-term. Patients who adhere only to clinical visits or to a post-discharge HEP for a short duration possess a flawed mental model of adherence because it informed them to perform exercise for a duration

that was insufficient for true physiological change. In this case, the physical therapist should be specific about how adherence is defined, including the duration of adherence that will be necessary. Contradictions between the true (expert) and assumed (patient) mental model must be made explicit to appropriately address a flawed model (Chi, 2008). By assessing the accuracy of the patient's articulated mental model, the physical therapist can provide education regarding the benefits of long-term adherence including avoidance of condition recurrence or improved overall wellness.

In addition to being flawed, mental models can also be incomplete. In this case, individuals may simply need additional information to complete their model (Chi, 2008; Gentner & Smith, 2012). Physical therapists should ask patients whether they believe exercise, specifically an HEP, is an essential part of their treatment to assess its presence in their mental model. Individuals who expect exercise to be a part of a physical therapy plan of care adhere more to a HEP (Schneiders, Zusman, & Singer, 1998). Therefore, the physical therapist may be able to improve adherence through early "gap filling" (Chi, 2008, p. 67) of patients' mental models.

Discrepancy Between Patient and Provider Mental Models

When patients' adherence mental models are flawed or incomplete, their mental models are likely to differ from that of the physical therapist. Differences between patient and medical provider mental models often exist. Clinicians' mental representation of a patient problem is often based on a "disease model" (where biomedical concepts are paramount), while patients subscribe to an "illness model" (where interruptions in daily life take precedence) (Patel, Arocha & Kushniruk, 2002). Soergel, Tse and Slaughter (2004) illustrated differences between patient

and provider mental models by demonstrating that the medical representations and expressions used by consumers frequently contrast true medical terminology. For example, patients may use the ambiguous phrase "cut out" to mean "restriction" of a detrimental activity (i.e. "cut out" fatty foods) or "excision" via surgical intervention ("cut out" the appendix) (p. 932). To remedy the gap between patients' and providers' terminology, the authors suggested an "interpretative layer" (p. 933) of medical terminology and communication, one that is an intermediary between the disease and illness models. In physical therapy, this could entail asking patients to articulate their understanding of key terms that relate to their condition. This may allow the physical therapist to determine the extent to which patient's definitions match the provider's and are consistent with scientific principals and evidence-based practice.

Mental Model Revision

Patients' adherence mental models require revision when they are flawed, incorrect, or in conflict with that of the physical therapist. As established in the social sciences as well as through research in adult learning, a barrier to mental model revision is the tendency for individuals to be resistant to information that disconfirms or contradicts their current mental model (Eckert & Bell, 2006; Gentner & Smith, 2012; Markham & Gentner, 2001). When new information is in conflict with a patient's existing mental model, the clinician may have more success in promoting change in the model by presenting new information in a gradual progression (Gentner & Smith, 2012). Also referred to as "bridging analogies," this approach employs a gradual and progressive change of the learner's original perceptions of the system

(Clement, 1991). For example, for patients who do not include a HEP as part of their adherence mental model (incomplete model) physical therapists should give initially just a few, easily managed HEP activities. With success in performing these new activities, patients gain a new, positive experience that includes a HEP, increasing the chances of adoption of the HEP into their mental model of adherence.

Purposeful use of "new experiences," specifically experiences that invoke positive core emotions such as surprise and joy (Jensen, 2008), can be particularly effective in triggering learning that effects changes in mental models (Phelps, 2006). When core emotions accompany a new experience, details of the experience are more likely to become "hard wired" in long-term memory (Garrett, 2008; Phelps, 2006). Physical therapists can seek to revise a patient's flawed or incomplete mental model through use of memorable experiences. Such experiences may include creative and interactive methods of education. For example, physical therapists can show post-surgical patients an animation of the surgical technique they underwent to help them understand precautions or recovery; or, physical therapists can take before and after videos of a patient's gait to demonstrate effectiveness of interventions and overall improvement. Use of these techniques to improve adherence infers that patients who better understand pertinent pathology or realize improvements in their condition may be more inclined to adhere to recommendations. On the other hand, physical therapists who fail to create positive experiences may degrade patient adherence. Examples of negative experiences put forth by the provider include failure to give positive feedback (Sluijs et al., 1993) or clarify doubts (Medina-Mirapeix et al., 2009). Although improvement of adherence is a multifactorial phenomenon, physical therapists should realize that their educational and motivational strategies could be pivotal in either promoting or inhibiting patient adherence.

Mental Models vs. Traditional Approach to Adherence Study

A key difference of the mental models approach to adherence study from other theoretical frameworks regards the method in which the influences of adherence are defined. A large body of research, either in whole or in part, has investigated whether patients' beliefs and perspectives affect actual adherence behavior. For example, previous authors demonstrated that low exercise self-efficacy (Stenstrom, Arge, & Sundbom, 1997), perceived feelings of helplessness (Castañeda, Bigatti, & Cronan, 1998), low sense of personal control (Laubach, Brewer, Van Raalte, & Petitpas, 1996), and depression (Oliver & Cronan, 2002) diminish adherence. Investigation of adherence through the lens of mental models "takes a step back" from this approach by attempting to reveal what experiences led to these beliefs and expectations in the first place. For example, if a patient's self-efficacy for exercise is low (which may lead to decreased adherence), from what experiences does this come? If the clinician is aware of the origins, he or she may be able to intervene by dispelling beliefs that originated from the experiences in an attempt to increase self-efficacy moving forward. Low self-efficacy for HEP adherence may stem from a previous experience in physical therapy where the HEP called for purchase of equipment and/or an excessive number of exercises were required to be performed daily. Knowing this, the physical therapist could immediately dispel the patient's belief that the HEP will require significant monetary and time resources once again. This may be a first step in revising the patient's mental model, possibly improving adherence. Future research will need to identify the most effective ways to uncover these prior experiences.

The recommendations for practice in this section are based on a synthesis of research in the social sciences, general medical adherence, and physical therapy adherence. Although

combining these complementary research bases creates a plausible theoretical perspective, research is needed to better understand the links between mental models, prior experiences, and physical therapy adherence behavior. Future research using this perspective should define mental models of adherence via qualitative or other means designed to capture patients' prior experiences and perspectives of adherence. Researchers may subsequently use these data to develop methods to assess and ultimately improve adherence behavior, thus offsetting the individual, financial, and societal costs of non-adherence.

Conclusion

This professional theoretical paper provides a perspective of patient adherence through the lens of mental models. A new theoretical framework for adherence study is sorely needed to remedy the "eclectic" approaches used to date to address the challenge of non-adherence. Research from the social sciences and medical fields indicates that through experience, individuals develop mental models that guide decision-making and action. Prior experiences and mental models of patients entering physical therapy could have a strong influence on adherence to a HEP. To date, empirical studies of adherence in physical therapy have not addressed the influence of mental models on HEP adherence behavior. However, a few studies investigating influences on HEP adherence have established links between the building blocks of mental models—previous experiences—and future adherence behavior. Although continued research is vital to refining the theoretical framework and clinical applications described in this paper, the role of mental models on adherence behavior provides a new and exciting approach to adherence study.

CHAPTER III

The Role of Physical Therapy Patients' Mental Models on Adherence to Home Exercise Programs:

A Qualitative Study

Introduction

Adherence refers to both the adoption and maintenance of a specific behavior. For individuals with health issues, adherence to self-care recommendations from medical professionals can promote healing and return to normal function, whereas non-adherence can lead to progressive health decline, lost work time, and a rise in health care costs (Falvo, 2011). In the United States, the costs of non-adherence to medical regimens are estimated to be 300 billion per year (DiMatteo, 2004).

Within a physical therapy context, adherence commonly relates to patients attending appointments, following advice, or undertaking prescribed exercise. For patients with musculoskeletal disorders, long-term physical therapy adherence often involves adherence to a home exercise program (HEP) during and after formal therapy. Similar to findings for general medical adherence, researchers have found that long-term adherence to physical therapy interventions is poor (Dean, 2009), with HEP adherence ranging from 35-72% (Alexandre et al., 2002; Forkan et al., 2006; Kolt & McEvoy, 2003; Sluijs et al., 1993)

Although the systematic study of medical adherence began in the 1950's and 60's, Vermeire et al. (2001) noted that adherence continues to be a poorly understood and multifactorial phenomenon. Physical therapists are in a unique position to positively impact

adherence because they have greater one-on-one contact with patients compared to other health care providers (Dean, 2009). However, experts have yet to agree upon a theoretical model to guide practice in ways that enhance patient adherence. In a systematic "review of reviews" of the effectiveness of medical adherence interventions, van Dulmen et al. (2007), concluded that some interventions based on behavioral reinforcement models, such as reminders, self-monitoring, and incentives are effective in promoting adherence, but only in the short-term. Likewise, some educational interventions, particularly those designed to increase patient knowledge of his or her condition, can promote adherence, but again the positive effect diminishes over time.

In assessing educational adherence interventions, van Dulmen et al. (2007) noted that, "education appears to reflect an eclectic approach" (p. 64), making assessment of the validity of the theoretical underpinnings of the interventions difficult. Nonetheless, the authors recognized that interventions based on "cognitive models [that] emphasize patients' perceptions and beliefs" (van Dulmen et al., 2007, p. 64) may play an important role in educational efforts to enhance adherence behaviors. In several other systematic reviews of adherence research, researchers have found that patients' perspectives (including attitudes, beliefs, values, and perceived barriers) are important to the study of adherence (Jack et al., 2010; McLean et al., 2010; Vermeire et al., 2001).

In the social sciences, the collection of individuals' beliefs, values, and expectations about a particular aspect of their life is referred to as the their *mental model* (Byrne & Johnson-Laird, 2009; Gentner & Smith, 2012; Johnson-Laird, 2006). In the plural form, the term mental models is virtually synonymous with "cognitive models" used by van Dulmen et al. (2007). Through experience, individuals develop mental models about all aspects of their lives (Gentner & Smith, 2012), such as family, learning, health, and exercise. At a non-conscious level, mental

models represent an individual's thoughts about how the world works, including expected consequences of their own actions.

Mental models enable individuals to make meaning of current circumstances, form assumptions about new experiences, and create mental images of the future that guide their actions (Johnson-Laird, 1994). Research on analogical reasoning (Gentner & Smith, 2012), indicates that adults make meaning of current experiences by tacitly comparing and contrasting salient features of new experiences to features of past experiences. Analogical reasoning results in the formation of mental models by virtue of an accumulation of beliefs, values, and expectations based on previous experiences.

The purpose of this study was to identify aspects of patients' mental models that relate to physical therapy HEP adherence. A better understanding of mental models related to adherence may guide clinicians in designing interventions that more effectively promote HEP adherence, thereby improving patient outcomes.

Mental Model Influences on Patient Decision-Making

Prior research has demonstrated the role of past experiences and mental models on patient decisions and health behaviors. For example, in their qualitative study of factors related to changing health behaviors among a sample of 40-year-old males ($N = 21$), Meillier et al. (1997) found that prior experiences influenced confidence, attitude, and motivation to change health practices. Participants' existing mental models of health behavior (formed from prior experiences) trumped "logical rational arguments" (p. 48) when considering health changes. Social influences also contributed to participants' health behavior change, indicating that individuals' interactions with others can result in shared ways of perceiving and reasoning about health decisions. Other researchers have established the influence of mental models for both

preventative measures (Calnan & Moss, 1984) and treatment options (McNeil et al., 1982) for cancer by demonstrating how past experience and preconceived beliefs influence patients' decisions regarding the disease.

Mental Model Influences on Physical Therapy Home Exercise Programs

Prior experiences play a vital role in patients' decisions about medical care. Researchers in physical therapy have found that the building blocks of mental models—prior experiences—influence HEP adherence behavior.

Medina-Mirapeix et al (2009) demonstrated the relationship between previous adherence behaviors and future adherence. The authors investigated the effect of several factors on both frequency components (i.e., performing required number of exercise sessions per week) and duration components (i.e., performing required minutes per session of exercise) of a physical therapy HEP. Results revealed that individuals were respectively two and three times more likely to adhere to frequency components when they reported "use of a physiotherapist in previous episodes of pain" (p. 159) and "previous participation and adherence" (p. 159) to home exercise. Therefore, previous experiences with a physical therapist and previous adherence positively influenced frequency adherence. These factors did not affect the duration component. The fact that frequency but not duration of exercise was affected by previous experiences may suggest that patients prior experiences with a HEP is biased toward daily program repetition rather than persistence within a given exercise session.

Rejeski et al. (1997) also successfully demonstrated the influence of prior experience on a HEP. They assigned patients with knee osteoarthritis ($N = 439$) to aerobic training, resistance training, or a health education (control) group. The participants in the aerobic and resistance training groups underwent 3 months of clinical exercise, followed by 15 months of home

exercise. Adherence was measured at 3, 9, and 16 months. Associations between adherence and a number of predictive factors (e.g., age, sex, body mass index, depression, social support, knee pain intensity, among others) were generally weak. However, adherence in the previous time interval was significantly associated with attendance and time spent exercising for both groups at all time intervals with correlations ranging from .36 to .70 ($p < 0.05$). Similarly, in a study of 115 participants with osteoarthritis, Schoo et al. (2005) showed that adherence to weeks 1-4 of a HEP was the strongest predictor of adherence in weeks 5-8 ($OR = 19.86$; 95% $CI = 4.84$-81.56).

In sum, research outcomes by Medina-Mirapeix et al. (2009), Rejeski et al., (1997) and Schoo et al. (2005) demonstrate previous experience adhering to physical therapy routines positively relates to adhering in subsequent episodes. Although these authors did not study adherence with specific regards to mental models, the fact that past experiences are the foundation for mental models suggests that patients' mental models influenced their adherence behaviors. The results of these adherence studies may suggest that patients with positive prior physical therapy adherence experiences possessed beliefs and expectations about physical therapy that contributed to their mental models and enabled them to make positive adherence decisions in new physical therapy episodes. Examples of beliefs and expectations that foster adherence are those already established in adherence research such as a positive view of the exercise program and knowledge of expected results (Mazières et al., 2008) a high level of social support (Rejeski et al., 1997; Sluijs, et al., 1993) high self-efficacy for exercise Medina-Mirapeix et al., 2009; Milne et al., 2005), and a decreased number of perceived barriers (Alexandre et al., 2002; Sluijs et al., 1993).

Methods

Design

The overarching research question addressed by this study was: *What aspects of individuals' mental models relate to adherence to physical therapy home exercise programs?* In an effort to more robustly identify aspects of individuals' mental models that relate to HEP adherence, individuals were asked to describe experiences and perceptions regarding adherence to a physical therapy regimen as well as to regimens outside of physical therapy (non-HEP regimens). Consistent with the conceptual framework, this approach was taken because through analogical reasoning processes, individuals' prior adherence experiences to regimens outside physical therapy may shed light on why they adhere or not to a HEP. From a methodological perspective, adherence themes that were consistent across HEP experiences and non-HEP experiences allowed for better triangulation of qualitative data and provided a more encompassing look at aspects of mental models concerning adherence. The study employed a basic interpretive qualitative design with interviews, which allowed participants to voice their experiences related to adherence and the meanings they attributed to those experiences (Merriam, 2009).

Procedure

The setting for the study was an outpatient physical therapy clinic associated with a large research university in the Northeast that served patients with both orthopedic and neurological conditions. The researcher used purposeful sampling strategies to recruit patients who were referred for an orthopedic condition for whom a HEP would be indicated. Patients with neurological diagnoses were excluded from the study. Following IRB approval of the study, clinic front-office staff introduced the study to potential participants when they made their initial

physical therapy appointment by phone, informing individuals that participation involved two 60-minute interviews, and that a 20-dollar Amazon.com gift card would be awarded following completion of both interviews.

While 20 individuals indicated interest in participating during the recruitment period of October 2012 to January 2013, the first 10 who scheduled a meeting for the initial interview were enrolled in the study. Participants included seven women and three men. Mean age was 50.3 years (*range* = 20-80, *SD* = 18.7). Table 1 provides a summary of participant demographics and non-HEP regimens addressed in Interview One. Although the researcher was also a physical therapist at the clinic, he was not involved in the physical therapy treatment of any of the participants.

Data collection involved two face-to-face interviews with each participant conducted by the researcher in a private room of the clinic. Interviews were audio-recorded (iPhone Five, Apple, Cupertino, CA) and later transcribed by the researcher. Interview One, which took place prior to a participant's first physical therapy session, focused on prior experiences in which the individual engaged in some form of adherence to a self-selected behavioral regimen via repeated attention and change in lifestyle. The Table includes a description of non-HEP regimens each participant focused on during Interview One. The overarching question in Interview One was, "*Are you involved in anything right now that reflects a relatively new change to your daily routine?*" The goal of the interview was to describe participants' experiences adhering to non-physical therapy HEP activities and underlying beliefs and expectations that facilitated or impeded their adherence to the activities. Interview Two occurred after at least five physical therapy sessions and focused on participants' current experiences adhering to their physical therapy HEP. Questions addressed factors leading to success or failure in being adherent,

analogy to similar experiences, expectations of future adherence, and importance of HEP adherence versus other routines and responsibilities. The researcher used a constant comparative method (Merriam, 2009) to analyze interview data and identify aspects of participants' mental models that related to their adherence.

Table 1

Participant Demographics and Non-HEP Regimens from Interview One

Pseudonym	Age (years)	Gender	Non-HEP regimens addressed in Interview One
Ann	80	F	Gluten-free diet, prison literacy volunteer, meditation
Beatrice	50	F	Running, teaching English as second language, asthma medication
Cecile	55	F	Losing weight, relinquish household chores to husband, walking for exercise
Deidra	68	F	Volunteer at hospital coffee shop, women's group, dieting
Erin	21	F	Yoga, singing group, meeting for coffee weekly with friend, watching favorite TV show
Frank	50	M	Coaching hockey, yoga, taking dietary supplements
Georgia	57	F	Exercise at gym, going to church, teaching religious education classes
Henrietta	44	F	Dieting, walking dogs, performing morning tasks (ironing, etc.) at night to save time
Ivan	58	M	Participating in car pool, exercising during lunch hour at work, taking daily baby aspirin
Jonah	20	M	Jogging, nightly studying at library rather than dorm room, playing guitar

Data Analysis

The researchers carried out data analysis according to (Hycner, 1985). Hycner outlined a systematic and repeatable method of analysis specific to phenomenological research. Although a basic interpretive qualitative approach was used for this research, use of Hycner's approach was appropriate because the goal of the present research was to understand individuals' perceptions

of their experiences. Among the steps in the analysis process described by Hycner are "bracketing" (p.280) predispositions of the researcher, coding "units of general meaning" (p.282) (literal words of participant that express unique meaning), coding "units of relevant meaning" (p. 284) (words of the participant that are relevant to the research question), "clustering" (p. 287) units of relevant meaning, and finally determining themes.

The goal of the analysis for the present study was identification of themes specific to Interview One and Two as well as themes common across interviews. Table 2 displays an example of the data analysis progression. The researcher began identification of Units of General Meaning in Microsoft Word 2011 for Mac (Version 14.4.1, Microsoft, Redmond, WA) by underlining possible Units on interview transcripts. Units of General Meaning that were progressed to Units of Relative Meaning were transferred to an Excel spreadsheet (Microsoft Excel 2011, Version 14.4.1, Microsoft, Redmond, WA) that the primary author divided into individual Sheets representing each Interview for each of the participants. Because the focus of the study was to identify components of mental models that related to adherence, the Sheets were further divided into three more Sheets, representing Units of Relevant Meaning that could be considered "prior experiences," "beliefs and values," and "expectations and assumptions." The authors made this delineation due to prior experiences' key role in forming mental models and because mental models are comprised of individuals' beliefs, values, expectations, and assumptions (Byrne & Johnson-Laird, 2009; Gentner & Smith, 2012; Johnson-Laird, 2006). All Units of Relevant Meaning were copied to a second Excel spreadsheet where the authors delineated Clusters of Meaning and Centralized Themes.

When data analysis reveals no new information, data saturation has been reached (Merriam, 2002). For Interview One, data saturation became apparent after the ninth participant. One additional interview was conducted to ensure saturation. Because the

Table 2

Progression of Qualitative Data Analysis

Transcript Excerpts with Identification of Units of General Meaning (Underlined)	**Units of Relative Meaning**	**Clusters of Meaning Derived**	**Central Theme**
Yeah, ah, I don't…I don't think it's really changed too much. And I think that's been the key. And that's why I said I been…I feel I've been relatively successful with it. Um, I feel like it' just been a small addition to some of the things I'm trying to do anyway	1. Did not change (schedule) too much which has been key. 2. Small addition to some of the things I'm trying to do.	1. Time effectiveness 2. Lack of equipment needed 3. Lack of special or physical space needed 4. Low number of exercises	Convenience
Um, a lot of them was able to work into things I'm doing normally like…I'm going up and down the stairs a lot so I had a couple of things I could do right in the stairway…As I was going down the stairs, I could stop and do…ten…	1. Able to work into things I'm normally doing		
Um, just because it is, just uh, you know, a few exercises and can be done quick and I can do them anywhere so it's…it's pretty easy, ah, not very time consuming to get it done.	1. A few exercises that are done quickly 2. I can do them anywhere 3. Not very time consuming		

purpose of Interview Two was to triangulate Interview One data but with the focus changed to HEP regimens, 10 more interviews were performed on each participant regardless of saturation.

To ensure rigor in the analysis process, an outside individual (also a physical therapist and researcher with experience in qualitative data analysis) performed an independent analysis of excerpts from three participant's interviews. These did not contain the authors' coding. A comparison of codes and themes revealed that although the exact wording differed between the authors and outside reviewer, the codes and themes closely aligned. Additional methods of establishing reliability of data included an audit trail to establish "transparency of method" (Merriam, 2002, p.21) and a reflective journal to capture ideas and questions as data analysis evolved (Merriam, 2002).

Findings

Data analysis resulted in several findings that shed light on aspects of individuals' mental models that relate to adherence to non-HEP regimens (Interview One) and physical therapy HEP regimens (Interview Two). Four themes were common to both Interview One and Two: *realized results*, *anticipated results*, *social cause*, and *value of convenience*. Whereas prior research has confirmed that prior experience is the basis for mental models and that mental models guide actions in all aspects of life, including health-related aspects, themes from this study describe the specific types of prior experiences that contribute to mental models and relate to HEP adherence. Findings are summarized in Figure 3.

Realized Results

Regardless of whether it was in the context of a HEP or some other experience in their lives, individuals' weighed heavily the immediate *realized results* of any regimen they decided to perform. As an aspect of mental models, realized results represent individuals' perceptions of outcomes that directly result from performing a regimen. Individuals reported improved adherence when results were obvious and profound in "real time." For non-HEP regimens,

realized results meaningful to participants included enhanced physical or emotional health, amount of daily "free time," work performance, and recreational exercise or sport performance.

One participant, Cecile, discussed how she had initially struggled to remain adherent to relinquishing some household chores to her husband when he retired but eventually overcame this because of the realized result of increased free time:

> I think just enjoying the free time that it does give me. I mean…you go off…I mean you're talking 3-4 hours sometimes by the time you leave the house, go grocery shopping, come back, put it away. All of that…that's a big chunk where I could be doing other things.

Concerning physical therapy HEPs, individuals stated that the importance of adherence were apparent when they experienced improvement in their symptoms or when the physical therapist provided feedback in the form of improved physical measurements.

One participant, Georgia, provided an example of how physical measurement improvement can positively influence adherence:

> Um and, most of the time I was. If…if, [my therapist] actually did a measurement of my range of motion of my knee, usually I had improved a little bit. That's, you know, gives you a lot of incentive to work harder when you know that you're going to get better.

In contrast to being informed of improvements by the physical therapist, realized results also came in the form of patients simply feeling better. Henrietta reported that because of realized improvement in her condition, she could more easily understand why continued performance of the exercises was necessary:

> …so actually the stuff that she explained to me did seem to make sense and it did um, and it's…it's working…better than the, you know, better than the stuff my doctor gave

me…the one sheet my doctor gave me. So, um, so, yeah, it does make sense why I need to do the exercises that she gave me.

Anticipated Results

In addition to experiencing *realized* results, *anticipated results* of non-HEP and HEP regimens influenced individuals' adherence. Expectations for the future are a key aspect of mental models. Participants seemed to perform cognitive calculations of the potential positives and negatives of the regimens they performed based on their current status and physical abilities. Regarding HEP adherence, participants frequently modified their calculations based on education of the physical therapist regarding prognosis. When participants' calculations resulted in a positive outcome for health, learning, work performance, or personal day-to-day activities their adherence was enhanced.

In Interview One, Jonah provided an example of how cognitive calculations of outcomes can promote adherence to non-HEP regimens. Jonah spoke about how nightly studying at the library rather than returning to his dorm improved his efficiency with his schoolwork. He believed improved study habits would result in better future outcomes: "I mean it was clear. I could see the…the difference in my work ethic. Where…where I was. So, I knew I'd get better results."

Interview Two provided several examples of anticipated results enhancing present adherence. Patients' cognitive calculations were enhanced as a consequence of education from the physical therapist regarding long-term benefits. Frank provided an example of this:

I think to the experience that I have had here with physical therapy is that "Yep, you're doing it, you're doing it right," you know? "Keep doing it and you'll see results. Believe in it. Believe in it, so…It's not Santa Clause, but it's physical therapy."

Whereas anticipation of positive outcome resulting from a HEP regimen promoted adherence, uncertainty of anticipated benefits diminished adherence. This occurred when the original cause that prompted the regimen was resolved or the reason to perform activity was not obvious to the patient. For example, Beatrice explained that she found it difficult to adhere to a HEP because the therapist failed to give a rationale for the activity and therefore made it difficult for her to project a future benefit:

> There was one exercise where she had me doing toe crunches like this [gestures with foot] with a towel and it hurt. Or it bugged me or it ached or…and I was like "What does this have to do with my Achilles tendon?" and I started not doing it as much.

Social Cause

As discussed earlier, social relationships influence individuals' mental models. In both interviews, participants reported instances where valued others were the motivating force, or cause, for their adherence. When *social cause* had a positive effect on adherence, participants were inspired to adhere because individuals they valued—family members, friends, or someone considered an expert as it pertains to the regimen—endorsed the specific regimen, engaged in the regimen themselves, or shared similar experiences that lead to the regimen. Some individuals perceived that others viewed them more favorably when they performed the regimen or that performing the regimen improved their relationship with others. Many of the non-HEP regimens influenced by social interaction involved independent exercise regimens, but other examples included community service, work responsibilities, and other health-related activities (meditation, weight loss).

Beatrice demonstrated the importance of social influences for non-HEP regimen adherence when she discussed her husband's love of running and interest in her own running

regimen: “And my husband runs. He’s always really thrilled when I run…wants to hear all about it.”

In some circumstances, the influence of social relationships had a negative effect on adherence to non-HEP activities, as demonstrated when Georgia discussed how her adherence to performance of daily walks was diminished by her husband’s poor motivation and physical ailments:

> Well, my plan was to be walking with my husband on a regular basis but some days he would say, “Well, I don’t really feel like going” or “My knee is hurting, my hip is hurting” or some other thing. “I need to do some other work” or…and I found that it was very easy for me to say, “Ok, I’m not going to go either.”

In Interview Two, social cause for performing a HEP originated not only from participants’ family and friends, but also from interactions with their physical therapist.

Henrietta gave an example of social influence that came from her husband. She reported that his feedback regarding her walking would motivate her to perform her HEP: “[He would say], ‘Oh yeah, it looks like you’re not limping around so you should keep up on that.’”

The physical therapist also provided social cause for HEP adherence. Ivan discussed how consistent monitoring of adherence by the physical therapist kept him on task: “Well, that’s…I mean just having the therapist expect you to do it that’s why I do the therapy. [laughs] As opposed to reading a book, you know?”

Value of Convenience

A final theme consistent in the data across both interviews was the *value of convenience*. Values are a recognized component of mental models (Gentner & Smith, 2012; Johnson-Laird, 2006; Johnson-Laird, 1994). This theme indicates that individuals highly value convenience

when it comes to adhering to a regimen. In general, individuals' adherence to non-HEP and HEP activities was enhanced when the activities did not require an excessive amount of time, equipment, or physical space. Participants provided several examples of convenience promoting adherence to non-HEP activities such as independent exercise (running, walking, yoga), dietary changes, taking medications, walking their dog, and going to church.

Similarly, the value of convenience was apparent in adherence to HEP regimens. In Interview Two, Beatrice discussed how she appreciated the fact that the exercises her therapist asked her to perform only added a small amount of time to her running routine:

> So that just really made it easy to implement, as, if I just have to do the basic stretches to run…fine. That just slightly lengthens my running time anyway, so it's easy to put in there. I don't have to invent a whole new time slot, you know?

Georgia also commented on how her HEP could be integrated into her normal daily activities, highlighting the value of convenience:

> I didn't have to set out a special time and spend 45 minutes doing them. I could do some on my way down the stairs. I could do one…I'd sit down to eat dinner, and I could get up and down out of my chair a few times, you know, while I was there…at dinner time.

In summary, the themes of *realized results, anticipated results, social cause,* and *value of convenience* were identified as aspects of individuals' mental models related to adherence to physical therapy HEPs. These themes were also present in the data for adherence to non-HEP regimens. The findings illustrate the importance of experiences individuals perceive as being an immediate and direct result of their adherence behaviors as well as expectations they have for the future because of their adherence. Perceptions of how others impact adherence highlight the strong role of social relationships in mental models related to adherence. Finally, individuals

value convenience (less time, equipment, space required) when it comes to both HEP and non-HEP regimens.

Summary of Findings

As depicted in the Model of Adherence Influences in Physical Therapy (Figure 3), four aspects of individuals' mental models (*realized results, anticipated results, social cause,* and *value of convenience*) related to their physical therapy HEP adherence. Specific types of prior experiences contributed to each aspect. These themes were present also in the data for adherence to non-HEP regimens. The findings illustrate the importance of experiences individuals perceive as being an immediate and direct result of their adherence behaviors as well as expectations they have for the future because of their adherence. Perceptions of how others impact adherence highlight the strong role of social relationships in mental models related to adherence. Finally, individuals value convenience (less time, equipment, space required) when it comes to both HEP and non-HEP regimens.

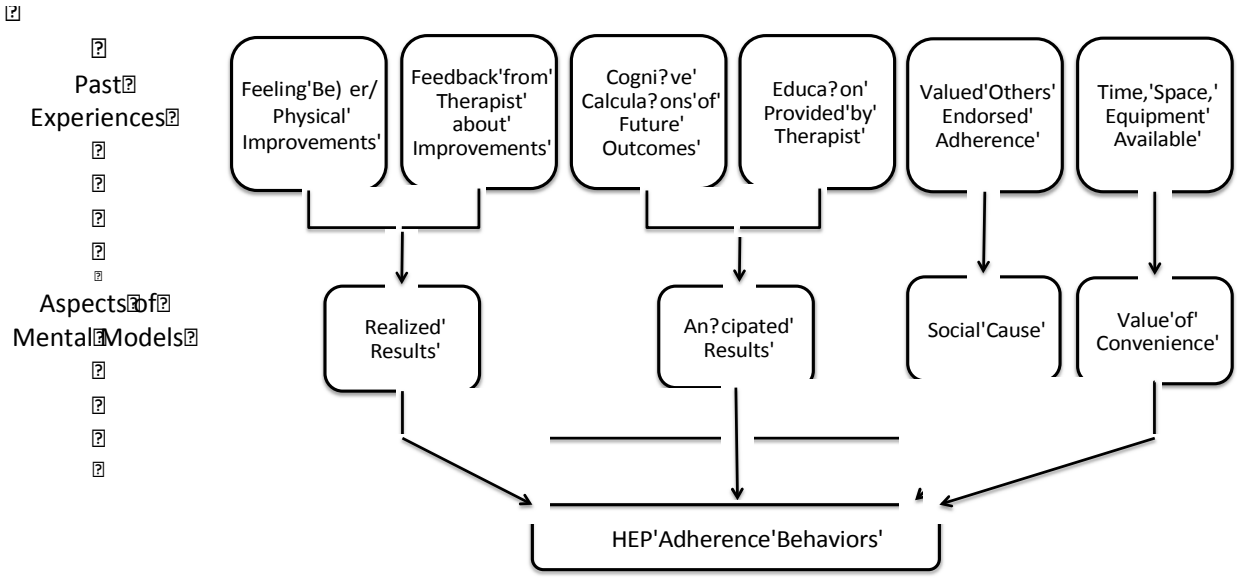

Figure 3. Model of Adherence Influences in Physical Therapy

Discussion

Physical therapists have a unique opportunity to provide information and support to patients who may be teetering between adherence and non-adherence. This study has direct implications for physical therapists and other health care providers who seek to understand factors that relate specifically to HEP adherence. A better understanding of these factors will enable providers to intervene in ways that promote patient adherence and ultimately improve patient health.

The study has several strengths in its approach to investigating adherence. A conceptual framework that can guide adherence research and practice is badly needed (van Dulmen et al., 2007). Using research in the social sciences indicating that prior experiences are the building blocks of mental models (Gentner & Smith, 2012) and that mental models affect decision-making and behavior (Bechara, Damasio, Tranel, & Demasio, 1997; Eckert & Bell, 2005; Johnson-Laird, 1994), this study extends these relationships to HEP adherence. Mental models are an accumulation of individuals' perspectives—their beliefs, values, and expectations—about a given phenomenon, and individuals implicitly construct mental models from prior experience. (Gentner & Smith, 2012). Findings from this study strongly align with this conceptualization of mental models indicating that participants' *beliefs* about current results (realized results), *expectations* of future results (anticipated results), and *values* regarding social relationships (social cause) and convenience (value of convenience) presented as components of mental models that influenced adherence.

The consistency in themes across HEP and non-HEP regimens is also consistent with prior research about the role of analogical reasoning in mental model development (Gentner & Smith, 2012; Johnson-Laird, 2006; Johnson-Laird, 1994). Through implicitly comparing and

contrasting adherence experiences, individuals may develop perceptions about adherence that they apply across a variety of life domains. Subsequently, adherence behaviors in one life domain may influence adherence behaviors in other domains. Interviewing participants twice, first about non-HEP adherence experiences and then about HEP experiences, enabled discovery of these interconnections. To the authors' knowledge, this method has not been used in medical adherence research to date.

Other researchers have demonstrated results similar to those of the current research. Social support has been long established as a factor in adherence Oliver & Cronan, 2002; Rejeski et al., 1997; Sluijs et al., 1993). Several of the conclusions drawn here align closely with findings from a recent quantitative study of exercise adherence in patients with osteoarthritis (Mazières et al., 2008), which demonstrated the importance of favorable social conditions (*social cause*), material conditions (*value of convenience*), explanation of expected results by the clinician (*anticipated results*), and a self-evaluation diary kept by the patient (*realized results*) in promoting adherence. In addition, a qualitative study investigating exercise adherence in patients with osteoarthritis found that one of the key factors facilitating adherence was perception of the exercises being effective in relieving symptoms (Campbell et al., 2001). This result highlights again the importance of being explicit with the patient and giving timely information about current (*realized*) results and future (*anticipated*) results.

A key difference in the current study compared to virtually all other adherence research pertains to the method in which the influences of adherence were framed. A large body of research, either in whole or in part, has investigated whether patients' perspectives of physical therapy, exercise, and adherence itself, affects actual adherence behavior. Types of patient perspectives investigated by previous researchers include self-efficacy to perform exercise

(Medina-Mirapeix et al., 2009), barriers to adherence (Dexter, 1992; Jack et al., 2010), and severity of condition (Sluijs et al., 1993) among others. The current study adds to this body of research by "taking a step back" from patients' perspectives by examining the nature of the experiences on which their perspectives are based. For example, if patients' self-efficacy for exercise is low (which may lead to decreased adherence), what experiences contributed to the low self-efficacy? Low self-efficacy for HEP adherence may stem from a previous experience in physical therapy where conditions were not convenient for adherence, entailing complex exercise movements and gym membership for equipment needs. Knowing this, the physical therapist could immediately dispel the patient's belief that the new HEP will have the same requirements, and design an HEP the patient perceives as convenient. By enabling the patient to experience success early on, the physical therapist can support a change in the patient's mental model and increase self-efficacy.

Limitations of the study exist. First, generalizability of the study is limited secondary to implementation of qualitative methods with a small sample. However, the qualitative approach provided the level of depth in data collection and analysis needed as a first step in exploring the role that mental models play in HEP adherence. Second, in terms of data collection, an incongruity existed between the types of regimens participants were asked to address in Interview One and Interview Two. In Interview One, participants received no direction regarding whether the regimen was self-imposed (e.g., independently deciding to lose weight) or imposed by another (e.g., directed to lose weight by their physician). In Interview Two, participants were directed to focus specifically on the HEP prescribed by their physical therapist. The possibility exists that findings may have differed if participants were asked in Interview One to focus only on experiences in which they tried to adhere to regimens imposed by others. Few authors have

explored how adherence differs when specific exercise parameters (i.e., intensity) are self-selected versus imposed (Williams, 2008), therefore, predicting how our results may have differed is difficult. Given that individuals' adherence behaviors appear to be influenced by relationships with others whom they value, even stronger alignment between aspects of mental models related to HEP and non-HEP adherence may exist when adherence pertains only to regimens imposed by others. However, variability in the circumstances of imposed regimens may influence analogical processes and the extent to which individuals develop similar perceptions about adherence that they apply across a variety of life domains.

Results of the current study have several implications for physical therapists who seek to improve patient adherence to HEPs. The congruency in themes about adherence to HEP and non-HEP regimens suggests that physical therapists may want to inquire about patients' non-medical adherence experiences, as these may relate to mental models that impact their adherence to medical therapies. The level of success adhering to other regimens may provide insights into the potential for success in HEP adherence. It also may reveal strategies the patient customarily uses to adhere to other activities that could be applied to promote HEP adherence. Because physical therapists must be efficient in their patient encounters, future research should identify how to inquire about non-medical adherence experiences in a time-effective manner (i.e. brief set of questions or short survey).

Based on the findings, physical therapists can consider four factors in supporting patient adherence. Representing the first two factors, therapists can help patients appreciate "real-time," physical improvements made during the program, as well as future improvements patients can anticipate if adherence is maintained. Physical therapists can use several methods to show immediate results (e.g., sharing physical measurement results, or showing before and after videos

of physical abilities), and continually educate about how interventions lead to future physical change. Related to the third factor of social cause, physical therapists need to show support for all patients, whether successful or not with adherence. Physical therapists can also help establish support from loved ones, inviting them attend appointments and become familiar with technical aspects of treatment and projected goals. Further, physical therapist can educate loved ones regarding the physical signs of improvement so they can offer feedback and encouragement to the patient. Lastly, physical therapists can inquire how an exercise program could be made more convenient for patients, particularly in terms of equipment and space.

This study represents a novel approach to examining adherence and additional study is needed to refine understanding of the role mental models play in adherence behavior. Future researchers can employ quantitative methods to identify the extent to which the themes in this study relate to actual adherence behavior. For example, researchers could assess correlations between patients' self-report measures of HEP adherence and aspects of mental models such as perceived level of *convenience* of the HEP and level of *social cause* in performing the HEP. Future studies that identify aspects of individuals' mental models that most strongly relate to adherence behaviors can guide the design of interventions to improve adherence. For example, the aspects of *realized results* and *social cause* could be applied to an intervention focused on education of patients' loved ones in a simple physical assessment technique (e.g., postural assessment in sitting). With this knowledge and skill, loved ones could monitor improvement in a patient's posture, give real-time feedback several times per day, and offer encouragement when improvement is shown.

Conclusion

The current study used qualitative means to apply the concept of mental models from the social sciences to better understand factors related to physical therapy HEP adherence. The findings indicate that adherence may be influenced by experiences individuals perceive as being an immediate and direct result of their adherence behaviors as well as expectations they have for the future because of their adherence. Perceptions of how others influence adherence behaviors also appear related to adherence. The findings have implications for theory and practice. Using mental models as a framework for adherence study shows promise, however further research is necessary to establish the ways and extent to which individuals' mental models relate to the most important aspect of adherence study, behavior change in patients.

CHAPTER IV

Improving Self-Care Recommendations and Adherence through Articulation, Assessment, and Revision of Patients' Mental Models

Introduction

Adherence refers to both the adoption and maintenance of a specific behavior. Patients who are not adherent to medical recommendations risk a decline in health and increased health care costs even when the recommendations for treatment made by the practitioner are well thought out and evidence-based. Although the systematic study of medical adherence began in the 1950's and 60's, Vermeire et al. (2001) noted that adherence continues to be a poorly understood and multifactorial phenomenon. Adherence to various medical therapies is only about 50% (WHO, 2003) and adherence is particularly poor long-term (McLean et al., 2010; van Dulmen et al., 2007; Vermeire et al., 2001). An estimate of the societal cost of non-adherence is 300 billion per year in the United States (DiMatteo, 2004).

Researchers have identified a range of factors related to medical adherence, including positive feedback from the provider (Campbell et al., 2001; Sluijs et al., 1993), the patient-provider relationship (Campbell et al., 2001; Leventhal, Lambert, Diefenbach, & Leventhal, 1997), and environmental factors such as availability of transportation (Jack et al., 2010; Mailloux, Finno, & Rainville, 2006). Consistently, authors have found individual perceptions, beliefs, and expectations impact patient adherence behaviors, including self-efficacy to perform exercise (Medina-Mirapeix et al., 2009), perceived barriers to adherence (Dexter, 1992; Jack et al., 2010), and perceived severity of condition (Sluijs et al., 1993). In a review of 38 systematic reviews of adherence research, van Dulmen et al. (2007) found that interventions based on

"cognitive models [that] emphasize patients' perceptions and beliefs" (p. 64) may play an important role in educational efforts to enhance adherence behaviors.

In the social sciences, a collection of an individual's beliefs and assumptions about a particular aspect of their lives is referred to as their *mental model* (Byrne & Johnson-Laird, 2009; Gentner & Smith, 2012; Johnson-Laird, 2006). Through experience, individuals develop mental models about all aspects of their lives (Gentner & Smith, 2012), such as family, learning, health, and exercise. In the plural form, the term mental model is virtually synonymous with "cognitive models" used by van Dulmen et al. (2007). At a non-conscious level, mental models represent an individual's thoughts about how the world works, including expected consequences of their own actions.

This paper presents a synthesis of adherence and mental models research, offering a novel perspective on why patients may or may not adhere to medical recommendations. The purpose of this paper is to apply mental models research in the social sciences to better understand medical adherence and offer recommendations for practice that may promote patient adherence. Key concepts are defined first, followed by a synthesis of research demonstrating interrelationships among prior experiences, mental models, and adherence decisions. Strategies to assess patients' largely tacit mental models are discussed as well as methods to revise mental models in ways that enhance adherence.

Definitions

Adherence

The World Health Organization (2003) defines adherence as "the extent to which a person's behaviour…corresponds with agreed recommendations from a healthcare provider" (p. 3). Researchers have investigated adherence in regard to several medical conditions including

HIV, cancer, arthritis, diabetes, cardiopulmonary disease, and psychological disorders. Adherence studies routinely focus on patient behaviors in keeping appointments, taking medications, and making lifestyle changes such as exercise and weight loss.

Mental Models

Mental models enable individuals to make meaning of current circumstances, form assumptions about new experiences based on similarities with prior experiences, and create mental images of the future that guide their actions (Johnson-Laird, 1994). Because mental models are constrained by experience, some components can be erroneous or incomplete, leading to faulty assumptions (Gentner & Smith, 2012). With new experiences, however, mental models can be reshaped, enabling new behaviors (Eckert & Bell, 2006, Vosniadou & Brewer, 1992). In medical contexts, individuals likely bring a mental model of their condition and what it means to adhere to recommendations based on prior experiences. This places the medical provider in a position to provide new experiences that effect a change in salient aspects of patients' mental models in ways that promote long-term adherence.

Interrelationships among Prior Experiences, Mental Models, and Adherence

Prior Experience Link to Mental Models

Individuals form mental models through analogical reasoning (Byrne & Johnson-Laird, 2009). This involves cognitive processes occurring below the level of consciousness that enable one to orientate him or herself in a given situation and form expectations for the future based on the past. Analogical processes include, (a) encoding sensory input representing features of a current experience, (b) mapping the encoded features to features of similar prior experiences stored in memory, and (c) forming complex mental representations (i.e., mental models) of experience, including associated knowledge, values, and beliefs in a given life domain (Gentner

& Smith, 2012). Mental models, in turn, influence decision-making in both non-medical and medical contexts.

Mental Models Link to Decision-Making in Non-Medical Contexts

Eckert and Bell (2005) illustrated the role of mental models in decision-making in a study investigating influences on farmers' business decisions. The researchers found farmers' tacit mental models of farming practices influenced their problem solving strategies and decisions to participate in educational activities. Bechara, Damasio, Tranel, and Damasio (1997) also highlighted the importance of making tacit references to prior experience in order to form mental models and guide decisions. In their study, participants with and without cognitive impairments were faced with a decision to gamble or not during a card game. Individuals with normal cognitive functioning unconsciously referenced past experiences and their mental model of similar games to guide their gambling decision, outperforming those whose cognitive impairments in memory allowed them to use only present information to decide.

Mental Models Link to Decision-Making in Medical Contexts

Mental models can also influence decision-making in medical contexts. McNeil et al. (1982) asked participants to choose, in a hypothetical situation, between a conservative and an invasive medical procedure to treat cancer. The authors provided participants with current statistical information regarding survival rates for the two treatments. Participants chose the conservative option less often (26%) when the researchers identified it specifically as radiation, compared to when they did not identify it as radiation (42%). In making their decisions, participants relied more on "preexisting beliefs" (p. 1262) (a component of their mental models) than present day statistical information. In other words, negative beliefs about radiation influenced them to choose the conservative measure less often. Although the authors could not

determine whether participants' beliefs were based on fact or a preconceived bias against radiation, these data exemplify the power of mental models on decision-making even when new, pivotal information is provided.

Mental models also influence decision-making regarding preventative measures of disease. In a study of 678 women, aged 45 to 64, faced with a decision to participate or not in a breast self-examination class (Calnan & Moss, 1984), those with vicarious or direct experience with breast symptoms were more likely to attend. Results suggested that participants with relevant prior experience had formed mental models that influenced their decision to attend. Additionally, in a study of 84 male participants undergoing HIV testing and a test counseling session, Mattson (1999) demonstrated that following safe-sex counseling, clients decision-making related to safe-sex practices were moderated by perceptions of susceptibility of the disease ($r = .32$, $p > .05$). Results suggest that participants' mental model of how likely they were to contract HIV influenced their decisions regarding use of a condom. The results of both studies demonstrate that past experiences influence mental models and that mental models influence decisions related to medical prevention behaviors.

Articulation, Assessment, and Revision of Patients' Mental Models

With a better understanding of patient mental models, medical providers may be able to understand better the underpinnings of adherence behaviors (key prior experiences) and design individualized interventions that promote adherence to medical recommendations. Mental models form as a result of comparisons between prior experiences and current experiences via analogical reasoning. Although formation of mental models continually contributes to reasoning

and decision-making across life domains, the individual remains unaware of this entirely tacit process.

Because mental model formation is tacit, a first step for medical providers is to "uncover" and assess aspects of patients' mental models that may influence their adherence behaviors. After uncovering the "content" of patient mental models, providers can design experiences that help revise erroneous aspects of mental models while promoting characteristics that enhance adherence. This section addresses specific strategies providers can use to better understand the nature of a patient's mental models, identify aspects that may be limiting adherence, and design interventions to augment adherence.

Articulation and Assessment of Mental Models Through Patient Interview and History

One or more tacit mental models may influence a patient's adherence to medical advice. Each mental model can have many components, for example, a particular memory, or set of knowledge or beliefs that reflect the range of prior experiences on which the mental model is based. While it is not possible for medical providers to fully appreciate all the components of a patient's mental models related to adherence, providers can use strategies to help a patient express or articulate aspects of their mental models. Through articulation, the provider and patient become more aware of underlying knowledge, beliefs, or expectations that may influence adherence. Articulation enables providers to assess a patient's mental model, identifying inaccuracies and variations between patient and provider models (Austin & Fischhoff, 2012; Carley & Palmquist, 1992). With this increased understanding providers can individualize care to promote adherence.

Each patient begins an encounter with his or her provider with a "base" mental model of what treatment and adherence entail. Uncovering relevant aspects of those mental models can begin with the initial patient interview. In fact, interview is the most common method used to explicate mental models in mental model research (Carley & Palmquist, 1992; Eckert & Bell, 2006; Grenier & Dudzinska-Przesmitzki, 2015). Providers can encourage patients to express how their beliefs and values have guided past actions adhering to expert advice or prescribed routines. Questions such as, "Can you tell me what led you to that idea?" and "What types of things did you consider when you made that decision?" are effective in helping an individual verbalize knowledge and experiences that underlie their mental models in a particular domain (Eckert & Bell, 2005). For example, the provider can ask, "What led you to the belief that medication alone would be most effective to improve your diabetes?" A question such as this may reveal that alternative approaches, such as exercise, are missing from the patient's current mental model, providing clues as to why they may be resistant to adopting an exercise routine.

In assessing a patient's mental model providers also can focus on patient expectations and assumptions about upcoming treatment. Questions include, "Is staying with recommendations and treatments I suggested going as you expected?" as well as "What are your assumptions regarding the time and effort needed to follow my recommendations?" Answers to these questions will reveal if discrepancies exist between provider and patient mental models regarding adherence. When discrepancies are present, patient mental models are likely to be either "flawed" or "incomplete" compared to empirically valid medical and physiological phenomena (Chi, 2008).

Flawed or Incomplete Patient Mental Models

When one or more components of a patient's mental models guiding their adherence behaviors are flawed, the individual may anticipate a successful result when they run a mental simulation of their intended actions. However, the simulation they run is not valid, leading to a false set of assumptions about the outcomes of their actions. Chi (2008) illustrated how individuals who have a faulty mental model of the human circulatory system, incorrectly believing that human circulation is a "single-loop" system (where blood simply goes to the heart and then to the rest of the body) rather than the correct "double-loop" system, engage in incorrect reasoning and form inaccurate assumptions about how the system will respond to future events.

Regarding adherence to exercise, medications, and other therapies that are most effective when performed in the long-term, flawed mental models regarding the duration of treatment adherence can negatively impact health outcomes. Several authors have demonstrated that adherence is particularly poor long-term (McLean et al., 2010; van Dulmen et al., 2007; Vermeire et al., 2001). When patients incorrectly believe that adherence to a medical intervention is needed only in the short term rather than over a course of years or for life, the provider needs to point out contradictions between components of the patient's mental model and the valid (expert) model (Chi, 2008). As illustrated in the previous example regarding diabetes treatment, interview questions should allow the patient to demonstrate flaws in their understanding of their condition. With this knowledge, the provider can design interventions that address correcting the erroneous components of a patient's mental model.

In addition to being flawed, mental models can also be incomplete. In this case, individuals may simply need additional information to complete their models (Chi, 2008; Gentner & Smith, 2012). Patients who possess "all the pieces" of what their treatment entails

may be more adherent. For example, in a study of physical therapy patients with low back pain, those who expected exercise to be a part of a physical therapy plan of care were more adherent to a home exercise program (Schneiders et al., 1998). Providers may need to perform "gap filling" (Chi, 2008, p. 67) in patients' mental models so process and outcome expectations are correct. Gap filling may be necessary in patients diagnosed with conditions such as cancer where invasive (i.e., excision of a tumor) and non-invasive (i.e. radiation, chemotherapy) treatments represent viable options. Patients may be aware of certain options but possess limited or no knowledge of others.

In cases where a patient's mental models are either flawed or incomplete, the provider can provide specifics regarding how adherence is defined early in the treatment course. The definition should include specific actions the patient will perform (e.g., exercises, type of diet, medications, etc.), duration of adherence, and methods for measurement of improvement. The provider can play a pivotal role in helping a patient revise components of their mental models in ways that promote adherence.

Patient-Provider Discrepancy in Mental Models

Differences between patient and medical provider mental models often exist. Previous researchers posit that some of the mismatch stems from providers' mental representation of patient problems being based on a "disease model" (where biomedical concepts are paramount), while patients subscribe to an "illness model" (where interruptions in daily life take precedence) (Patel et al., 2002; Soergel et al., 2004). One source of discrepancy demonstrated by Soergel et al. (2004) lies in the interpretation and use of medical terminology. To remedy the gap between patients' and providers' terminology, the authors suggested an "interpretative layer" (p. 933) of

medical terminology and communication serving as an intermediary between the disease and illness models. Applying this suggestion to a recent study demonstrating that about 1 in 4 patients with atrial fibrillation do not have adequate understanding of their condition (Markham & Gentner, 2001), providers can ask questions such as, "What is your understanding of atrial fibrillation?" and "What do you know about atrial fibrillation treatments and their purpose?" Using the responses of the patient, the provider can address points of discrepancy and introduce medical perspectives using analogies and metaphors to activities or concepts that are familiar to the patient. Providers and patients can then develop a shared vocabulary that bridges disease and illness models.

Revising Patient Mental Models

Patients' mental models require revision when they are flawed, incomplete, or in conflict with the medical provider's models. As demonstrated by research in the social sciences, a barrier to mental model revision is the tendency for individuals to be resistant to information that disconfirms or contradicts their current mental model (Eckert & Bell, 2005; Gentner & Smith 2012; Markham & Gentner, 2001). Medical providers can foster revision of mental models with practical strategies aimed at gradual health behavior change.

Referred to as "bridging analogies," one approach employs a gradual and progressive change in behaviors that enables individuals to modify their perceptions of possibilities and thus their mental models (Clement, 1991). For example, medical providers who recommend daily dietary changes and exercise to a patient who is obese may want to start initially with only one of these changes. A less drastic change in the patient's daily habits may allow for smoother revision of their mental models and more success in their adherence. Success in performing just one

recommendation (either new diet *or* exercise activities) provides the patient with a new, positive experience that may increase chances of their adoption of the other recommendation.

Research in learning and the brain has demonstrated that when core emotions accompany a new experience, details of the experience are more likely to become "hard wired" in long-term memory (Garrett, 2008, Phelps, 2006). Purposeful use of "new experiences," specifically those that invoke surprise and joy (Jensen, 2008), can be particularly effective in triggering learning that effects changes in mental models (Phelps, 2006). Medical providers can design positive memorable experiences to trigger revisions in components of individuals' mental models associated with adherence. Memorable experiences may include creative and interactive methods of education, such as showing a patient an animation of the surgical technique they underwent to promote understanding of how poor post-surgical adherence can allow pathology to return. In the case of weight loss, the provider may take before and after videos of the patient performing real-life, everyday tasks so that the patient can better internalize the dramatic changes in their health and abilities. These types of experiences enable patients to gain, recall, and apply new knowledge that enhances their mental models in ways that promote adherence.

A summary of recommendations for articulation, assessment, and revision of aspects of patients' mental models related to adherence is featured in Figure 4.

Mental Models of Adherence Across Life Domains

As stated by Gentner (2002, p. 9685), "Mental models are often based on implicit or explicit analogies with other knowledge." In other words, individuals' may derive mental models from either conscious or non-conscious comparisons between experiences in one aspect of their lives with experiences in other aspects. In the case of medical adherence, components of individuals' mental models that influence their adherence may be based on experiences adhering to routines in other aspects of their lives. In practice, this suggests that medical providers seeking

to help patients articulate or modify their mental models related to adherence may need to inquire about other medical or non-medical routines or regimes. Questions can be specific to the target medical recommendation or very general in nature. For example, a physical or occupational therapist seeking to understand mental models that may influence an individual's adherence to a home exercise program may begin with asking, "Do you already perform daily or weekly exercise? How successful are you in maintaining the regimen?" If the patient does not engage in such a regimen, questions can become more general: "Are you involved in anything

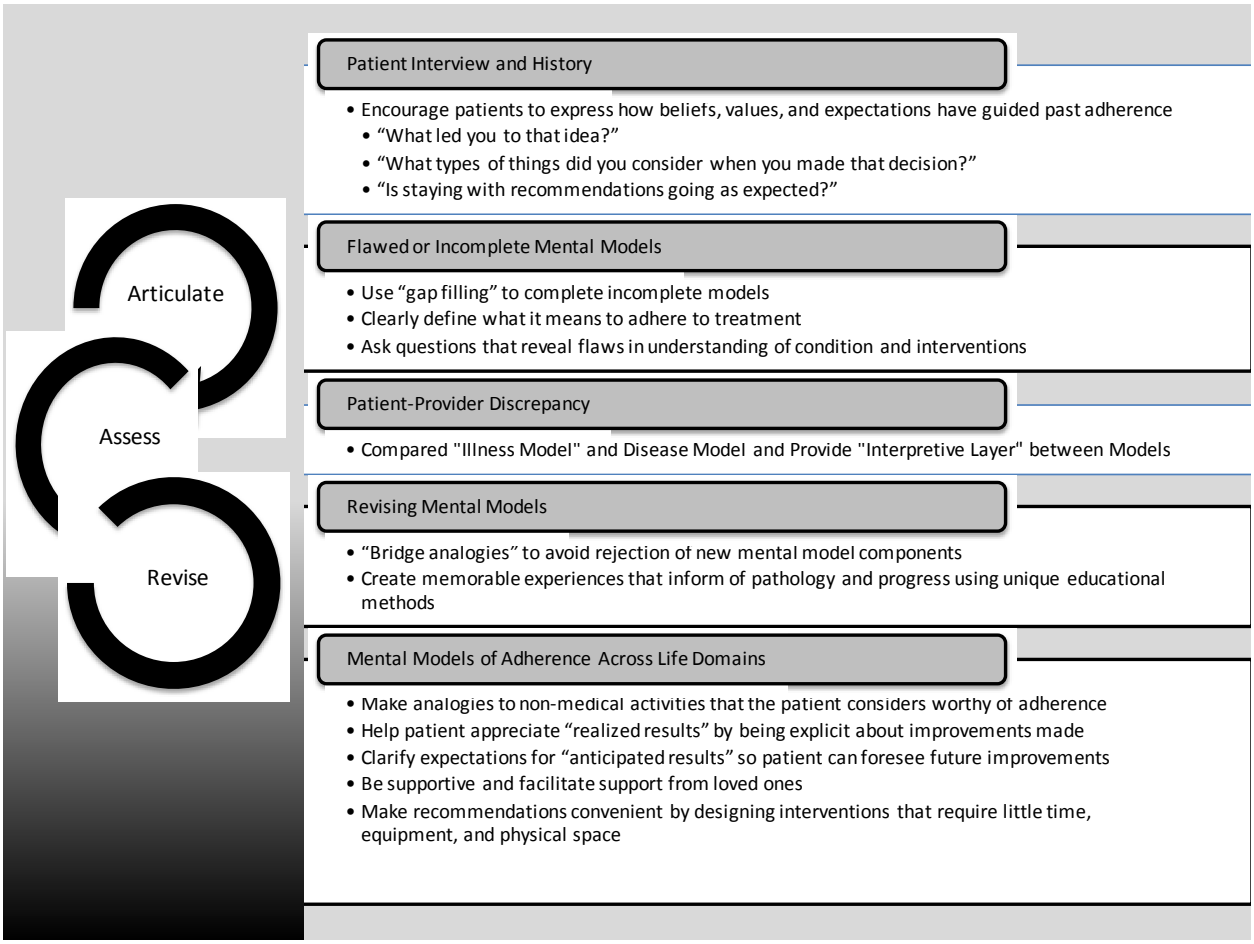

Figure 4. Summary of Recommendations for Articulation, Assessment, and Revision of Patient Mental Models

right now that involves repeated time and attention?" or "Are you performing any daily or weekly routine that you have had to make room for?" The purpose here is to reveal activities that require adherence so that the patient can make connections to a medical recommendation that may demand similar attention.

The possibility that individual experiences adhering to non-medical routines may inform the mental models that affect an individual's adherence to medical recommendations is supported by a recent qualitative study by Rizzo and Bell (2015). The authors interviewed individuals referred to a physical therapy clinic before the patient's first appointment and then again after at least five visits. The first interview focused on participants' experiences, beliefs, and expectations adhering to non-physical therapy routines, and included activities such as jogging, study habits, volunteer work, household chores, and dieting. The second interview focused on adhering to the home exercise program prescribed by the physical therapist. The authors found that several components of participants' mental models related to physical therapy home exercise program adherence also influenced adherence to activities unrelated to physical therapy. Mental model components included beliefs about current realized results, expectations for future results, social influences, and valuing convenience in performing a routine. The authors concluded that by implicitly comparing and contrasting adherence experiences, individuals may develop perceptions about adherence that they apply across a variety of life domains.

Rizzo and Bell (2015) offered suggestions for promoting patient adherence to physical therapy home exercise routines that are applicable to other medical adherence contexts. First, providers can strive to help patients appreciate realized results of their efforts by sharing changes in pertinent physical or physiological measurements on a regular basis. Second, because results

are not always immediately tangible, providers need to offer education about types of results patients can expect in the future if they adhere to recommendations. Next, because patients' perceived level of social support can influence individual adherence efforts, medical providers need to show support for both adherent and non-adherent patients. Also related to social support, providers can spend time educating loved ones regarding physical signs of improvement so they can offer feedback and encouragement to the patient. Finally, providers can explore with patients ways to make a proposed medical regimen more convenient, particularly in terms of time, equipment, and space.

Challenges to Application of Mental Models to Medical Adherence

The benefits of articulation, assessment, and revision of patient mental models to improve adherence to medical therapies need to be empirically validated. In addition to the need for further research to establish relationships between mental models and adherence, several additional challenges exist for clinicians and researchers to consider. The first challenge concerns limits to the time providers have in interviewing patients. Though our recommendations include asking patients several open-ended questions to articulate their beliefs, values, and expectations regarding adherence to both non-medical and medical regimens, we realize implementation of this recommendation may be unpractical in most medical settings. A concise questionnaire or brief set of questions may prove useful for efficient assessment of patient mental models related to adherence. A concise, valid, and reliable method of evaluating mental models with respect to medical adherence does not exist at this time.

The next challenge concerns how to proceed with this line of research. Similar to Rizzo and Bell (2015), further qualitative research is necessary to identify components of patients' mental models that relate to medical adherence. Participant interviews are the most common

method of articulating and assessing mental models (Carley & Palmquist, 1992; Eckert & Bell, 2006; Gentner & Smith, 2012), however additional methods such as concept mapping (Carley & Palmquist, 1992) and card sorts (Smith-Jentsch, Campbell, Milanovich, & Reynolds, 2001) may prove useful in identifying salient aspects of patient metal models. As a next step, researchers will need to quantitatively evaluate relationships between mental models and adherence. Quantitative research should identify the extent to which qualitative themes related to mental models actually affect adherence behaviors and how these relationships can guide interventions.

Finally, a challenge to all medical adherence research is how to ensure adherence long-term (McLean et al., 2010; van Dulmen et al., 2007; Vermeire et al., 2001). Providers find it difficult to monitor patients' adherence when regular office visits end. Some researchers have employed with some success follow-up telephone calls or print-based information (Allison & Keller, 2004; Napolitano et al., 2008) to promote continuation of long-term exercise. Application of mental model articulation, assessment, and revision strategies may prove helpful for this type of intervention because components of mental models that relate to adherence may direct the content of these interventions. For example, if social influences of loved ones represent a key component of mental models that relate to adherence, a question asked on a follow-up phone call could be "Is your adherence to your exercise program supported by family or friends?" as well as "Can you identify a loved one or close friend that may remind you to exercise?"

Conclusion

In all aspects of medical care, patient adherence is a prerequisite for intervention effectiveness. Previous researchers have identified a myriad of factors that influence adherence as well as some effective interventions, but no consensus exists to guide empirical and clinical efforts to improve adherence. Research in the social sciences demonstrating the role of mental

models in decision making and behavior points to the viability of mental models as a framework to assess and promote patient adherence in medical contexts. This paper presents several practical methods providers can use to articulate, assess, and revise patient mental models in ways that improve adherence. Many of the recommendations can be reasonably integrated into initial patient interviews and follow-up conversations. Additional research is needed, however, to substantiate the connections between patients' prior experiences, mental models, and actual adherence behavior. The ultimate goal of this research is better identification of the non-adherent patient as well as development of interventions to improve adherence, especially in the long-term.

CHAPTER V

CONCLUSION

Medical providers are continually challenged to foster patient adherence to prescribed recommendations. Previous researchers have explored influences of patients' perspectives on adherence, but have failed to consider the possibility that patients' prior experiences with non-medical and medical adherence could influence adherence decisions in the future. Likewise, authors have not studied adherence in reference to the social science concept of mental models, despite mental models established connections to decision making and reasoning in other contexts. The three papers presented in this dissertation lay a new foundation for adherence study by considering how mental models may influence individuals' adherence decisions and behaviors.

The first paper presents a conceptual framework that lays the foundation for study of adherence through the lens of mental models. The conceptual framework applies relationships between analogical reasoning, mental models, and decision-making that are well established in the social sciences to better understand patients' medical adherence decisions. The second paper represents an application of this theoretical foundation to physical therapy patients challenged to adhere to a home exercise program. The findings of the study demonstrate that realized and anticipated results, social influences, and convenience of the regimen may represent key

components of patient's mental models that influence their adherence. By integrating the conceptual framework and empirical findings of the first two papers, the third paper broadens conclusions to a general patient population. This paper addresses recommendations for articulation, assessment, and revision of patients' mental models, including patient interview questions, methods to reduce patient and provider mental model discrepancies, and provision of powerful experiences that open patients' eyes to the importance of adherence.

Contributions to Adult Learning Theory

The application of mental models to medical adherence research bridges key concepts in adult learning theory with medical practice and demonstrates how patients make meaning of recommendations from medical providers. Researchers in adult learning posit that individuals develop mental models by implicitly referencing context-specific past experiences and comparing them to the present via analogical reasoning (Gentner & Smith, 2012; Jones et al., 2011; Markman & Gentner, 2001). Mental models represent a foundation for why individuals hold certain values and beliefs, making them pivotal for everyday reasoning and decision-making (Gentner & Smith, 2012), including those pertaining to adherence.

The findings of this study suggest that adults' experiences trying to adhere to non-medical regimens may inform their adherence to medical regimens. The possibility exists that adults tacitly reference prior experiences in adherence to guide new adherence experiences, regardless of the context in which the prior experiences occurred. Context and environmental cues play an important role in the specific mental models that are elicited to guide an individual's expectations and behaviors in a given situation (Gentner & Smith 2012; Jones et al 2011). However, because mental models are represented by existing neural networks in the brain, they can be elicited and "run" in conscious thought outside of contexts in which they are most

influential (Gentner & Smith, 2012). In other words, individuals make analogies to contextually different but structurally similar phenomena where application of the model makes sense. For example, individuals are able to make tacit analogies between plumbing and electrical systems secondary to structural similarities between the flow of the water and electrical current (Gentner & Smith, 2012). Subsequent analogies can involve an even higher level of abstraction such as then applying a mental model of an electrical system to the human nervous system.

Through use of interview questioning focused on explication of mental models and uncovering analogies between factors that influenced adherence to non-HEP and HEP regimens, this study represents first steps toward identification of a "mental model of adherence". A mental model of adherence suggests that individuals may possess an *adherence belief system*, transcending non-medical and medical contexts, that influences learning and behaviors in any new adherence challenge. Presence of such a belief system may begin to answer the question, "What beliefs, perceptions, and attitudes must an individual possess to consider a given pursuit worthy of repeated attention and performance?" By conceptualizing adherence as a mental model in this way, educators, including clinicians who support patient education, can educate individuals in such a way to foster this ideal mental model of adherence.

Contributions to Adult Learning Practice

Application of the concept of mental models to adherence research has implications for adult learning practice. Physical therapists and other medical care providers are educators and facilitate learning among the adult patients with whom they work. In this way, medical providers serve their patients not only as individuals in need of medical care, but also as adult learners in need of knowledge pertinent to their pathology and recovery.

Medical providers should recognize that individuals faced with adherence decisions

already hold beliefs and perspectives that are pivotal in the decision-making process when they start a medical regimen. Therefore, educators must not only consider patients' present mental model, but the prior experiences on which the mental model is based. Providers attempting to reveal pertinent prior experiences as well as provoke articulation and assessment of a patient's mental model can do so through effective interview and open-ended questioning (Eckert & Bell, 2005). In addition, providers can also use alternative methods such as concept mapping (Carley & Palmquist, 1992) and card sorts (Smith-Jentsch et al., 2001).

Revision of mental models occurs when providers "create experiences" that help patients visualize the benefits of adherence. Therefore, medical providers must go beyond "lecturing" their patients, instead affecting core emotions of their patients with profound and true-to-life experiences that help patients and loved ones *feel* physical improvements and lifestyle change (Garrett, 2008; Jensen, 2008; Phelps, 2006). Introduction of novel, real-life experiences coupled with comparison to prior experience is a powerful learning tool because it couples adults' propensity to learn from experience with reflection and active knowledge construction (Legrow, Sheckley, & Kehrhahn, 2002; Sheckley & Bell, 2006). Although new to medical adherence study, these methods for mental model articulation, assessment, and revision have roots well established by those who study how adults learn and decide.

Effective interventions to improve adherence is the ultimate goal of adherence research. Therefore, methods to improve adherence must "trickle down" from researcher to clinician to patient. An important next step falls on medical educators who must raise students' awareness of the adherence problem and teach methods to improve adherence effectively. Because of the emphasis on disease diagnosis and psychomotor skills in medical education programs, adherence is surely not in the forefront of new medical graduates' minds. However, any treatment placed in

the patient's hands relies on adherence to be effective.

Recommendations for Future Research

More research is necessary to provide merit to the contention that medical providers can improve patient adherence via articulation, assessment, and revision of patient mental models. In order to develop the linkage between the influences of mental models and adherence, future studies should continue to apply adult learning concepts in medical adherence research. One line of research should further investigate the role of prior experiences when starting a new medical regimen. This type of inquiry should identify the influences of both medical and non-medical adherence experiences and to what extent patients create implicit analogies to these experiences. Secondly, because physical therapists must be efficient in their patient encounters, future research should identify how to inquire about adherence experiences in a time-effective manner. The development of patient surveys or a brief set of questions may accomplish quantification of patients' mental models, but researchers should again use adult learning concepts as a guide, employing aforementioned strategies such as concept mapping or card sorts. Finally, application of adult learning principals may enhance the limited success seen thus far in developing adherence interventions. Some researchers have successfully employed educational interventions such as follow-up telephone calls or print-based information (Allison & Keller, 2004; Napolitano et al., 2008) to promote continuation of long-term exercise, but the theoretical framework behind these interventions is not robust. By borrowing from established adult learning concepts, including those pertaining to mental models, researchers can develop empirically based educational methods to enhance adherence across medical domains and contexts.

The three papers presented here provide a new lens through which researchers and medical providers can investigate patient adherence. Though early in development, mental

models' influence on adherence behavior provides a long overdue reconceptualization of a topic that has persisted since the 1950's with no widely agreed upon theoretical foundation or intervention approach (van Dulmen et al., 2007; Vermeire et al., 2001). Representing an exciting new avenue for adherence research, mental models serve as a basis for reasoning and decision making in a wide variety of contexts. Future research will determine the merit of mental models for providing new inroads for adherence assessment and intervention.

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APPENDIX A

Informed Consent Form

Consent Form for Participation in a Research Study

University of Connecticut

Principal Investigator: Sandy Bell, PhD.
Student Researcher: Jon Rizzo
Study Title: Patients' Mental Models and Adherence to Outpatient Physical Therapy Home Exercise Programs

Introduction

You are invited to participate in a research study investigating the influence of physical therapy patients' experiences and beliefs on their participation in home exercise programs. You are being asked to participate because the researcher is interested in the unique experiences and beliefs you may bring to your treatment. The researcher is conducting this study as part of the requirements for his doctoral dissertation.

Why is this study being done?

The purpose of this research study is to investigate the unique experiences and beliefs that patients bring to a bout of physical therapy. The findings will expand the literature on physical therapy participation and participation to home exercise programs.

What are the study procedures? What will I be asked to do?

If you agree to take part in this study, you will be asked to engage in two, 60-minute interviews. As a participant in this study, you will be interviewed by the researcher prior to your first physical therapy session and at your fifth (or later) session. The interviews will take place in a private room of the clinic. The interviews will be audio-taped so that the researcher can recall the information at a later date. During the interview, you will be asked about your life experiences and your personal beliefs regarding starting new activities, including physical therapy.

What are the risks or inconveniences of the study?

We believe there are no known risks associated with this research study; however, a possible inconvenience may be the time it takes to complete the study.

What are the benefits of the study?

You may not directly benefit from participating in this study; however, your participation may cause you to reflect on your experiences and beliefs that influence your participation in personal endeavors and medical regimens in a positive way.

Will I receive payment for participation? Are there costs to participate?

You will not receive payment for participating in this study and you will incur no costs. Should you remain a participant through to the end of the second interview, as a token of appreciation you will receive a $20 Amazon.com gift card or $20 donation to the charity of your choice.

How will my personal information be protected?

The following procedures will be used to protect the confidentiality of your data.

- The researchers will keep all study records locked in a secure location.
- Only the researchers will have access to the tapes and transcripts.
- Audiotapes will be destroyed after three years.
- To protect your identity, in all forms of data and in reporting study results, your name will be replaced with a pseudonym, and any other identifying information will be replaced with generic descriptors.
- All electronic files (e.g., database, spreadsheet, emails, etc.) containing identifiable information will be password protected. Any computer hosting such files will also have password protection to prevent access by unauthorized users.
- Only the researchers will have access to the passwords.
- At the conclusion of this study, the researchers may publish their findings. Information will be presented in summary format and you will not be identified in any publications or presentations.

You should also know that the UConn Institutional Review Board (IRB) and the Office of Research Compliance may inspect study records as part of its auditing program, but these reviews will only focus on the researchers and not on your responses or involvement. The IRB is a group of people who review research studies to protect the rights and welfare of research participants.

Can I stop being in the study and what are my rights?

You have the option to discontinue participation in the study at any time. There are no penalties or consequences of any kind if you decide that you do not want to participate.
You will be notified of all significant new findings during the course of the study that may affect your willingness to continue.
During the interview, you have the right to refuse to answer any or all questions.

Who do I contact if I have questions about the study?

We will be happy to answer any question you have about this study. If you have further questions about this project or if you have a research-related problem, you may contact the principal investigator, Dr. Sandy Bell at (860) 486-0251 or the student researcher, Jon Rizzo at (860) 860-1146. If you have any questions concerning your rights as a research subject, you may contact the University of Connecticut Institutional Review Board (IRB) at 860-486-8802.

Documentation of Consent:

I have read this form and decided that I will participate in the project described above. Its general purposes, the particulars of involvement and possible hazards and inconveniences have been explained to my satisfaction. I understand that I can withdraw at any time. My signature also indicates that I have received a copy of this consent form.

_____	_____	_____
Participant Signature:	Print Name:	Date:
_____	_____	_____
Signature of Person Obtaining Consent	Print Name:	Date:

APPENDIX B

Interview One and Two Protocols

Interview 1

Interviewer: *"In this project, we're trying to find out what's on physical therapy patients' minds relating to any changes they might make in their daily routines based on the therapist's recommendations. There are not "right" or "wrong" answers, we're really just interested in knowing what you are thinking. Your answers to questions are confidential and will not be shared with your physical therapist.*

1. Are you involved in anything right now that reflects a relatively new change to your daily routine? Examples would include eating in a new way, committing to walking your dog every evening, or leaving earlier for work every morning to avoid being late. If nothing new comes to mind, think back on a time in the past when you tried to "make room" for a new daily or weekly activity.

    a. Can you tell me a little bit more about this experience? *(If not mentioned, probe about what brought on the regimen.)*

    b. How successful do you think you were in making the change and adding the new activity to your daily or weekly routine?

    c. What do you think contributed to your being successful or not?

    d. Did you feel it was important to stay with this task? Please explain. *(Probe for beliefs and values of the experience.)*

    e. When you first started to make the change or start the routine, what results did you anticipate? *(Probe for expectations and assumptions.)*

    Take note of whether the regimen was self-imposed or given by another. Probe for an example of the alternative, possibly leading to second example for Question 2.

    Take note of whether the new regimen is for the patient themself or for someone else. Probe for an example of the alternative, possibly leading to a second example for Question 2.

2. Can you give me another example of something you began that represented a change in your daily or weekly routine?

    (Return to Questions 1a.-1e.)

Interview 2

Interviewer: *"Similar to the first interview, we're trying to find out what's on physical therapy patients' minds relating to any changes they might make in their daily routines based on the therapist's recommendations. There are not "right" or "wrong" answers, we're really just interested in knowing what you are thinking. Your answers to questions are confidential and will not be shared with your physical therapist.*

In the first interview, I asked if you were involved in anything that reflected a change to your daily routine. Examples included eating in a new way, committing to walking your dog every evening, or leaving earlier for work every morning to avoid being late. In short, I was interested in any previous or current experiences where you tried to "make room" for a new daily or weekly activity. In this interview, I would like to talk more about your experiences related to your physical therapy here at the clinic.

1. Can you tell me about your experience here at the clinic thus far?

    a. In general, what has your treatment entailed? *(Probe about what interventions and activities are being performed including if this includes a home exercise program.)*

2. Other than attending office visits, has your physical therapist asked you to perform any activities that represented a change to your daily routine? Please explain. *(Probe about the presence of home exercise program or other activities that represent a change in daily activities.)*

    a. Approximately how many exercises or activities have you been asked to perform on your own?

    b. When you first started to begin the home exercises, what results did you anticipate? *(Probe expectations and assumptions.)*

    c. How successful have you been in performing these activities?

    d. What has contributed to your success or lack of success?

    e. Is staying with the home routine going as you expected? Is anything not as you expected?

    f. If you described your home exercise program with one adjective, what would it be? Examples would include "easy", "painful", or "fun".

    g. Is performance of your home exercise program supported at home?

h. Have you changed anything else in your daily routine as a result of the changes recommended by the therapist?

3. When you think of activities like this that represent a change to your routine, where does physical therapy fit in? *(Probe whether individual considers physical therapy activities to be worthy of changing routine.)*

4. Are the interventions and activities you are performing consistent with what you believe will help your condition?

5. What has been your role in improving your condition? Was this what you expected? Please explain.

6. What has the therapist's role been in improving your condition? Was this what you expected? Please explain.

7. Have you had any past experiences that are similar in some way to what you have experienced thus far here at the clinic? Your past experiences could be in physical therapy or some other context. If yes, please explain. *(Probe for how aspects of prior experiences are similar to aspects of current physical therapy experience.)*

8. Is there anything else you would like to add related to your experience here at the clinic or changes you have made to your daily routine?

APPENDIX C

Subjectivity Statement

As I begin this qualitative research, it is important that I express opinions and biases that I hold regarding physical therapy treatment and patient education as it relates to patient adherence. In my 13 years as a physical therapist, I have held a "keep it simple" philosophy when I treat my patients. Answers to problems of physical ailments are often not complicated. However, physical therapists must examine dysfunction on an individual basis because no two patients are alike. I believe that the most reliable method to extract meaningful information from patients is frequent and honest dialogue. I feel this can sometimes yield more pertinent data than the actual physical examination. Devising meaningful methods to get patients to talk can help clinicians educate and treat their clients. Too often, physical therapists spend insufficient time questioning, problem solving, and educating before initiating physical interventions. Subsequently, physical interventions fail because the true cause of the problem is not identified or the patient does not understand how the treatment will help. Discussion, troubleshooting, and patient education can remedy these problems. In fact, physical interventions, including home exercise programs, can be rather concise when they focus on the correct problem and involve the patient as an active participant in their care.

Learning about our patients can take the form of interview, observation, and reflection. I believe there is a wealth of information inside the minds of patients that can give us new insight regarding how to approach their care. We just need to devise ways of revealing it. This theory has led me to believe that there is a body of qualitative research with regard to patient adherence that is waiting to be developed. Specifically, I believe that qualitative data regarding adherence to physical therapy will help physical therapists determine why patients cancel appointments,

forgo prescribed home exercise programs, and generally disregard other important recommendations.

The importance of adherence to home exercise programs cannot be overstated. With co-payments rising and insurance companies approving a decreased number of clinical sessions, physical therapists must arm their patients with a home program that can supplement weekly sessions and provide maintenance of their condition when physical therapy concludes. It is my belief that adherence to home programs may depend on how patients' prior experiences shape their values, beliefs, expectations, and assumptions regarding adherence to non-physical therapy-related and physical therapy regimens. Therefore, I believe that evaluation of patients' mental models may shed light on adherence behaviors.

I consider adherence of paramount importance because all other physical interventions are dependent on it. Screening for adherence tendencies may allow clinicians to ultimately improve patient participation, ensuring optimization of physical interventions.

APPENDIX D

Physical Therapy Facility Director Permission

University of Connecticut
Nayden Rehabilitation Clinic

4/17/2012

To whom it may concern:

As part of his dissertation research at the University of Connecticut, Jon Rizzo has permission to recruit patients referred for physical therapy at the Nayden Rehabilitation Clinic at the University of Connecticut to participate in his study. I understand that Mr. Rizzo will not begin to recruit participants and collect data until the Institutional Review Board (IRB) at the University of Connecticut approves his study. I also understand that the principle investigator for Mr. Rizzo's IRB approved study will be his major advisor, Dr. Alexandra Bell, in the Department of Educational Leadership. Mr. Rizzo has shared with me the nature of the study to be conducted and will keep me informed of any changes that may occur.

Sincerely,

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