MODIFIED DISCIPLINE-SPECIFIC EPISTEMOLOGICAL BELIEFS SCALE – LAY MEDICAL KNOWLEDGE: DEVELOPMENT AND VALIDATION

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CHAPTER I

INTRODUCTION

Health care quality is measured in part by the level of patient-centered care (Robinson, Callister, Berry, & Dearing, 2008). Patient-centered care influences financial policies related to health care, licensure, medical education, and assessment and quality of care (Epstien et al., 2005). Patient-centered care is a recognized determinant of health outcomes and is related to communication, participation in health care, positive relationships with the healthcare team, and medication and treatment adherence (Agency for Healthcare Research and Quality, 2005). Given this information related to the importance of patient-centered care, it is not surprising that in the past ten years, the field of medicine has continued to move toward, and remains focused on providing, patient-centered care. However, as reported by the Agency for Healthcare Research and Quality (2005), up to 18% of patients report that they have never experienced patient-centered care.

Patient-centered care is defined as "outcomes oriented, with a focus on what patients experience and, among the range of medical reasonable options, gives precedence to what patients prefer" (Krumholz, 2011, p. 374). In a healthcare system that integrates patient-centered care:

- Patients receive care when they need it, delivered in a manner they can understand;
- Patients and their families form a partnership in making health care decisions;
- Patients and their families actively participate in the decision making process; and
- Health care providers are responsible for providing feedback to the patients and their families letting them know how well they are doing in providing patient-centered care (American Academy of Family Physicians et al., 2007).

If this constitutes patient-centered care, the patient who would obtain optimal benefits would be a person who is willing to understand medical information, partner with their healthcare provider in making health care decisions, actively participate in the decision making process, and take and provide feedback to health care providers about their care.

Patients who would be best suited to benefit from patient-centered care, based upon the above criteria, desire to actively participate in their health care. They are effectively members of their own healthcare team. These so-called ideal patients would be those who are willing to participate in the healthcare process, making decisions about their health care in partnership with their families and healthcare providers. However, based upon existing research, there is variation in the level of participation in health care based upon characteristics such as race, age, level of education, income, perceived health status, and health insurance coverage (Agency for Healthcare Research and Quality, 2005). People who are members of a minority; are older; have limited education, income, and health insurance; and view themselves to have poor health tend to participate less in the healthcare process. Conversely, patients who are younger and have higher levels of education have been shown to have a greater desire to participate in their healthcare decisions (Robinson & Thomson, 2001). What this implies is that those patients who are most likely to experience disparities in

health care are unfortunately the same patients who tend to lack the desire or ability to participate in their own health care (Kaplan, 2007). The so-called ideal patients, or the patients who desire to participate in their own health care, rarely experience the health care disparities encountered by this group of people based upon their demographics. If people who do not desire or are not able to participate in their own health care experience more health care disparities than those that do, regardless of the reason, it may be possible to reduce the disparities experienced in health care by these people if there is a way to increase their desire or ability to participate in their health care process.

When a person actively participates in the health care process, they can also be considered to co-create medical knowledge with their health care provider. They become a partner in the creation of new knowledge with their health care provider which translates into improved quality of care, improved health outcomes, and innovations in care. Patients and health care providers each hold unique and complementary sources of medical knowledge. The patient holds knowledge to which the health care provider is not privileged, including history, symptoms and behavior. Providers rely on the patient to provide them with this information. The provider has knowledge which patients rely upon and to which they do not have access, including technical medical knowledge such as treatment and medications. If providers and patients bring these pieces of medical knowledge together they can then create new medical knowledge in the form of customized treatment specific to the history, symptoms and behavior of the patient. Treatment prescribed without taking into account both sources of medical knowledge would not meet the individual needs of the patient.

Research has shown that many patients do not want to participate in the health care process. The level of desired participation varies from wanting to be fully integrated to

allowing the physician to completely direct health care (Dy, 2007; Hubbard, Kidd, & Donaghy, 2008; Robinson & Thomson, 2001; Robinson et al., 2008). Why would patients prefer to have their health care directed by someone else? One possible explanation could be the beliefs these patients hold about medical knowledge. Patients may believe that medical knowledge is complex, keeping them from being able to understand the information well enough to have an informed opinion. They may feel doctors are the experts and hold the knowledge necessary to make good healthcare decisions, therefore leaving their decisions in the hands of their doctors. They may become frustrated when they realize that doctors do not hold all the answers. Patients may believe that they are not qualified to judge good medical practice. Insights into these possibilities can be gained from research related to cancer patients' information needs and information-seeking behavior. Interviews were conducted that brought forth surprising if not startling evidence about beliefs people hold about medical knowledge (Leydon et al., 2000). One participant stated:

> To be honest, when they said to me it's cancer I thought I'll put it in their hands now because sometimes it can be a dangerous thing when you start listening and looking. We only have a certain amount of intellect, and we only have a certain amount of education. There is nothing like an ignorant man trying to learn and know every little thing about it. With regards to medicine and the like, the less you know the better. (p. 910)

Other participants espoused beliefs that physicians withhold information and dislike patients providing input (p. 910), that medical information is frightening (p. 911), and that there is difficulty making medical decisions because of conflicting information (p. 911).

Beliefs people hold about medical knowledge are integral in improving health outcomes and influencing participation in health care. People with suboptimal beliefs about medical knowledge have poor health outcomes. If a person believes that instead of tentative and evolving, medical knowledge is absolute and certain, he or she may have beliefs about health conditions that are not accurate such as asthma being episodic rather than chronic (Federman, Wisnivesky, Wolf, Leventhal, & Halm, 2010). If people believe that they are not co-creators of knowledge and instead obtain all their medical information from an all-knowing omniscient authority, they may take medications in a manner that is not advisable, resulting in poor health outcomes (Graham, Bennett, Holmes, & Gross, 2007). However, with proper education and empowerment, beliefs can be changed or modified. It has been shown that when people address their beliefs, such as beliefs about medication, when changed from negative beliefs to positive beliefs, health status improves.

The beliefs that a person holds about medical knowledge affect reasoning, learning, and decision making (Sturmberg & Martin, 2008). If optimal beliefs are those beliefs that result in improved health status, people with optimal beliefs about medical knowledge would believe that knowledge is accessible to reasonably intelligent people. They would not be in awe of their doctors. They would realize that the answers are not always easy or readily apparent. They would know that there are no answers to everything, and that medical knowledge is fluid and dynamic. They would accept their responsibility to evaluate medical information. These kinds of issues fall into the realm of epistemology. The beliefs laypersons have about medical knowledge, their epistemology, could influence their willingness to seek and evaluate information and their desire for participatory health care. Unfortunately, the study of lay beliefs about medical knowledge is largely ignored in educational and medical

research (Bachmann et al., 2007). This research joins the efforts of other scholars who have initiated efforts to address this gap in epistemology specific to medical knowledge.

Theoretical Framework

Beliefs people hold about knowledge is firmly established as an area of study in Educational Psychology with more sophisticated beliefs about knowledge being associated with improved learning outcomes (Hofer, 2000, 2006; Muis, Bendixen, & Haerle, 2006; Schommer, 1993). Those with sophisticated epistemological beliefs perform better in the classroom setting, navigate difficult problems more effectively, and are more comfortable facing difficult problems. Medical knowledge is neither certain nor unchanging and is considered contextual, contingent, and fluid (Knight & Mattick, 2006). If people believe that medical knowledge is certain and unchanging, but are confronted with medical knowledge that is changing and fluid, there will be dissonance and discomfort.

Epistemological beliefs about medicine concern the beliefs people have about medical knowledge. People may believe that medical knowledge is absolutely right or wrong, or that it is tentative and evolving. Or people may believe that medical knowledge is composed of discrete knowable facts, or that it is relative, contingent, and contextual. People may believe that medical knowledge comes from a source outside of self, or they co-construct medical knowledge with others. Finally, people may believe that they need to justify medical knowledge through the opinion of others or wonder whether they can evaluate evidence and integrate differing opinions. These are some of the issues with which the study of epistemological beliefs about medicine is concerned.

The belief that medical knowledge comes from a source outside of self is easy to understand, but the concept of co-construction of medical knowledge is more difficult to grasp. To clarify, it is important to understand that patients hold information in the form of their story including their history, current symptoms and behavior. This is information to which the doctor does not have access. This perspective of the patient is an integral piece of medical knowledge which is used by doctors to practice medicine. This piece of medical knowledge, the patient's story, is different from what a layperson may consider medical science. While the layperson may be able to understand to some degree the more technical aspects of medical knowledge, they are unable to understand it in the same way that medical professionals can understand that knowledge base. Laypersons should not be expected to know this knowledge base in the same way medical professionals understand this content. However, laypeople have an obligation to be invested in the health-care process by sharing the piece of medical knowledge to which the medical profession does not have access, the patients' story, and integrate it with the information provided by medical professionals. This highlights the need to justify medical knowledge including how to evaluate sources of medical knowledge, and whether those sources are trustworthy, logical and consistent with other information.

The theoretical framework utilized for this study is a multidimensional model of epistemology that was proposed by Barbara Hofer (2000). The study of epistemology as we know it was first proposed by William Perry (1968) as a developmental theory of epistemology and was later theorized to be multidimensional by Marlene Schommer (1990). Schommer proposed that epistemology was comprised of the dimensions related to knowledge and learning, namely Certainty of Knowledge, Simplicity of Knowledge, and

Source of Knowledge, as well as Nature of Learning and Nature of Intelligence. The model proposed by Hofer as shown in Figure 1 is the theoretical framework for this study, excludes the domains related to learning and intelligence, and is composed of only those domains related to knowledge. These domains are:

- Certainty of Knowledge: Knowledge is either absolute or tentative and evolving.
- Structure of Knowledge: Knowledge is comprised of either isolated pieces of information or interrelated concepts.
- Source of Knowledge: Knowledge is handed down from an authority, or people are co-creators of knowledge.
- Justification for Knowledge: Knowledge is either justified through observation and authority with a reliance of what feels right, or evidence is personally evaluated with an integration of evidence from multiple sources, coalescing into a personal opinion.

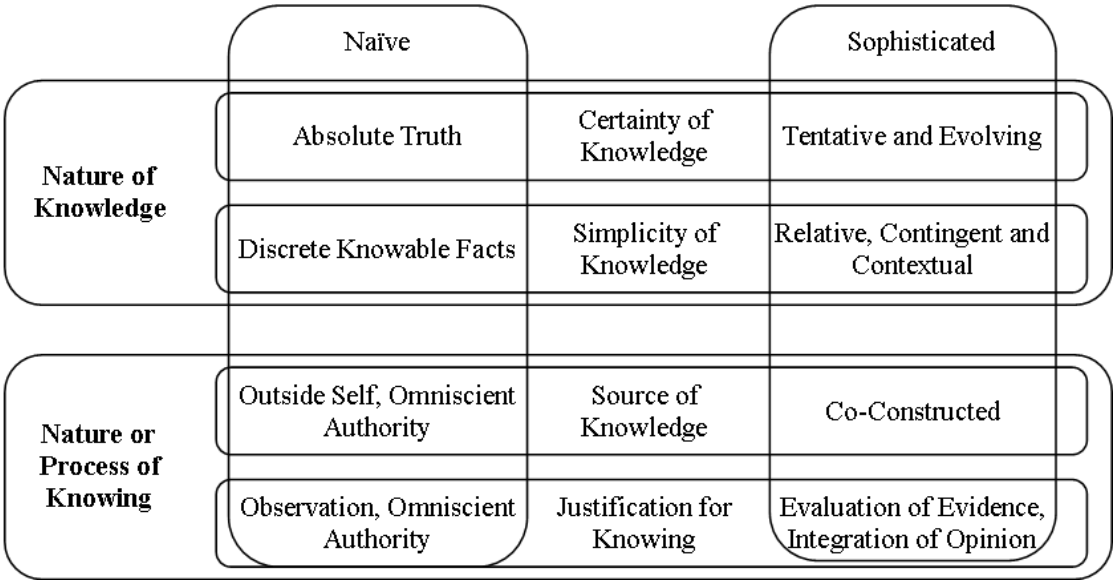

Figure 1. Hofer's Model of the Dimensionality of Epistemology

Discipline-Specific Epistemological Beliefs Scale – Lay Medical Knowledge

Scholars (Barnes, Wheeler, Morse, McGaugh, & Laster, 2012) have begun the study of epistemological beliefs about medicine through the development of the Discipline-Specific Epistemic Beliefs Scale – Lay Medical Knowledge (DEBS-LMK). For this instrument, the factor structure was intended to follow Schommer's five-dimensional model of epistemology, with items being developed for the domains of Certainty of Knowledge, Structure of Knowledge, Source of Knowledge, Control of Knowledge Acquisition, and Speed of Knowledge Acquisition. This theoretical structure utilized for this measure does not include a domain of Justification of Knowledge.

For the Barnes et al. study, approximately 100 items were developed and were adapted from existing measures of epistemology with new items being developed as needed. After subject matter expert (SME) review and further refinement, 63 items remained. Additional items were added to study related constructs of interest including Patient Empowerment and Content Difficulty. The final version of the instrument contained 72 items.

To examine the psychometric properties and factor structure of instrument, the authors completed two separate principal axis factor (PAF) analyses with oblique rotation, one for the certainty and structure items and the other for the remaining constructs. Proportions of variance, pattern and structure loadings, and interpretability guided the decisions for factor solutions and item retention. The items developed for the Certainty and Structure of Knowledge domains did not load onto factors representing those separate domains, but loaded onto one factor that was interpreted as Simple/Certain ($\alpha = 0.73$). Three

factors were realized from the Omniscient Authority items including Patient Autonomy (α = 0.76), Training (α = 0.79), and Expertise (α = 0.68). Quick Learning (α = 0.80) and Innate Ability (α = 0.72) items loaded as separate factors as theorized.

The Multidimensional Health Locus of Control (MHLC) scale form A was utilized in this research to "evaluate the degree of relatedness among the constructs of epistemological beliefs, patient empowerment, and health locus of control" (p. 6). The authors wanted to determine if epistemological beliefs about medical knowledge were related to health locus of control in predictable ways, as people who are considered to have internal locus of control sought out more information but were less satisfied with the information they found whereas people who have external locus of control sought less information and were more satisfied with the information they found. The MHLC scales were used as the dependent variables in a multivariate regression analysis. The resulting DEBS-LMK variables were the predictors in this analysis. The result was significant (Pillais F (18, 927) = 8.34, $p < .001$) and the predictors accounted for 17% of the variance of the dependent variables. Univariate post hoc tests found that the MHLC variables and DEBS-LMK variables were related in predictable ways, with lower scores in quick learning predicting higher internal health locus of control, beliefs in quick learning and need for innate ability predicting chance health locus of control and beliefs that doctors are an omniscient authority along with a belief that medical knowledge is simple and certain predicting powerful others in the MHLC scale.

There are three specific limitations identified, which were addressed in this study: improved instrument items, a measure of Justification of Knowledge, and expanded investigation of the relationship between epistemology of medical knowledge and other health-related constructs. Through item improvement efforts, additional items may be

developed that will distinguish between the simple/certain domain that was found. The dimensions utilized for the Barnes et al. instrument were those proposed by Schommer (1990) and do not include the dimension of Justification of Knowledge that was proposed by Hofer (2000). Justification of Knowledge is related to if and how people evaluate multiple sources of evidence, which is particularly important when laypersons are making decisions based on medical information. Finally, through the expanded investigation of the relationship between epistemology of medical knowledge and other health-related constructs, a deeper and more thorough understanding of these beliefs may be realized.

In summary, to improve this measure, items developed for the DEBS-LMK will be reviewed by Medical SMEs in a structured format for content validation. These items will be improved based upon the input of the Medical SMEs and integrated into the revised measure. Additional items will be developed in conjunction with Epistemological SMEs for the Justification of Knowledge domain. The final instrument, including the items that were validated for content by Medical SMEs and Justification of Knowledge items constructed with Epistemological SMEs, will be utilized to collect data. These data will then allow for the psychometric analysis of the MDEBS-LMK and other measures of health-related constructs such as health locus of control and perceived involvement in care.

Statement of the Problem

Medical epistemology has traditionally been focused on the professional practitioner, not the patient or layperson. There is limited research related to the layperson's beliefs about medical knowledge or epistemological beliefs about medicine. These beliefs are likely to affect peoples' reasoning, learning, and decision making regarding medical decisions.

Without first understanding and taking into account the beliefs people hold about medical knowledge, efforts in improving health interventions lack direction for people who may hold diverse beliefs about medical knowledge that are related to the desire to participate in their health care. Interventions aided by an understanding of epistemological beliefs about medicine may have better chances of increasing the level to which patients participate in their health care.

Purpose Statement

The first purpose of this research was to modify an existing measure of the epistemology of medical knowledge, the DEBS-LMK, which has been identified as promising but is in need of improvement. The second purpose of this research is to explore the relationship between epistemology of medical knowledge, health locus of control, and the desire for participating in health care.

Research Questions

The two following research questions underlie this study:

1. What are the psychometric properties of the Modified Domain-Specific Epistemological Beliefs Scale – Lay Medical Knowledge?
2. What is the nature of the relationships between epistemological beliefs about medicine, health locus of control, and desire to participate in health care?

Implications of the Study

This research will contribute to the study of epistemology and epistemological beliefs about medicine, reducing the acknowledged gap in research related to epistemology of

medical knowledge. An existing domain-specific measure of epistemological beliefs about medicine was modified using four dimensions of epistemology consisting of certainty, structure, source, and justification of knowledge, a different theoretical foundation than has been integrated thus far. This different theoretical approach may yield additional information about epistemology related to medical knowledge, ameliorating the difficulties experienced in efforts to measure epistemology that have been experienced previously. Further, the efforts to improve the measure may yield additional information related to the factor structure of epistemology of medical knowledge. The justification of knowledge domain unique to this theoretical structure is introduced to the study of epistemology of medical knowledge with this research, yielding unique information related to how people make decisions about what is reliable medical knowledge. Through better understanding of epistemological beliefs about medicine, new and existing interventions for improving health outcomes can be modified to take into account beliefs people hold about medical knowledge. Further, the role of epistemological beliefs about medicine will be better understood in relationship to health locus of control and desire to participate in health care. When taken together, the implications of this research and continued research related to the epistemology of medical knowledge may aid efforts in decreasing the debilitating effects of experiencing disparities in health care by addressing the beliefs people hold about medical knowledge prior to interventions. Future interventions would be aided by a more thorough understanding of the beliefs a person holds about medical knowledge.

CHAPTER II

REVIEW OF THE LITERATURE

A review of the literature was conducted to facilitate the study of epistemological beliefs about medicine. Literature related to epistemology was reviewed including the development of the field and the theories that comprise the breadth of current research. The varying theories give rise to diverse construct conceptualizations as described in this study along with a description of the conceptualization of this research and a review of the dimensions to be studied.

This research is focused on one domain of personal epistemology, lay medical knowledge. As a prelude to this domain-specific research, a review is provided regarding the domain generality and domain specificity of epistemological beliefs. Domain-general and domain-specific epistemological beliefs have been studied using both qualitative and quantitative methods, and a discussion of quantitative methods and difficulties in measurement is provided. After the review of epistemology, the literature is reviewed related to the relationship shared between epistemology, learning, and related outcomes. It is shown that sophisticated epistemological beliefs are associated with positive educational outcomes.

As with other domain specific areas of interest, medical knowledge has characteristics that need to be taken into account when used as an area of study, and as such, a review of medical knowledge literature is provided. To support the study of epistemological beliefs about medicine, there is a wealth of literature available about the influence of beliefs in the medical realm. Evidence is provided that shows the advantages of including beliefs as a focus of study in the medical realm and the associated positive outcomes. The literature regarding epistemological beliefs about medicine is reviewed. While there is no literature associated with the study of the relationship between epistemology of medical knowledge and health literacy, there is one article specific to epistemology and information literacy, and the implications of this research are reviewed. The chapter ends with a summary which states that while research shows that beliefs about knowledge are associated with positive outcomes in academic domains, there is limited research about epistemological beliefs about medicine and health-related constructs.

The formal study of epistemology is considered to have begun with the research Perry began in the late 1950s at Harvard University. These two longitudinal studies yielded information that aided in the understanding of how students interpreted their educational experiences, and through this understanding, Perry developed a theory of epistemological development in college students. Since that time, research continues to address the developmental theory established by Perry. While there is still disagreement on the definition, dimensionality, domain specificity, and related constructs of epistemology, Hofer and Pintrich (1997) state:

> Epistemology is an area of philosophy concerned with the nature and justification of human knowledge. A growing area of interest for psychologists and educators is that of personal epistemological development and epistemological beliefs: how individuals come to know, the theories and beliefs they hold about knowing, and the manner in which such epistemological premises are a part of and an influence on the cognitive processes of thinking and reasoning. (p. 88)

Epistemological Theories

Borrowing from the classification developed by Hofer and Pintrich (1997), there are Structural/Developmental Theories, Thinking/Reasoning Theories, and Multidimensional Theories of epistemology. A brief review of other theories not included in these three classifications is presented here.

Structural/Developmental Theories

Structural/Developmental Theories begin with research conducted by Perry (1968, 1999) and serve as the foundation of further research on epistemology. In these studies, Perry sought to understand how students make meaning of their educational experiences. To facilitate this research, Perry developed the Checklist of Educational Values (CLEV). While it was assumed that personality would drive the understanding of the students, it is determined by Perry that this conceptualization is more a sequence of developmental positions than personality. He and his colleagues posited a developmental scheme of nine positions over three stages, moving from dualism to relativism.

In the first set of three positions, dualism, students view knowledge as either right or wrong (Perry, 1999). In the second set of three positions, students move to

multiplicity, which is similar to dualism but with the understanding that while in the process of obtaining truth, it has not yet been obtained. Finally, the last set of positions is commitment within relativism, or the Evolving of Commitments. These positions are not commonly found in the students who comprise the sample for the study, but Perry and colleagues considered the transitions to be more qualitative than structural. This developmental scheme is seen in one form or another in most epistemological theories that are in existence.

In Perry's study, there are very few female students in the sample, and while Perry considered developmental stages to be the same for male and female students, other researchers find this to be a serious limitation to Perry's study. With the goal of viewing women as the knower and learner, Belenky et al. (1986) used a sample comprising only women. Using the scheme developed by Perry, Belenky and colleagues wanted to see if there are differences in the developmental scheme of women than was found in Perry's primarily male sample. This study used a qualitative approach, and questions were modified to represent the educational level of the study subject. Through their analysis, they found that Perry's scheme did not fit the female population, and they developed five educational perspectives that better represent the female study subjects, "a set of epistemological perspectives from which women know and view the world" (p. 15).

Baxter Magolda became interested in the possible gender-related implications suggested by the studies of Perry (1999) and Belenky et al. (1986), and began a five-year longitudinal study of 101 randomly selected students, with relatively equal numbers of males and females (Baxter Magolda, 2002). Baxter Magolda focused on epistemological reflection, "assumptions about the nature, limits, and certainty of knowledge, and how

these epistemological assumptions evolve during young adulthood" (2004, p. 31). While the theory developed by Baxter Magolda is similar to other developmental theorists, she proposed that epistemology is socially constructed and context-bound, making it related to other dimensions of development including identity and relationships.

Thinking/Reasoning Theories

Focusing on epistemological cognition, King and Kitchener (1994) developed the Reflective Judgment Model (RJM) after fifteen years of interview studies with high school students and middle-aged adults. This is a seven-stage developmental model, but differing from the work by Perry (1999), Belenky et al. (1986), and Baxter Magolda (2002), this model focuses on cognition. The interviews conducted by King and Kitchener consisted of ill structured problems where the respondents were asked to justify their position and respond to six follow-up questions. The transcripts were then scored by trained certified raters in a three-round process. This model focuses on people from late adolescence through adulthood and shows how epistemic assumptions are interrelated and how they reflect on reasoning (King & Kitchener, 2004).

Kuhn (2008) pursued research interests in argumentative reasoning using ill-structured problems as in the research by King and Kitchener (1994) but did not provide definitive solutions to the ill-structured problems. While this research specifically aimed to understand argumentative thinking, also included were epistemological principles as well. This model is similar to other developmental and thinking/reasoning models and comprises three epistemological categories: absolutist, multiplist, and evaluative.

Multidimensional Theories

Perry and those whose research he influenced developed unidimensional models of epistemology with a fixed model of development. In a technical report in 1989 and in a journal article published in 1990, Marlene Schommer (now Marlene Schommer-Aikins) reported on her research regarding epistemological beliefs and presented a theory that broke from the developmental conception of epistemology previously theorized (1989, 1990).

> A more plausible conception is that personal epistemology is a belief system that is composed of several more-or-less independent dimensions. Beliefs about the nature of knowledge are far too complex to be captured in a single dimension. I propose that there are at least five dimensions: the structure, certainty, and source of knowledge; and the control and speed of knowledge acquisition. (1989, p. 2)

Schommer (1989, 1990, 2004) reported that the dimensions of structure, certainty, and source of knowledge are based on the work by Perry (1968) in which students' beliefs tend to be initially simple, certain, and handed down by authority, but as they develop, they come to believe that knowledge is complex, tentative, and co-created. Differing from developmental models of epistemology, Schommer hypothesized that epistemological beliefs are more or less independent, "that epistemological beliefs may not develop in synchrony" (2004, p. 21).

The two dimensions related to knowledge acquisition or learning come from research previously completed by Dweck and Leggett (1988) and Schoenfeld (1983). While not Schommer's (1990) initial inspiration, Dweck and Leggett found that some

students believe that intelligence is fixed while others believe that intelligence can be improved, showing two different beliefs about control of knowledge acquisition. Schoenfeld found that students tend to believe that if they do not complete a math problem within 10 to 12 minutes, they will be unable to solve the problem, hence the belief in quick learning or the speed of knowledge acquisition. Schommer found it "plausible that the beliefs about the source of knowledge serve as the closest link to learning beliefs. In other words, the learning beliefs unveil what students think about the source of knowledge" (2004, p. 20).

While previous epistemology research was chiefly qualitative in nature, Schommer followed Ryan (1984) in using a questionnaire to measure epistemology. In his study, he used a questionnaire in research regarding individual differences in epistemology related to the monitoring of text comprehension. While his study focused on one aspect of Perry's work, the structure of knowledge, Schommer developed the Epistemological Questionnaire (EQ), a questionnaire using Likert-scale responses used to study her five hypothesized dimensions of epistemology (1990, 2004). While this instrument has questionable psychometric properties, it remains the most widely used instrument to measure personal epistemology.

Barbara Hofer (2000) presents an alternate multidimensional model of epistemology following the extensive review of epistemological theory she and Paul Pintrich completed in 1997. She posits that "Although there are distinctions among the models, there are points of convergence among them about what individuals believe knowledge is and how it is they know" (2000, p. 380). Like Schommer, she hypothesizes that epistemology is made up of discrete but interrelated dimensions that are stated

explicitly in some developmental models and inferred in others. She does not include dimensions related to learning, and hypothesizes that dimensions of epistemology are contained in two areas, the nature of knowledge and the nature of process of knowing. In the area of nature of knowledge, there are two dimensions, the certainty of knowledge and the simplicity of knowledge. In the area of nature of process of knowing is the source of knowledge and justification of knowledge.

While a more thorough discussion of domain generality/domain specificity of epistemology follows later in this chapter, it is important to note that in the theory Hofer presents, she brings forward three questions about epistemological beliefs and whether they are similar across domains or specific to individual domains.

> What we need to know is (a) to what extent the dimensions of epistemological beliefs are consistent from discipline to discipline, as evidenced in similarity of factor structures; (b) what differences there might be in the beliefs about disciplines, as suggested by mean differences in beliefs; and (c) how these relate to more general epistemological beliefs, as suggested by inter-correlations among domain specific and domain general beliefs. (Hofer, 2000, p. 384)

This follows research conducted by King and Kitchener (1994) and Schommer and Walker (1995) regarding epistemological beliefs specific to academic area.

In her research, Hofer used a questionnaire called the Discipline-focused Epistemological Beliefs Questionnaire, which contains items that were adapted from Perry's CLEV and additional items that were developed in accordance with her four hypothesized dimensions of epistemology. A team of researchers developed the

questionnaire, and three psychologists reviewed the instrument for wording, content validity, and relevance to each of the four dimensions. When completing the instrument using Likert-scale responses, subjects were instructed to keep a specific field, either psychology or science, in mind. Results from her study indicated that the items developed to measure certainty and simplicity of knowledge load onto one factor. The other two factors did not emerge as hypothesized, only representing certain distinct aspects of justification for knowing and source of knowledge. An additional factor emerged that she did not hypothesize. The items that loaded on this factor were written for the source of knowledge domain, but instead loaded on a separate factor that she titled attainability of truth. While the four factors did not emerge as hypothesized, evidence indicated that epistemology is a multidimensional construct, and she calls for more research on this instrument to see how consistently this factor appears.

Other Theories of Epistemology

As opposed to developmental stages or beliefs, Louca et al. (2004) view epistemology as resources, or "epistemologies as constructed from finer grained cognitive elements" (p. 57). What this means is the form of epistemology held by a student, in the case of this article, is the "stability, and context dependence of the relevant cognitive elements" (p. 57). A person may have a professed epistemology, but can operate under a different epistemology given certain circumstances. This hypothesis claims that a person can operate under one epistemology in the classroom and yet another while at home or in a different environment. Epistemology in this model is not so much of a constant belief, but a resource that can be enacted given the context under which one is operating.

Bendixen and Rule (2004) propose an integrated model of personal epistemology that addresses the issues of the nature of the construct, development, mechanisms of change, learning, motivation, affect, and methodological issues. This model proposes to integrate what has previously been seen as disparate paradigmatic approaches to epistemology research by providing common ground, which they propose exists in previous models and theories but under a metacognitive umbrella. The authors outline implications for future research, providing an outline for measurement approaches that to date have not been undertaken.

Muis, Bendixen, and Haerle (2006) in furthering research related to domain-general and domain-specific epistemology research present a novel theoretical framework of epistemology. Through an exhaustive review of the literature related to domain-specific and domain-general epistemology research, they present a hypothesis that epistemology is both domain specific and domain general, and developed a model that integrates aspects of developmental models and multidimensional models called the TIDE framework, the Theory of Integrated Domains in Epistemology. They acknowledge that epistemology is complex and socially constructed as in developmental models of epistemology. However, once individuals enter into an educational system, domain-specific beliefs begin to develop. General epistemological beliefs develop in nonacademic contexts, academic epistemological beliefs develop once an individual enters into an educational system, and further, instructional systems shape domain-specific epistemological beliefs. Thus, these researchers hypothesize that epistemology changes as related to a socio-cultural context, academic context, and instructional context.

Schommer-Aikins (2004) recently introduced an embedded systemic model and proposed a research approach to epistemology that expanded the scope of a study from epistemology to include other aspects of cognition and affect. This direction came from her awareness that epistemology does not function in a vacuum and is related to other systems including thoughts, actions, and motivations. She proposed that six systems interact in this model including cultural relational views, beliefs about ways of knowing, beliefs about knowledge, beliefs about learning, classroom performance, and self-regulated learning. While incomplete, this model was presented to stimulate research to provide a more complete picture of how systems work together to influence epistemology.

Construct Clarity

Various lines of research related to epistemology utilize different conceptualizations of the dimensionality of epistemology. Two of the more common conceptions of dimensionality are those that include dimensions related to learning such as speed of learning and innate ability (Schommer, 1994) and those that exclude dimensions related to learning (Hofer, 2000). While the domain of epistemology is ill structured, it does play a subtle but critical role in learning that demands a need to develop a thorough understanding of the nature of epistemology. As the study of epistemology moves forward, this leaves researchers with the critical question of what dimensions to include in conceptions of epistemology in the absence of a clear definition of epistemology.

Two arguments were recently presented, one providing the case for including an explicit definition of personal epistemology and one justifying an open-ended definition of personal epistemology. Elby (2009) argues that without further empirical and theoretical evidence being provided, the scholarly community should not reach consensus on one definition of epistemology. From this view, it is argued that excluding dimensions of learning from epistemology research would obscure the construct of epistemology since knowledge and learning are closely related. Elby goes further to respond to three arguments made by those who call for a clear definition of epistemology including conflation, definitional alignment and clarity. He first responds that while mixing together the definitions of knowledge and learning may cause difficulties in epistemological research, it should not be a reason to limit the definition of epistemology solely to dimensions of knowledge. By aligning the definition of epistemology, he argues it may favor some frameworks at the expense of others without the empirical and theoretical support to warrant this action. In response to a call for clarity, Elby states that by "encouraging multiple definitions to coexist for a while as research explores which dimensions are most fruitful" (p. 148) more progress can be made than if a clear definition of epistemology is accepted. He reiterates through this work that he does not argue for a definition that includes dimensions of learning in the field of epistemological research, but that competing conceptualizations of dimensionality be allowed to exist and let further empirical and theoretical progress provide future direction.

While personally favoring the epistemological resource theory presented earlier in this work, Sandoval (2009) provides counter arguments to the position of Elby. Regarding conflation, Sandoval argues that the issue is theoretical in nature and that the

"failure of some psychological studies to tease apart epistemological views from views about learning is that the theoretical ideas that underlie them do not make the distinction salient" (p. 158). While knowledge and learning may be related and conflated in the mind, it does not indicate the need to conflate views of knowledge and views of learning in epistemological research. Elby (2009) does not conflate the views of knowledge with views of learning as indicated in his description and in his work with the resources framework that defines epistemological and pedagogical resources. Sandoval affirms that the exclusion of beliefs about learning from a definition of personal epistemology does not mean that learning and epistemology should not be studied together, especially in light of recent evidence of the relationship between the two constructs. "The issue is not one of exclusions, but of theoretical conflation" (p. 159), and recent efforts by Elby in the resources framework is a move toward understanding epistemological and pedagogical components of that model. Sandoval finishes by stating that beliefs about learning are not more or less important than beliefs about knowledge, and acknowledges the relationship between the two but that "distinguishing beliefs about knowledge and knowing from beliefs about learning seems the only way to compare how these varying beliefs relate to each other or combine to influence learning in particular situations" (p. 160).

Study Dimensionality of Epistemology

The present study will use Hofer's (2000) conceptualization of dimensionality of personal epistemology. Within her theory, epistemology clusters in two areas which she considers the nature of knowledge and the nature or process of knowing. The first area is the nature-of-knowledge area, and contains dimensions about the form of knowledge, certainty, and simplicity. The second area is the nature-or-process-of-knowing area. This

area contains dimensions that are related to how one comes to know, specifically the source of knowledge and justification of knowledge. There are two dimensions within each area with certainty and simplicity of knowledge in the nature-of-knowledge area and source and justification of knowledge in the nature-or-process-of-knowing area.

Certainty of Knowledge

Evidence for this dimension can be gathered from structural/developmental theories, thinking/reasoning theories, and multidimensional theories. In Perry's (1968, 1999) studies, students in the beginning developmental stages viewed knowledge as either right or wrong. In Hofer's theory, this represents naïve epistemologies where knowledge is seen as absolute and certain. Sophisticated epistemologies view knowledge as tentative and evolving. In King and Kitchener's (1994) reflective judgment model, the highest developmental stage finds knowledge to be tentative and evolving. Schommer (1989, 1990) also hypothesizes a dimension of certainty of knowledge based off work by Perry (1968, 1999).

Simplicity of Knowledge

Hofer utilizes Schommer's (1989, 1990) conceptualization of simplicity of knowledge as the basis for her theorized dimension. In relationship to simplicity of knowledge, naïve epistemologies view knowledge as being composed of discrete pieces of knowledge that are knowable facts. People who are considered to have sophisticated epistemologies view knowledge as relative, contingent, and contextual. Similar to the certainty of knowledge dimension, Schommer bases the simplicity of knowledge dimension on the work conducted by Perry (1968, 1999) but with a slightly different

conceptualization. In her conceptualization, she views knowledge as isolated pieces of information in naïve epistemologies, and in sophisticated epistemologies knowledge is comprised of interrelated concepts. This is the simplicity of knowledge dimension Hofer uses in her conceptualization of epistemology.

Source of Knowledge

Evidence for this dimension is drawn from the work of Perry (1968, 1999), King and Kitchener (1994), Belenky et al. (1986) and Baxter Magolda (1992). Naïve epistemologies find the source of knowledge to be outside of self, in particular from authority. Sophisticated epistemologies co-construct knowledge with others. In Perry's (1968, 1999) work, students move from a position of a holder of meaning to a maker of meaning. These roles are viewed as spectator or active constructor in the reflective judgment model (King et al., 1994). The evidence from Baxter Magolda (1992) is based on the observation that a person moves through various positions of source of knowledge, from that of learner to peer, and finally to instructor.

The concept of authority related to source of knowledge in naïve epistemologies is of particular interest. Schommer uses the term omniscient authority as a source of knowledge. This dimension did not realize as a factor in her study, but has been shown to realize in other studies (Chan & Elliott, 2002; Schommer, 1989, 1990). Some studies use the term authority or external authority related to source of knowledge as opposed to omniscient authority (Chan & Elliott, 2002; Hofer, 2000; Jehng, Johnson, & Anderson, 1993). This concept of authority appears to be related to the role of self in developmental models in which a person first views self as a holder of meaning and through the

developmental process becomes a maker of meaning (Perry, 1968, 1999). As a holder of meaning, a person would rely on a source of knowledge outside of self, such as an authority, to deliver information to be held in naïve epistemologies. Through the developmental process a concept of self as knower evolves in which the person constructs knowledge with others. This process is described by other structural/developmental theorists including King and Kitchener (1994) and Belenky et al. (1986).

Justification for Knowing

Hofer's argument for this dimension of epistemology is based on the work by King and Kitchener (1994). While the source of knowledge is concerned with beliefs people hold about where knowledge comes from, justification of knowing is concerned with how individuals evaluate knowledge claims when coming from those sources and the role that evidence, authority, and expertise plays in that evaluation and how people evaluate experts. When knowledge is uncertain, naïve epistemologies justify beliefs about knowledge through observation and authority and rely on what feels right as a justification for knowing. In sophisticated epistemologies evidence is personally evaluated, and in developing knowledge, people will integrate evidence from multiple sources, including the opinions of others, along with their opinions. "Only at higher stages do individuals use rules of inquiry and begin to personally evaluate and integrate the views of others" (Hofer, 2000, p. 381).

Domain Specificity/Generality

Research related to domain-specific and domain-general epistemological beliefs remains mixed with results from some studies indicating that epistemological beliefs are moderately general across domains, while others find that they are specific to domain. Developmental, thinking/reasoning, and multidimensional models initially hypothesized that epistemological beliefs are similar across domains. That is, if a person believes that knowledge is simple and certain in mathematics, they will view knowledge as simple and certain in other areas as well whether it is history, science, psychology, or the arts. However, "If individuals can retain varied and sometimes opposing forms of knowledge in memory, then it is conceivable that the beliefs they hold about such knowledge can be similarly varied and even oppositional" (Buehl, Alexander, & Murphy, 2002, p. 416). Statements such as this drive an area of research within epistemology regarding whether epistemology is domain specific or domain general.

Schommer and Walker (1995) examined differences in epistemological beliefs across domains through the use of four factors as presented in Schommer's theory of epistemology. Using regression analyses, the degree of relationship between students' epistemological beliefs across domains were examined using two areas of study, history and mathematics. They found evidence to indicate that epistemology is predominantly domain independent. The regression analyses indicated that epistemological beliefs across both history and mathematics predicted performance in the study. Given the interest in domain-specific epistemology, she followed this research with a study using Biglan's classification system of academic domains and again found that epistemology is moderately domain general, but that there are "a large range of correlations suggesting

that epistemological beliefs for some students are domain specific" (Schommer-Aikins, Duell, & Barker, 2003, p. 362). She speculates that as students gain experience, there may be differences in epistemological beliefs between their domains of interest and general epistemological beliefs. These studies find moderate evidence for domain generality.

Wheeler (2007) developed the Epistemological Belief Survey for Mathematics (EBSM) to assess students' domain-specific beliefs related to mathematics. In her study, she found evidence to support that domain-specific and domain-general beliefs are related, but not redundant constructs. Participants in her study completed both the domain-specific EBSM and the domain-general EBI, with the EBSM having superior psychometric properties compared with the EBI and posit that "students are able to respond in more consistent ways to domain specific items" (p. 133). These findings are similar to those by Buehl and colleagues (2002).

Hofer (2000) presents evidence related to an early study to examine whether there are disciplinary differences in epistemology and finds evidence to support that while students have some beliefs that are general across disciplines, there are also differences, as in this study between views of science and psychology. Using *t* tests with a conservative alpha to control Type I error ($\alpha = 0.01$), she found there were differences in beliefs between science and psychology in four scales: certainty/simplicity of knowledge; justification for knowing: personal; source of knowledge: authority; and attainability of truth. Moderate correlations among the scales found that "there were intra-individual differences regarding perceptions of the dimensions of epistemological theories" (2000,

p. 394). The factor structure of both disciplines was similar, and the factors were correlated similarly across disciplines.

Buehl and Alexander (2001; 2002) extended the work into domain-general epistemology through the study of two academic domains, mathematics and history. In this study, the researchers created the Domain Specific Belief Questionnaire (DSBQ) and compared the results of this instrument with Schommer's EQ. This instrument, similar to the EQ, did not replicate the hypothesized four-factor model theorized by Schommer, and they found that it "is limited in its use of a survey methodology and its conceptualization of epistemology" (2001, p. 443). Similar to the results by Hofer (2000), Buehl and Alexander supported the hypothesis that epistemology of academic knowledge differs by domain and hypothesize that their results may be generalizable to other domains similar to the structure of mathematics and history. The researchers attribute the ability of the DSBQ to unearth domain-specific differences due to the development of the instrument to detect domain-specific beliefs. Other instruments used prior to this study, while containing some items specific to academic domain, were not geared specifically to measure domain-specific differences in epistemology. Hofer (2000) and Buehl and Alexander (2001; 2002) find evidence that epistemological beliefs are both domain specific and domain general.

Muis, Bendixen, and Haerle (2006) propose the TIDE framework to further research related to domain-general and domain-specific epistemology. In this model, epistemology is posited as complex and socially constructed and that once individuals enter into an educational system, domain specific beliefs begin to develop. Domain-general epistemology develops in nonacademic contexts and academic epistemological

beliefs develop once an individual enters into an educational system. Moreover, instructional systems in which the students are exposed to academic domains help to shape domain-specific epistemological beliefs.

Measurement of Epistemology

Most early research related to the measurement of epistemology is qualitative in nature and is not the focus of this research. Perry did incorporate the CLEV in the foundational studies, which led to the development of epistemology as an area of study, but it was Schommer who brought quantitative measurement of epistemology to the forefront of the scientific community when she developed the EQ to measure her multidimensional model of epistemology.

The EQ developed by Schommer (1990) is the most widely used measure of epistemology encountered in the literature (Hofer, 2000). This instrument is intended to measure five hypothesized dimensions of epistemology: the structure, certainty, and source of knowledge and nature of ability and speed of learning. In developing this instrument, she initially conducted two experiments: The first tested the conceptualization that epistemological beliefs are more or less independent and to explore what may influence epistemological beliefs. The second examined linkages between epistemology and comprehension. This study included 120 males and 143 females, 117 from a junior college and 149 university students.

She developed subsets of items to measure each dimension she hypothesized, ranging from 2 to 11 items for each subset, for a total of 63 items (Schommer, 1990). Schommer included the 12 subsets as variables in her analysis using factor analytic

techniques. Using principal components analysis with orthogonal varimax rotation, four of five hypothesized factors were revealed using a cutoff point of eigenvalues greater than one. These four factors -- Innate Ability, Simple Knowledge, Quick Learning, and Certain Knowledge -- accounted for 55.2% of the total variance in the initial study. Some subsets developed to load on a specific dimension instead loaded onto other dimensions for which they were not hypothesized. These four factors are replicated in following research (Schommer, 1993), the four-factor structure is utilized in other epistemological research (Schommer & Walker, 1995), and the EQ is stated to "assess four epistemological beliefs" (Schommer-Aikins et al., 2003, p. 355). Internal consistency coefficients range from $\alpha = 0.50$ to $\alpha = 0.85$, depending upon the sample under study (Duell & Schommer-Aikins, 2001).

In the second experiment, 86 of the initial subjects read a passage related to either psychology or nutrition and then completed comprehension tasks to test predictive validity, or linkages in epistemology and comprehension (Schommer, 1990). Results indicated that quick learning predicts simple conclusions [$F(1, 59) = 7.47$, $b = -.18$, $MS_e = 0.17$] and certain and prior knowledge predicts certain conclusions [$F(1, 59) = 8.5$, $b = -.33$, $MS_e = 0.21$]. What this implies is that as students have increasingly less sophisticated epistemological beliefs, they provide answers that are increasingly simple and certain.

Limitations of this instrument include items stated in general terms, items representing perceptions of self and others, and Confirmatory Factor Analysis (CFA) that uses only subscales and not individual items of the scale (Hofer & Pintrich, 1997). The scoring system in place for the EQ is also sample specific, which makes it difficult to compare results across studies. Moreover, "because scoring of the instrument is typically

based on a factor analysis of subset scores in each new sample, individual studies may in essence be using different instruments" (DeBacker, Crowson, Beesley, Thoma, & Hestevold, 2008, p. 284). Four factors are realized in the studies stated above, however other studies report four factors that have been identified differently (Clarebout, Elen, Luyten, & Bamps, 2001; Kardash & Wood, 2000) or indicate a different factor structure (Qian & Alvermann, 1995; Schommer-Aikins, Mau, Brookhart, & Hutter, 2000; Schommer, 1993).

In research that utilized the EQ, Qian and Alverman (1995) used individual items for factor analysis, and while it realized only three factors, there are similarities with the factors originally hypothesized by Schommer (1990). However, when using the same instrument, Hofer (2000) did not find a similar factor for either the Qian and Alverman (1995) or Schommer (1990) solutions even though she used items for factor analysis. It is suspected that the inconsistency of the factors "have to do with the internal consistency of the factors identified through factor analysis and of the item subsets on which the factors are based" (DeBacker et al., 2008, p. 285) and "poor internal inconsistency of scales is indicative of large proportions of measurement error and is related to difficulty in replicating findings across samples" (p. 286).

The Epistemic Beliefs Inventory (EBI) used new items to better capture the original factor structure hypothesized by Schommer (Schraw, Bendixen, & Dunkle, 2002). The purpose for the development of this instrument was to create a valid and reliable self-report instrument to measure epistemology through generating items that fit unambiguously into the five dimensions hypothesized by Schommer (1990), preserving the Source of Knowledge factor. The five-factor structure was retained in some studies

(Bendixen, Schraw, & Dunkle, 1998; Schraw et al., 2002) while others find the five factor solution to be a poor fit (DeBacker et al., 2008; Nussbaum & Bendixen, 2003) Internal consistency coefficients for this study have been an improvement over the EQ but in some instances are moderate and in one study are uniformly below $\alpha = 0.70$ (DeBacker et al., 2008).

The Epistemological Beliefs Survey (EBS) retains the 63 original items developed by Schommer and adds to them items developed by Jehng et al. (1993), which results in an 80-item instrument. Efforts were made to find a factor structure that is more stable and clean (Wood & Kardash, 2002) than previous results. After exploratory factor analysis and an internal consistency analysis, 38 items were retained to measure five dimensions including Speed of Knowledge Acquisition and Structure of Knowledge, which have been realized previously and three unrealized dimensions including Knowledge Construction and Modification, Characteristics of Successful Students, and Attainability of Objective Truth. This five-dimension solution fits the data marginally well (DeBacker et al., 2008) and internal consistency ranged from $\alpha = 0.54$ to 0.74 in the original study. The internal consistency results are above what has been indicated for other instruments but are all below $\alpha = 0.80$ (DeBacker et al., 2008; Schommer-Aikins & Easter, 2006).

Relationships between Epistemology, Learning, and Related Outcomes

The relationship between personal epistemology and learning is firmly established and acknowledged by researchers in the field of personal epistemology (Hofer, 2004; Hofer & Pintrich, 1997; Michael P. Ryan, 1984; Schommer-Aikins & Easter, 2006;

Schommer, 1990). Epistemological beliefs that are more sophisticated are shown to be related to more favorable outcomes.

> In most studies more availing beliefs, that is beliefs in knowledge as complex, changing, justified by evidence, and gained by rational inquiry, are associated with better performances in school and academic learning contexts, while less availing beliefs in knowledge, such as simple, stable, mirroring the reality, and transmitted by authority, are associated with worse performances (Mason & Bromme, 2010, p. 2).

Beginning with Ryan in 1984, it is found that sophisticated epistemological beliefs are related to higher grades. In his study, he found that students with less sophisticated epistemological beliefs, who view knowledge as either right or wrong, have lower class grades and poorer reading comprehension. Conversely, he finds students with more sophisticated epistemological beliefs, who believe that knowledge is relative, tend to have higher class grades and better reading comprehension even when controlling for other factors such as aptitude and experience. These findings are supported by research, which indicates that less sophisticated epistemological beliefs are associated with drawing simple and absolute conclusions from texts (Schommer, 1990; Schraw et al., 2002; Wood & Kardash, 2002), sophisticated epistemological beliefs enhance learning (Schommer-Aikins & Easter, 2006), and sophisticated epistemological beliefs result in better grades (Schommer-Aikins et al., 2000).

In a study regarding epistemological beliefs and approaches to learning in a sample of students from Hong Kong, Chan (2002) finds evidence to support that

epistemology is related to learning approaches, motives, and strategies. These findings were supported through Pearson correlation analysis and Structural Equation Modeling (SEM). In relation to study approaches of surface and deep, Chan finds that unsophisticated epistemologies are positively related to Surface Approach ($r = 0.21$, $p < 0.001$) and sophisticated epistemologies are positively related to Deep Approach ($r = 0.22$, $p < 0.001$). The surface study approach is when a student studies with the intent to reproduce information to meet an external demand. A deep study approach incorporates the intent to understand the information. The relationship between epistemological beliefs and study motives and corresponding strategy is also investigated, and he reports that naïve epistemological beliefs are positively related to Surface Strategy ($r = 0.25$, $p < 0.001$) and Surface Motive ($r = 0.12$, $p < 0.05$) and sophisticated beliefs are related to Deep Motive ($r = 0.22$, $p < 0.001$) and Deep Strategy ($r = 0.17$, $p < 0.01$). In studying the causal relationship between epistemological beliefs and study approaches, SEM is employed and satisfactory goodness of fit was obtained (GFI = 0.98, AGFI = 0.90, RMSEA = 0.099). Chan finds that "Surface Approach is determined by the beliefs that ability to learn is innate and fixed, knowledge is handed down by authority or experts and that knowledge is certain and unchanging" (p. 44). Conversely, "Deep Approach is driven by the belief that learning requires effort and a process of understanding and integration, that knowledge is acquired through one's reasoning rather than handed down by authorities or experts" (p. 44).

Medical Knowledge and Epistemological Beliefs

Medical knowledge, based on medical evidence, is provisional, emergent, incomplete, constrained, collective, and asymmetric (Cornish & Gillespie, 2009; Upshur,

2000). People with naïve epistemological beliefs hold views about knowledge as simple and certain but at times, in the field of medicine, answers can be fluid and existing knowledge can change in light of new evidence. "This is a major barrier to both the public and professional dissemination of research evidence as there seems to be a dissonance between the actual evolution of scientific knowledge and the public's preconceptions about what medical science can provide" (Upshur, 2000, p. 94). Clinicians can be reluctant to change the way they practice as a result of evidence-based medicine, and this may restrict the information provided to patients by the provider. Moreover, policy and planning can also be slow to reflect the emerging and shifting base of medical knowledge. Whether medical knowledge is gained through evidence-based medicine which is fluid and changing as it is grounded in empirical science, or through oral tradition and narrative which is less fluid and changing, the practice of medicine is dynamic whether science or art.

Many patients do not have enough medical knowledge to make informed and responsible medical decisions. In preventative care, a lack of medical knowledge can result in behavior that may be detrimental, and when living with chronic illnesses, lack of medical knowledge results in increased morbidity and mortality (Bachmann et al., 2007). In a study consisting of 185 participants in Zurich, Switzerland, researchers found that patients lack the medical knowledge needed to make informed health care decisions. Twelve clinical experts defined the minimum medical knowledge needed to detect risks and symptoms of chronic obstructive pulmonary disease, HIV infection, heart attack, and stroke. A questionnaire was developed which is delivered in five minutes, and a score of 100% minimum medical knowledge would indicate that participants are able to identify

the risks and symptoms of the above medical conditions. No participants included in the study reached 100% minimum medical knowledge, and the mean proportion of minimum medical knowledge was 32% (95% CI) and the range of minimum medical knowledge was 0% to 72%. Those who have personally or professionally encountered the health conditions in the study only had marginally more medical knowledge than other segments of the population.

Medical knowledge has been shown to be related to shared decision-making (Dy, 2007; Heldal & Steinsbekk, 2009; Peek et al., 2009) and has been reported as a physician-related barrier to shared decision-making, which is the process by which people share information, participate in joint consensus building, and agree on a treatment plan (Peek et al., 2009). In the study by Peek et al., it was noted that having accurate medical knowledge would increase patients' comfort in discussing treatment options and participating in shared decision-making with their physician. In a review of the literature related to shared decision-making and the instruments used to measure this construct, it was indicated that for decision aids, the most commonly used measures were related to medical knowledge (Dy, 2007). Heldal and Steinsbekk (2009) find that how health care providers perceive their patients' ability to understand medical knowledge affects the shared decision-making process. This qualitative study was conducted to investigate how healthcare professionals relate to patients with different levels of knowledge and involvement in their disease and treatment. What was found in this research was that providers of healthcare typically group patients into four groups, passive, withdrawn, uncooperative and expert. The behaviors perceived by the providers formed the basis for relationships involving decision making. When it is perceived that

patients are informed about medical knowledge, or expert, patients are allowed to participate in shared decision-making. However, patients who were seen as withdrawn, passive, uncooperative, and not possessing medical knowledge were excluded from the shared decision-making process.

A patient's understanding of medical knowledge has consequences for information-seeking behavior (Baker & Pettigrew, 1999; Leydon et al., 2000; O'Leary, Estabrooks, Olson, & Cumming, 2007). Preferences of a person for format of knowledge, whether text or picture, can determine what method will be used in information-seeking (Baker & Pettigrew, 1999). In an analysis of the literature related to information-seeking of women facing surgical treatment for breast cancer, it was found that the level of comfort with medical knowledge, and the amount of medical knowledge possessed, dictated information-seeking behavior (O'Leary et al., 2007). Those more comfortable and possessing more medical knowledge sought information differently than those less comfortable and with less medical knowledge. In a qualitative study of 17 patients in an oncology treatment program, 11 patients with a limited understanding of medical knowledge expended little to no effort to obtain information related to their medical condition, with one of those patients reporting that information-seeking could be dangerous and make worse an already dire situation (Leydon et al., 2000). Female participants often sought knowledge of other patients over medical information and male participants often did not seek information from either source.

Given that medical knowledge is comprised of the varied resources and information collected by people in a wide variety of roles, and that the medical knowledge gained by patients is impacted by their health care providers, it is important to

consider the beliefs held by these individuals when considering medical knowledge as a complete domain (Upshur, 2000). The beliefs of health care providers related to medical knowledge have been explored in different stages of the providers' training as they become health care professionals. As such, in addition to the evidence related to medical knowledge from a patients' perspective presented above, reviewed below you will find results from studies related to beliefs about medical knowledge from providers as students and then practicing providers.

In an exploratory study using qualitative methods, asking semi-structured questions of medical students, Knight and Mattick (2006) found that related to medical knowledge, students report asynchronous differences between disciplinary domains, supporting the multidimensional theories of epistemology. However, they also found that the complexities of medical knowledge pose unique problems in describing transitions in epistemology. Medical knowledge is inherently uncertain and as such requires a "context-driven flexible approach to knowledge discovery and application" (Sturmberg & Martin, 2008, p. 767).

In a study that investigated the implications of Polanyi's tacit knowing and clinical medicine (Henry, 2010) the salient implications of decisions based on less sophisticated beliefs about medical knowledge is discussed and how reliance on quantifiable, right or wrong data restricts providers from incorporating beliefs patients may hold about medical knowledge. Again, the uncertainty that is prevalent in medical knowledge can lead some to adopt views that force a simplified approach to making medical decisions, ignoring the complexities that exist. Henry posits that:

> Recognizing tacit knowing in medicine will make it more difficult for clinicians to convince themselves that knotty problems in medical practice have simple solutions, but it will at least put them in a position to tackle these problems in the light of day rather than in the shadow of misleading epistemological ghosts. (p. 296)

Tacit knowing as introduced as a framework for epistemology which can accommodate various medical concepts included within and outside the scope of evidence based medicine refers to "those aspects of human knowledge that function subsidiarily and uspecifiably at the periphery of attention that make possible the conventional, more easily recognized explicit dimensions of human knowledge" (p. 188). Using an example given by Henry, tacit knowledge is apparent in ultrasonography where the practitioners "concentrate on what the sonogram shows rather than on how manipulating the ultrasound probe affects the image" (p. 189). There are times that the ability to complete a task is dependent on the person completing the task because there is a large dependency on the user's tacit knowledge.

Another consequence of tacit knowing is that "meaning is central to human knowing and that actions are not wholly separable from the motivations and thoughts of the people who perform them" (p. 190). Models that overlook tacit knowledge do not consider the differences between purposeful action and rote behavior. What this means is that if a physician only evaluates their patient as a machine and does not consider their thoughts and beliefs they hold, including those beliefs they hold about medical knowledge, they are not considering the whole of the patient. Clinicians are forced to look beyond the obvious and must incorporate tacit knowing, a sophisticated belief

system, to properly treat patients as individuals and not as a classic textbook case. If clinicians are faced with the need to incorporate more sophisticated epistemological beliefs to deal with the complexities of medical knowledge and how they treat their patients, it follows that patients accordingly need the ability to incorporate the difficult, and sometimes conflicting, task of making decisions based on medical knowledge.

Linkages are being found in relationship to information literacy, or the ability to locate, evaluate, and use information that has been identified as needed, and epistemology. As the Internet takes a more predominant role in higher education, scholars and librarians seek to incorporate the impact of this tool and how it impacts knowledge construction and information literacy (Swanson, 2006). The Internet provides a previously untapped source of information, and librarians and scholars are placed in a complex information world to navigate and from which to develop meaning.

Information is available through blogs, wikis, discussion boards, electronic academic libraries, and other untapped sources, and to search for information in these locations, users have a wide variety of search engines from which to choose. This places scholars, and in particular librarians, in a place to facilitate knowledge construction through increasing information literacy in those they serve. Prior to the 1990s, librarians did not consider issues of knowledge construction from these varied sources and are now calling for new approaches that establish knowledge construction as an underlying goal of the information navigation process. In furthering this work, Swanson (2006) notes,

> It is not enough to simply identify points where these areas intersect. Understanding the nature of this intersection will be required to have impact in

> the classroom and at the reference desk. The answers to these two questions could lead to a better understanding of the roles of librarians within the higher education curriculum. They could also lead to new and better pedagogical approaches for faculty and librarians. Finally, they could better link the internal processes involved with understanding knowledge to the external process of creating and sharing knowledge. (p. 107)

The benefits of understanding the relationship between information literacy and personal epistemology as suggested by Swanson (2006) may have an impact on the improvement of instruction and learning, thereby increasing information literacy in the students they serve. What has not been investigated is the link between information literacy and cognitive psychology that has been established in other areas relating to personal epistemology as covered earlier in this review of the literature.

Summary

Epistemology is the study of the nature of knowledge and is concerned with how people come to know, beliefs about knowledge, and how epistemology is an influence on cognition and reasoning. Research shows that sophisticated epistemological beliefs are associated with positive educational outcomes and has implications for the field of learning and educational pedagogy. Domain-specific epistemological beliefs have been indicated in the research associated with academic knowledge. As a fledging area of study that is receiving increased attention from scholars and researchers, the construct of epistemology is being refined and debates continue about defining epistemology. Epistemology is notoriously difficult to measure. Current instruments being utilized

measure different dimensions of epistemology, and psychometric inadequacies exist in reviewed measures of epistemology.

Given that sophisticated epistemological beliefs are associated with positive learning outcomes, that epistemology can be domain specific and that motivation to learn is associated with epistemology, it is surprising that there is limited research into the beliefs laypersons hold about medical knowledge. Shared decision-making is finding increasing attention in the medical literature as being related to positive health outcomes, and medical knowledge has been shown to be related to shared decision-making. Beliefs that people hold about medical knowledge have consequences not only for the shared decision-making but also for information-seeking behavior. Scholars have begun the study of laypersons' beliefs about medical knowledge, and recent publications have proposed promising new domain-specific measures of beliefs about medical knowledge. This research aims to further that progress by making efforts to improve upon the validity and reliability of that measure.

CHAPTER III

METHODOLOGY

In this study, a previously developed objective instrument of epistemological beliefs about medicine was modified specific to three identified limitations, namely additional items to distinguish between two theorized domains of epistemology of medical knowledge, additional items to measure the Justification of Knowledge domain, and continued investigation of the relationship between epistemology of medical knowledge and other health-related constructs, specifically health locus of control, and patients' perceived involvement in care. The study was divided into two phases. In the first phase, items from an existing measure of epistemological beliefs about medicine were modified specific to the Certainty of Knowledge, Structure of Knowledge, and Source of Knowledge domains. In addition, new items were developed for the Justification of Knowledge construct, which is specific to the theory guiding this research. These items were reviewed by content experts who assisted in improving items for this instrument. In the second phase, the instrument with the items identified by the content experts as best representing epistemological beliefs about medicine was used to gather data from study participants, and psychometric analysis was conducted to assess the validity and reliability of the instrument. These data were used to examine and

explain the relationship between epistemological beliefs about medicine, health locus of control, and patients' perceived involvement in care.

Phase I

The first sample of eight participants consisted of content experts in epistemology and medical knowledge. Two content experts in epistemology consisted of scholars with doctoral degrees who have conducted research in the field of epistemology and had either published dissertations related to the construct or have published results in scholarly peer-reviewed journals. One of these content experts is a professor at a large Midwestern university and is active in research within the field of Epistemology, academic service and teaching. The other Epistemological expert is a Coordinator of Research and Evaluation who received the doctoral degree in Educational Psychology with a focus on Research and Evaluation. The dissertation was specific to epistemology and they are currently active in the field of Epistemological research. Six content experts in medical knowledge were either allopathic or osteopathic physicians, a registered nurse currently licensed to practice medicine, or clinical psychologists. These medical experts work within a family medicine clinic at a large Midwestern university and are active in research, academic service and teaching. The allopathic and osteopathic physicians include a medical director of a family practice clinic, a residency program director and an associate program director. The clinical psychologists have active practices and are engaged in research interests. The research nurse coordinates research interests for the department within the university.

Procedure

Hambleton (1980) and Crocker and Algina (2008) provide a method for content validation that includes the following steps.

- Step 1: Defining the performance domain of interest.
- Step 2: Selecting a panel of qualified experts in the content domain.
- Step 3: Providing a structured framework for the process of matching items to the performance domain.
- Step 4: Collecting and summarizing the data from the matching process.

Items were taken from the DEBS-LMK and provided to Medical and Epistemological SMEs in efforts to improve the items and enable them to distinguish between the theorized domains of medical epistemology. Specifically, the items for the study dimensions of Certainty, Simplicity, and Source of Knowledge were the DEBS-LMK items with the most favorable psychometric properties as published (Barnes et al., 2012). Additional items were developed in collaboration with the Epistemological SMEs until a total of 20 items represented these study constructs. These 60 items were then subjected to the content validation methods outlined above. Utilizing the domain definitions as developed by Hofer for Certainty, Simplicity, and Source of Knowledge, a one-page informational sheet was developed which was to be utilized in interviews with Medical SMEs.

Initial one-on-one interviews were conducted with the Medical SMEs to introduce the domain definitions as covered in the information sheet, as described in Step 1. Also distributed to the Medical SMEs was the list of 60 items to be improved and subjected to

content validation. This introductory communication and information sheet is included as Appendix E. After reviewing the performance domain of interest and the items to be improved for the study, the Medical SMEs were asked to review the items over one week and indicate how they would improve these items to better represent the performance domain. At the end of that week, additional interviews were conducted with the Medical SMEs to review the modifications to the items. These recommendations were compiled and integrated into an updated list of potential MDEBS-LMK items.

These updated 60 items were then reviewed with two Epistemological SMEs in a focus group setting to review suggested changes by the Medical SMEs, construct items to measure the Justification of Knowledge domain, and to finalize item modifications. The four items to measure Justification of Knowledge included one item to indicate sources of medical knowledge, one item to rate the importance of each of those sources, one item indicating how likely they would be to utilize that source of information, and one item to rate how they would justify the information they accessed, such as if they accept it at face value or compare it with information from other sources. These four items were not included in the content validation process with the Medical SMEs. Recommendations from the Medical SMEs were reviewed, and modifications were suggested by the Epistemological SMEs to clarify the integration of the Medical SME item improvements. At the conclusion of this meeting, a final list of 60 items as modified by the Medical and Epistemological SMEs was developed for Step 3 of the content validation process.

Each SME received an electronic Qualtrics survey that included the 60 modified items. Qualtrics is a company that provides an online research suite of products including electronic surveys and data collection instruments, and students of the College of

Education at Oklahoma State University are provided access to this service. This electronic survey allowed the SMEs to first sort the items into the constructs which the items were developed to measure and then after sorting, rank the items according to how well the item represented the construct. For the sorting process, a column containing the list of modified items was presented in random order, and the SMEs were asked to drag and drop the item into one of three boxes, with each box representing either the Certainty, Simplicity, or Source of Knowledge domain. After the SMEs sorted each of the items into the content domain they believed the items were developed to measure, they were then asked to rearrange each list of items so that the top item best represented the domain and the last item least represented that domain. After the SMEs finished Step 4, the resulting data were analyzed, and this analysis is included in Chapter IV.

Phase II

The convenience sample for Phase II included personal and professional contacts of the researcher. Snowball methodology was utilized to expand the size of the sample. The goal of sampling was to achieve heterogeneity of age, gender, race and ethnicity, and educational attainment as these variables have been associated with differences in epistemological beliefs. For factor analysis, Gorsuch (2008) recommends a minimum of five responses per variable, with a minimum of 100 responses. Based on these recommendations, the goal sample size was 400 to 600 survey responses. Ethical guidelines were followed as outlined by the Oklahoma State University Institutional Review Board for the Protection of Human Subjects (Oklahoma State University, 2007). This research was approved by the IRB (Application No. ED11196.) Data collection

began in November 2011 and concluded in February 2012 when the minimum required sample of 400 was exceeded.

The sample consisted of 482 participants ranging in age from 18 to 74 with a mean age of 40.72 years. The sample was primarily female (63.5%) and white (75.3%). In educational attainment, 46.1% of the sample had a graduate degree, 19.3% an undergraduate degree, and 26.5% having high school to some college. Heterogeneity of the sample was not achieved due to the sample being primarily female and highly educated. The convenience sample was obtained by a recruitment email to potential participants who were personal and professional contacts. As a snowball sampling methodology was utilized, family, friends, and colleagues were asked to forward communication related to this research to their personal contacts, expanding the scope of possible research subjects.

Demographic Survey

A demographic questionnaire was completed by participants in Phase II of data collection. These participant questionnaires included questions related to age, gender, relationship status, race and ethnicity, level of education, employment and student status, medical training, and whether they have chronic health conditions.

Multidimensional Health Locus of Control Scales (MHLC)

The MHLC has been widely used in the literature and has been validated in different ethnic groups, ages, and education levels (Luszczynska & Schwarzer, 2005; Malcarne, Fernandez, & Flores, 2005; Moshki, Ghofranipour, Hajizadeh, & Azadfallah, 2007; Wallston & Wallston, 1978; Wallston, Wallston, & DeVellis, 1978; Wurtele,

Britcher, & Saslawsky, 1985). The MHLC has been used in research specific to epistemological beliefs about medical knowledge (Barnes et al., 2012). The basis for the instrument were the 11 items of the HLC, which was a unidimensional instrument for health locus of control (K. A. Wallston et al., 1978). New items were written to reflect a multidimensional conceptualization of health locus of control including internality, powerful others, and chance, resulting in 25 internal items, 30 powerful other items, and 26 chance items. These were written at a fifth to sixth grade reading level.

Two forms were developed, Form A and Form B, using six pairs of items for each of the dimensions (Wallston et al., 1978). Using a sample of 115, coefficient alpha reliability estimates ranged from 0.673 to 0.767, and when Form A and Form B were combined, coefficient alpha reliability estimates were 0.830 to 0.859. Form A, Form B, and Combined Form A and B scales were correlated with Levenson's I, P & C with alpha reliabilities from 0.508 to 0.733. In assessing predictive validity, health status positively correlated with internality ($r = 0.403$, $p < 0.01$), was negatively correlated with chance ($r = -0.275$, $p < 0.01$), and was not correlated with powerful others ($r = -0.055$).

Through continued use of the MHLC in health research, the authors have found that it does measure individual's health locus of control. However, to improve the psychometric properties of the instrument, the researchers have developed a Form C, which serves as an answer to needs in measuring health locus of control for generic health issues and which will be used in this study (Wallston, 2005; Wallston, Stein, & Smith, 1994). This scale was validated in a study of 273 participants, and the final 18-item scale resulted in a four-factor structure accounting for 57.6% of the total variance among the 18 items. The highest intercorrelation among the subscales was 0.31, which

accounted for less than 10% of the shared variance. Coefficient alpha reliability estimates ranged from 0.71 to 0.87.

To study the relationship between religious beliefs and health, an additional scale was developed consisting of six items and was named the God Locus of Health Control Scale (GLHC). These items were developed to be either utilized alone or in conjunction with the other forms of the MHLC scale. There are two versions of the GLHC, one based upon the belief that God controls health and one based on the belief that God controls change in a medical condition. These items will be included in this research, utilizing the version for the belief that God controls health in general.

Two studies were conducted using Form C, one in a sample of arthritis patients and one in a sample of chronic pain (Wallston et al., 1994). In the chronic pain sample, an intervention was utilized which allowed the researchers to assess construct validity of Form C. The intervention utilized was to increase internal locus of control and decrease external locus of control. The arthritis sample did not receive this intervention. Examination of the mean changes of subscale scores of both samples showed support for construct validity of Form C as the mean internality scores increased and mean externality scores decreased in the chronic pain sample [Internality, $t(104) = -5.10$, $p < 0.001$; Chance, $t(104) = 2.11$, $p < 0.04$, Doctors, $t(104) = 2.63$, $p < 0.01$; Others, $t(104) = 4.10.10$, $p < 0.001$)] with no significant change in the arthritis sample.

Patients' Perceived Involvement in Care Scale (PICS)

The PICS is a 13-item instrument rated on a binary agree/disagree format developed to examine three factors including doctor facilitation of patient involvement,

level of information exchange, and patient participation in decision making (Lerman et al., 1990). In the development of the instrument, 25 statements describing patient and physician behavior during an office visit were developed and were based on Lerman et al.'s observation of routine office visits. After these 25 items were developed, eight physicians reviewed them for content validity. These 25 items were administered to 131 study subjects. Following item analysis and item deletion, the remaining 13 items were administered to 31 patients to cross-validate preliminary findings. Following development of the instrument and cross-validation, the final version of the PICS was administered to 60 subjects to examine the relationship with patient satisfaction and another sample of 83 subjects to examine the relationship with illness attitudes.

The final 13-item version of the instrument had a coefficient alpha reliability estimate of 0.73 for the validation study using the sample of 131 participants. The sample of 81 subjects for the cross validation study yielded a coefficient alpha estimate of 0.60. The PICS has a unique advantage over other patient involvement scales in that it includes the factor of patient involvement in decision making. Other scales with more optimal coefficient alpha estimates include items developed to estimate the involvement of the patient based on physician influence (Martin, DiMatteo, & Lepper, 2001). Since the focus of this research is on patient involvement in decision making, and not on physician influence, the PICS was found to be the more appropriate choice as a measure of perceived involvement in care even with the lower coefficient alpha estimate of reliability.

Data Collection

Via electronic communication, potential participants were provided a copy of the IRB-approved informed consent form including their rights as participants, purpose of the study, procedures, risks and benefits, compensation, voluntary nature of the study, length of participation, confidentiality, and contact information in case they had any questions about the study or the process to participate. The participants were asked to print a copy of the consent form for their records. If the participant consented to be a participant in the survey, they electronically signed the consent form and proceeded to the survey questions. Research records were stored securely and all data was de-identified and stored on a password protected server. Access to research records on this electronic server was restricted to me and my advisor, Dr. Laura Barnes, as indicated on the IRB application. Statistical analyses were conducted utilizing Predictive Analytics SoftWare (PASW) Statistics 18, Release 18.0.0 (PASW) and IMB SPSS AMOS 19. The first step was item analysis conducted to assess item level properties, identifying any uncharacteristic variables that warranted further investigation as to appropriateness to include in further analysis. This was univariate analysis. Any items or variables that exceeded acceptable levels were excluded from further analyses. In the second step Confirmatory Factor Analysis (CFA) was conducted to test whether the data fit the hypothesized structure. In this second step, additional indices were considered related to multivariate normality, and those variables or items that exceeded acceptable levels were excluded from further analysis. Since the data were not appropriate for the theorized model, following the CFA, the third step was structural analysis of the MDEBS-LMK.

To complete the Exploratory Factor Analysis (EFA), the inter-item matrix was first visually inspected and then subjected to two statistical tests of sampling adequacy. Bartlett's test of sphericity is a statistical test of the hypothesis that the correlation matrix is an identity matrix, with significant values indicating that the correlation matrix is not an identity matrix. The Kaiser-Meyer-Olkin (KMO) test of sampling adequacy tests the shared inter-item variance to total variance, with the desired test statistic being .60 or greater for appropriate utilization of factor analysis. After the data were found appropriate for factor analysis, PAF analysis was utilized for structural analysis for the scales based upon arguments by Gorsuch (2008) that due to no assumption of error free measurement, this method of factor analysis is more appropriate for the data. In order to determine the number of factors to extract, results of the Kaiser criterion (Kaiser, 1958) and Cattell's scree plot (Cattell, 1966) were compared and the number of factors that best fit the theoretical model were retained. The Kaiser criterion states that any factor with an eigenvalue greater than 1.0 should be retained. Cattell's scree plot test is a visual inspection of a graph that shows the eigenvalues in descending order, with the highest eigenvalues to the left and the lowest eigenvalues to the right.

The fourth step was completed after exploratory factor analysis. The model that was developed was subjected to reliability analysis. In step five, the final step, discriminant and convergent validity were examined through studying the relationships among the MDEBS-LMK, PICS, and MHLOC scales using canonical correlation. Prior to canonical correlation, both the MHLOC and PICS scales were investigated using EFA to verify that the study data fit with results from previous research using those scales.

CHAPTER IV

RESULTS

In this chapter, the statistical analyses that were conducted to address the following research questions will be presented.

1. What are the psychometric properties of the Modified Domain-Specific Epistemological Beliefs Scale – Lay Medical Knowledge?
2. What is the nature of the relationships between epistemological beliefs about medicine, health locus of control, and desire to participate in health care?

Content Validation

As detailed in Chapter III, Hambleton (1980) and Crocker and Algina (2008) provide a method for content validation which includes the following steps.

- Step 1: Defining the performance domain of interest.
- Step 2: Selecting a panel of qualified experts in the content domain.
- Step 3: Providing a structured framework for the process of matching items to the performance domain.
- Step 4: Collecting and summarizing the data from the matching process.

Steps 1, 2, and 3 are detailed in Chapter III, and the results from Step 4 follow.

The results of the content validation process for the 30 items that comprise the MDEBS-LMK are presented in Table 1. Of the six participating medical SMEs, there were four complete responses to the electronic survey portion of the content validation process. The 30 items in the final version of the survey were decided upon in two stages. Of the items initially submitted to content validation for each domain, the items were sorted according to the level of agreement among the Medical SMEs. In the Level of Agreement column, agreement is indicated by a fraction with the number of Medical SMEs agreeing the item correctly represented the domain it was constructed to represent in the numerator and the total number of Medical SMEs who responded to the content validation survey in the denominator. A perfect agreement rating with all Medical SMEs agreeing the item represented the appropriate domain would be 4/4. A rating of perfect disagreement, or the items do not represent the domain, would be 0/4.

After the items were sorted according to level of agreement, the mean rankings over all 30 possible items among the Medical SMEs of how well the items represent the domains compared to the other items in the domain were reviewed. At this point, the top ten items for each domain were retained and utilized in the MDEBS-LMK. These 30 items comprise the MDEBS-LMK for the hypothesized domains of Source of Knowledge, Structure of Knowledge, and Certainty of Knowledge.

Table 1

DEBS-LMK Content Validation Item Agreement and Mean Rankings

Domain Item Number and Items	Level of Agreement	Mean Ranking
Source of Knowledge		
1. Following doctors' advice improves health...	2/4	7.00
2. Patients can learn as much as their doctor...	3/4	10.67
3. Medical information is too difficult to understand…	3/4	9.67
4. Doctors don't know everything about treating health ...	2/4	6.00
5. People should question their doctors' diagnosis ...	4/4	6.50
6. Medical information isn't that difficult to understand...	2/4	9.00
7. A person can't understand complex medical problems…	2/4	7.50
8. Medical information is too complex for untrained…	3/4	8.67
9. Patients don't know more than doctors about their own…	4/4	11.25
10. Patients can't teach their doctors anything new…	3/4	8.67
Certainty of Knowledge		
11. Doctors should not hold differing opinions about …	2/4	10.00
12. Medical truths are unchanging…	0/4	12.00
13. Medical knowledge is what is true…	1/4	10.67
14. The human body will always be a mystery...	1/4	14.00
15. There is usually more than one way to treat...	2/4	9.50
16. There is usually one best way to treat…	2/4	14.50
17. Doctors should not be creative in treating…	2/4	17.50

Table 1 Continued

DEBS-LMK Content Validation Item Agreement and Mean Rankings

18. Truth does not change …	1/4	6.67
19. Doctors should know whether a treatment works…	1/4	16.33
20. Medical science is a puzzle. You just …	2/4	10.50
Simplicity of Knowledge		
21. It is more important to know "what works" …	3/4	7.33
22. What is learned about one medical problem applies to …	3/4	8.67
23. Facts are more important than theories …	2/4	7.00
24. Medical science has too many theories …	3/4	9.67
25. Simple explanations are usually the best…	4/4	12.50
26. If doctors give the wrong diagnosis it is lack of facts…	1/4	8.00
27. If doctors had all the facts, they would treat most…	1/4	9.00
28. Just knowing that a treatment works isn't enough…	2/4	7.00
29. I would want my doctor to explain to me the reason…	0/4	0.00
30. Doctors should give the same medical treatment to all…	3/4	10.00

Note: Italicized items are reverse scored.

Justification of Knowledge

Four items in addition to the 30 reviewed above were developed in conjunction with Epistemological SMEs to measure the Justification of Knowledge domain with a list of possible sources of medical knowledge developed and presented in Table 2. These items were created to represent sources of Medical Knowledge a person could access and how a person rates the quality of the information gained from those sources. Using

knowledge of the domain, an initial list of 20 items for the Justification of Knowledge domain was developed prior to the SME review of items. The Medical SMEs reviewed the items for this domain alongside the review for the Certainty of Knowledge, Simplicity of Knowledge, and Source of Knowledge domains. Improvements for these items were suggested by the Medical SMEs; the suggestions were compiled and then reviewed with the Epistemological SMEs, Dr. Laura Barnes and Dr. Denna Wheeler. Upon review of these items with the Epistemological SMEs it was found that the individual items did not meet the needs to measure the number of sources, or variety of sources, that could be accessed in justifying medical knowledge. Four items were modified and prepared for the final version of the MDEBS-LMK. One question was developed to assess what sources of medical information a person would access if they were to have been diagnosed with a serious health condition. The second question was developed to assess how likely a person would be to access the sources of information identified in question one. The third question was developed so that a person could rank in order of importance the sources of information they identified as those they would access if they were diagnosed with a serious health condition. Finally, question four was developed to assess how the person would rate the quality of the information they accessed. Participants were asked the following finalized questions related to the sources of knowledge identified in Table 2.

1. Imagine you have just been diagnosed with a serious health condition. In regards to that health condition, mark all of the sources of information you would consult.
2. Imagine you have just been diagnosed with a serious health condition. Rate how likely you would be to consult the following sources for information about that condition.

3. Imagine you have just been diagnosed with a serious health condition. Rank each of the sources you may go to for information about that condition in order of importance by dragging your most important source to the top of the list assigning it to position 1. Then drag your 2nd most important source to the next spot, and so on until you rank all the sources listed below.
4. Considering the information you have consulted in regards to your imagined health condition, mark below how you rate the quality of this information?
    a. Take the obtained medical knowledge at face value.
    b. Compare the information from various sources.
    c. Utilize the information that best makes sense to them.
    d. Utilize the information which feels right to them.
    e. Do not evaluate any of the information because it is too confusing.
    f. Review the information with trusted sources.
    g. Just think about the information.

Table 2

Sources for Justification of Knowledge

Source
Alternative Practitioner
Book, Magazine, Articles
Family Member
Friend
God
Medical Doctor

Table 2 Continued

Sources for Justification of Knowledge

No One
Nurse
Other Person with Condition
Pastor, Priest, Rabbi, Imam, or Other Spiritual Authority
Pharmacist
Physician's Assistant or Nurse Practitioner
Radio/TV
Reputable Internet Site (WebMD, Professional Association Sites, etc.)
Self
Support Group
Other

The final version of the instrument after content validation was comprised of 34 items: 10 items for Certainty of Knowledge, 10 items for Simplicity of Knowledge, 10 items for Source of Knowledge, and four items for Justification of Knowledge. The final version of the instrument is presented in Appendix A.

Participants

Table 3 contains descriptive statistics of subjects who comprise the study sample. There were initially 588 responses to the survey. After responses with more than 10% missing data were deleted, the sample consisted of 482 participants ranging in age from

18 to 74 with a mean age of 40.72 years. Heterogeneity of the sample was not achieved due to the sample being primarily female and highly educated.

Table 3

Demographic Variable Frequencies and Percentages

Demographic Variable		Frequency	Percentage
Age	<= 30	166	34.3
	31 - 40	63	13.0
	41 - 50	52	10.7
	51 - 60	55	11.4
	61+	27	5.6
Gender	Male	141	29.1
	Female	341	70.5
Relationship	Married	211	43.6
	Partnered	70	14.5
	Single	184	38.0
	Other	18	3.7
Race	Amer. Ind./Alaska Nat.	40	8.3
	Asian	7	1.4
	Black or Af. Amer.	25	5.2
	Hispanic	14	2.9
	White	391	80.8
	Other	2	.4

Table 3 Continued

Demographic Variable Frequencies and Percentages

Education	HS Diploma/GED	14	2.9
	Some College	126	26.0
	Associate Degree	32	6.6
	Undergrad. Degree	117	24.2
	Grad./Prof. Degree	194	40.1
Employee/	Full-time Employee	218	45.0
Student	Part-time Employee	39	8.1
	Full-time Student	64	13.2
	Part-time Student	7	1.4
	Employee/Student	96	19.8
	Unemployed	56	11.6
Medical Condition	Yes	100	20.7
	No	380	78.5

Item Analysis

Item analysis was conducted to assess individual item level properties of the MDEBS-LMK scale. Descriptive statistics were first computed to investigate item means, standard deviations, skewness, and kurtosis. These descriptive statistics are presented in Table 4. From this table, items that displayed properties that were uncharacteristic when compared with other items were considered for further analysis.

Table 4

MDEBS-LMK Items Descriptive Statistics

Domain and Domain Items	Mean	SD	Skewness	Kurtosis
Source of Knowledge				
Following doctors' advice improves health...	4.17	.980	-.672	.885
Patients can learn as much as their doctor...	3.20	1.290	.256	-.604
Medical information is too difficult to understand…	3.86	1.162	-.368	-.417
Doctors don't know everything about treating health ...	2.23	1.109	1.160	1.586
People should question their doctors' diagnosis ...	1.93	1.087	1.321	1.660
Medical information isn't that difficult to understand…	3.78	1.200	-.103	-.652
A person can't understand complex medical problems…	2.69	1.216	.650	-.005
Medical information is too complex for untrained…	3.06	1.208	.292	-.598
Patients don't know more than doctors about their own…	3.32	1.206	.075	-.381
Patients can't teach their doctors anything new…	2.22	1.098	.964	1.007
Certainty of Knowledge				
Doctors should not hold differing opinions about …	3.16	1.129	.221	-.566
Medical truths are unchanging…	2.51	1.124	.466	-.411
Medical knowledge is what is true…	3.56	1.217	-.230	-.474
The human body will always be a mystery...	3.19	1.347	.316	-.694
There is usually more than one way to treat...	2.10	.857	.983	2.195
There is usually one best way to treat…	2.67	1.166	.443	-.433
Doctors should not be creative in treating…	2.66	1.199	.523	-.227
Truth does not change …	2.47	1.271	.748	-.042
Doctors should know whether a treatment works…	3.87	1.140	-.283	-.402
Medical science is a puzzle. You just …	3.92	1.120	-.379	-.191
Simplicity of Knowledge				
It is more important to know "what works" …	3.08	1.262	.064	-.735

Table 4 Continued

MDEBS-LMK Items Descriptive Statistics

What is learned about one medical problem applies to …	4.12	1.155	-.728	.574
Facts are more important than theories …	3.94	1.068	-.309	-.192
Medical science has too many theories …	3.06	1.030	.147	-.117
Simple explanations are usually the best…	3.98	1.180	-.343	-.248
If doctors give the wrong diagnosis it is lack of facts…	3.29	1.142	.140	-.381
If doctors had all the facts, they would treat most…	3.92	1.152	-.387	-.425
Just knowing that a treatment works isn't enough…	2.37	1.084	.735	.234
I would want my doctor to explain to me the reason…	1.48	.787	2.386	8.229
Doctors should give the same medical treatment to all…	2.31	1.237	.984	.518

Note: Italicized items are reverse scored.

Bivariate correlations between the items were produced and are presented in Appendix D. Three item-pairs produced correlations above 0.40, Item 3 and Item 8 (r = 0.41), Item 7 and Item 8 (r = 0.47), and Item 12 and Item 18 (r = 0.53). Item 3 is related to difficulty in understanding medical information, and Item 8 is related to complexity of medical knowledge. Although these items share moderate correlations, they are conceptually unique and will therefore be retained for analysis. Item 7 is related to the complexity of medical knowledge and is conceptually very similar to Item 8. Item 7 has greater skew (0.29) and will be deleted from further analysis. Item 12 and Item 18 are both related to the enduring truth of medical knowledge and upon closer inspection of the items are worded similarly enough to warrant deletion of one item. Item 12 is "Medical truths are generally unchanging" and Item 18 is "Truth does not change in medical science". Item 18 has greater skewness (0.75) and will be deleted from further analysis.

Of the remaining items, only Item 29 has properties that indicate a departure from normality. This item, "I would want my doctor to explain to me the reason behind a treatment," has positive skewness of 2.386, a mean of 1.48, and a standard deviation of .787. Both the mean and standard deviation indicate a lack of variance in this item, which was visually confirmed by a histogram. While these properties do indicate a departure for normality, the minimal severity does not warrant deletion (Curran, West, & Finch, 1996). Further, the item itself does contribute a conceptual understanding that is not present in any other items. Even though this item has little variance, it will be retained for analysis due to the conceptual contribution this item makes which is not present in other items.

Confirmatory Factor Analysis of the MDEBS-LMK

A CFA was conducted using AMOS version 19 with structural equation modeling on the hypothesized model using items developed by the SMEs as indicated in Appendix F. (Items 7 and 18 were removed as indicated in the item analysis.) Data for the CFA included participant responses to the MDEBS-LMK items related to the constructs of Source of Knowledge, Certainty of Knowledge, and Structure of Knowledge. Records with any missing data were deleted from the full sample of 482 responses, resulting in a final sample of 430 included in the analysis. Goodness of fit measures varied in how appropriate the data are for the hypothesized model, from very poor (CFI) to marginal (RMSEA). This analysis suggests that the hypothesized model may be a poor fit for the data based upon the goodness of fit measures.

AMOS version 19 provides additional tests of normality, and these were utilized in addition to the assessment of normality completed in the item analysis. The sample

was assessed by first identifying variables with kurtosis greater than 3.0, and then identifying individual responses that were multivariate outliers at a significance level of less than 0.01 (Curran et al., 1996; Hooper, Coughlan, & Mullen, 2008). Item 29, "I would want my doctor to explain to me the reason behind a treatment," was identified with kurtosis > 3.0 and was removed from the analysis. Thirty-one responses were multivariate outliers ($p < .01$) and were subsequently removed from the analysis, resulting in a final sample of 399. Maximum likelihood parameter estimation procedures were then appropriate for the analysis due to normal distribution of the data (Kline, 2005). The CMIN/DF is 3.58, CFI is .51, RMR is .21, and the RMSEA is .08 (CI .076, 0.085). Suggestions for cutoff criteria for these fit indices are ≤ 2 for the CMIN/DF, ≥ .95 for CFI, 0 as perfect fit for RMR and < .06 to .08 for RMSEA (Hooper et al., 2008). While these cutoff criteria are not absolute, they do suggest that the data may be a poor fit for the hypothesized model.

Structural Analysis of the MDEBS-LMK

Because of the failure of the CFA to confirm the theoretical structure of the MDEBS-LMK, the data were subjected to exploratory factor analysis. Responses to the remaining 27 items representing the constructs of Source, Certainty, and Simplicity of Knowledge were subjected to PAF analysis. First, the inter-item correlation matrix was inspected and values ranged in absolute magnitude from .003 to .467. To further verify that the inter-item correlation matrix was suitable for factor analysis, KMO and Bartlett's test of sphericity were utilized. KMO was .79 and Bartlett's test of sphericity was significant [χ^2 (351) = 2179.30; $p < .001$]. These results indicate that the inter-item correlation matrix was appropriate for factor analysis.

During PAF, two criteria were compared to determine the number of factors to extract including the Kaiser criterion and Cattell's scree plot. Eight eigenvalues were found to be greater than one, which accounted for 35.7% of the total variance. The scree plot appeared to indicate a three-factor solution. An eight-factor solution is not supported by the theoretical structure of the scale. However, the three-factor solution as shown in Figure 2 does fit the hypothesized nature of the construct and this three-factor solution was extracted and obliquely rotated using Direct Oblimin for interpretation.

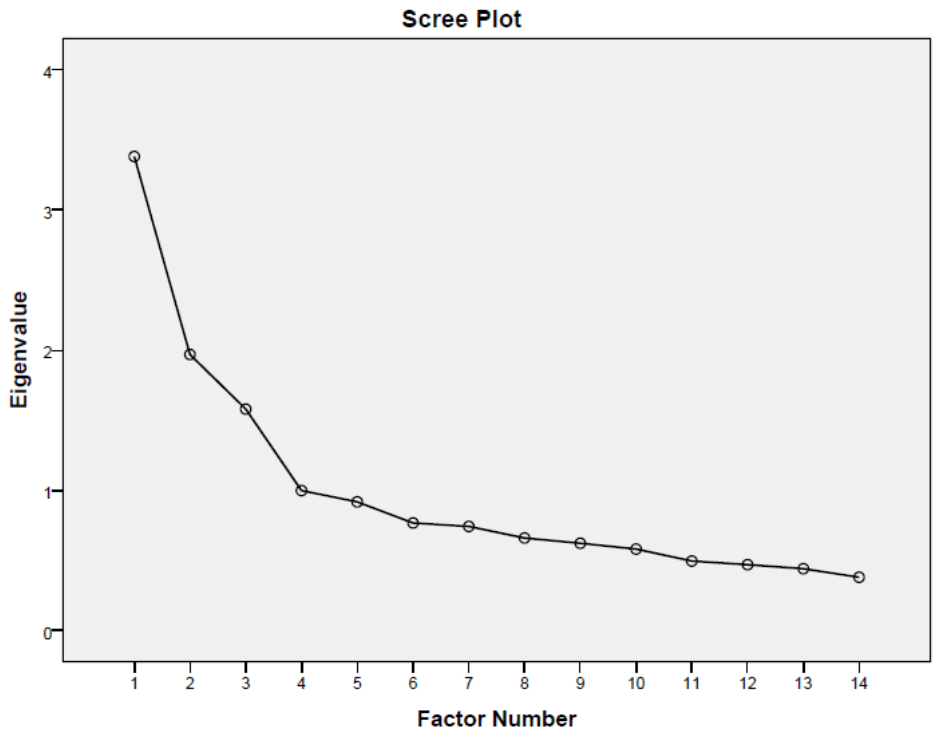

Figure 2. MDEBS-LMK Three Factor Solution Scree Plot

The rotated three-factor solution accounted for 24.0% of the total variance, with Factor 1 accounting for 13.5 % of the total variance (λ = 3.7), Factor 2 accounting for 6.2% of the total variance (λ = 1.7), and Factor 3 accounting for 4.2% of the total

variance (λ = 1.2). Structure coefficients and communalities for these three factors and items for the scale are presented in Table 5.

Table 5

MDEBS-LMK Structure and Pattern Coefficients and Communalities

	Factor			
	1	2	3	h^2
Medical truths are unchanging…	**.60 (.62)**	.11 (.17)	.04 (-.06)	**.39**
There is usually more than one way to treat…	**.54 (.56)**	.11 (.17)	.11 (.01)	**.32**
Doctors should give the same medical treatment to all…	**.51 (.52)**	-.00 (.05)	.09 (.01)	**.27**
If doctors give the wrong diagnosis it is lack of facts…	**.50 (.51)**	-.20 (-.13)	-.10 (-.16)	**.30**
Patients can't teach their doctors anything new…	**.50 (.51)**	.26 (.30)	.20 (.10)	**.35**
If doctors had all the facts, they would treat most…	**.47 (.43)**	-.24 (-.21)	.18 (.14)	**.28**
Medical knowledge is what is true…	**.47 (.45)**	-.08 (-.05)	.15 (.09)	**.23**
Doctors should not be creative in treating…	**.42 (.43)**	.14 (.17)	.14 (.07)	**.21**
Medical science is a puzzle. You just …	**.42 (.39)**	-.32 (-.28)	.02 (-.10)	**.26**
Facts are more important than theories …	**.40 (.40)**	-.15 (-.11)	.01 (-.04)	**.18**
Following doctors' advice improves health...	.39 (.35)	-.10 (-.10)	.32 (.28)	.23
Doctors should know whether a treatment works…	.37 (.36)	-.18 (-.15)	.04 (.01)	.16
Medical science has too many theories …	.35 (.37)	-.22 (-.16)	-.19 (-.23)	.21
It is more important to know "what works" …	.32 (.33)	.03 (.07)	.03 (-.03)	.11
Simple explanations are usually the best…	.30 (.25)	-.25 (-.25)	.19 (.18)	.17
There is usually more than one way to treat…	.16 (.20)	**.52 (.53)**	.14 (.06)	**.32**
People should question their doctors' diagnosis …	.22 (.27)	**.51 (.53)**	.17 (.07)	**.34**
Doctors don't know everything about treating health …	.28 (.31)	**.41 (.43)**	.14 (.05)	**.27**
Doctors should not hold differing opinions about …	.27 (.29)	-.28 (-.22)	-.26 (-.28)	.21
Just knowing that a treatment works isn't enough...	-.08 (-.06)	.25 (.24)	.03 (.01)	.07

Table 5 Continued

MDEBS-LMK Structure and Pattern Coefficients and Communalities

What is learned about one medical problem applies to …	.09 (.07)	-.24 (-.23)	.09 (-.02)	.06
The human body will always be a mystery…	-.11 (-.08)	.24 (.24)	-.07 (-.09)	.07
Medical information is too difficult to understand…	.20 (.09)	-.28 (-.32)	**.51 (.53)**	**.38**
A person can't understand complex medical problems…	.39 (.32)	-.06 (-.07)	**.49 (.45)**	**.35**
Medical information isn't that difficult to understand…	-.13 (-.20)	.06 (-.01)	**.45 (.48)**	**.24**
Patients can learn as much as their doctor...	-.00 (-.05)	.19 (.15)	**.42 (.41)**	**.20**
Patients don't know more than doctors about their…	.33 (.30)	.22 (.21)	**.42 (.36)**	**.29**
Eigenvalue	3.38	1.97	1.58	
Percentage of Variance	24.15	14.06	11.28	
Sum of Squared Loadings	19.84	9.60	6.71	

Note: Factor 1: Simple/Certain. Factor 2: Questioning. Factor 3: Omniscient Authority. Coefficients in parentheses are pattern coefficients. Only bold items are included in the scale. Italicized items are reverse scored.

Items with structure coefficients greater than .40 were retained for the analysis. The first factor is interpreted as Simple/Certain. Of the 10 items that loaded onto this factor, five were developed for the Certainty of Knowledge domain, four were developed for the Simplicity of Knowledge domain and one was developed for the Source of Knowledge domain. Participants who agreed with this factor believe that medical truths are absolute and certain and those who disagree with the factor believe that medical truths are less absolute. Participants who agreed with the Simplicity of Knowledge items believe that in order for doctors to properly diagnose patients, they need all the facts and that diagnoses should be the same across all patients if they have the same problem. People who agree with the items on the Certainty of Knowledge factor believe that

medical knowledge is absolute and certain, and that this knowledge is made up of isolated knowable facts. When combining the items from both hypothesized factors to the factor that was realized in this study, people who disagree with this factor believe that medical knowledge is tentative and evolving, and that it comprises interrelated concepts. The coefficient alpha estimate of internal reliability ($\alpha = 0.77$) would not substantially increase through the deletion of any items, therefore all sixteen items were retained for this factor. People who agree with this factor believe that knowledge is both certain and simple. In other words, they believe that knowledge is absolutely certain and that it comprises isolated and knowable facts.

Factor two is interpreted as Questioning. The items that loaded onto this factor were developed for Source of Knowledge and Certainty of Knowledge domains but loaded onto this individual factor. People who agree with these statements have a desire to question the medical decision-making process. The coefficient alpha estimate of internal reliability ($\alpha = .61$) would not substantially increase through the deletion of any items, therefore all three items were retained for this factor. For the remainder of this analysis, the reverse scored items will be used for this factor. Therefore, people who agree with this factor are those who believe that one should not question a doctor's treatment decision, believe that doctors know everything about health conditions, and do not want a reason behind a treatment explained to them.

Factor three is interpreted as Omniscient Authority, and items that loaded onto this factor were developed for the Source of Knowledge domain. This factor was named Omniscient Authority as opposed to Source of Knowledge because the items reflect the belief that an outside authority of medical knowledge, a medical omniscient authority,

holds all of the knowledge which a layperson is unable to understand. All five items that comprise this domain were developed for the factor for which the items loaded. Participants who agreed with these items believe that only those with medical training (omniscient authority) can understand this complex knowledge domain, and that they need to follow a doctor's advice to be healthy. The coefficient alpha estimate of internal reliability ($\alpha = 0.58$) would not substantially increase through the deletion of any items, therefore all five items were retained for this factor. The final version of this factor contained two reverse scored items. People who agree with this factor feel that doctors and physicians are the ultimate holders of medical knowledge. Scale properties are summarized in Table 6.

Table 6

Scale Summary Statistics

	Mean	SD	N	α
Simple Certain	31.0	6.35	10	.75
Questioning	6.3	2.30	3	.61
Omniscient Authority	17.2	3.71	5	.58

The relationship between the factors was explored through bivariate correlations. Simple/Certain is positively correlated with Questioning items ($r = 0.28$, $p < .01$) and is also positively correlated with Omniscient Authority ($r = 0.27$, $p < .01$). These low but positive correlations would suggest that people who believe that medical knowledge is simple and certain, and that doctors are the holders of medical knowledge, have a

tendency to not question doctors' diagnoses or treatment options and do not endeavor to participate in the medical decision-making process. People who believe that medical knowledge is tentative and composed of interrelated pieces of information, and co-create knowledge with experts, may be somewhat more likely to question doctors' diagnoses and treatment decisions and endeavor to participate in the medical decision-making process.

Participants were asked to indicate which sources of knowledge they accessed to obtain medical knowledge, and this number of sources of information accessed was summed and was used as a crude measure of information-seeking behavior. The number of sources of medical knowledge accessed was negatively correlated ($r = -0.14$, $p < .01$) with the Questioning factor. This suggests that participants who do not question doctors' medical decisions access fewer sources of medical knowledge than those participants who do question doctors' medical decisions.

Participants indicated how they justified medical knowledge such as if they compare the information from different sources or if they do not evaluate the information because it is too confusing for them. These items were measured by likert-scale items on a six point scale with higher ratings indicating agreement with the item, such as higher scores indicating that this choice is very likely or that higher scores indicate this item is most like me. Participants who believe that medical knowledge is certain and simple may not compare information from different sources ($r = -0.20$, $p < .01$) and also may not evaluate the information because it is too confusing ($r = 0.35$, $p < .01$). Participants who do not question their doctors' choices for health care and who do not want to be involved in the medical decision-making process may not compare information from different

sources (r = -0.36, p < .01) and may not evaluate information because it is too confusing (r = 0.27, p < .01). Finally, participants who feel that doctors are the authority from which they should obtain medical knowledge may not compare information from different sources (r = 0.13, p < .01) and may not evaluate medical information because it is too confusing (r = 0.27, p < .01). Correlations between the justification of knowledge items and the factors comprising the MDEBS-LMK are found in Table 7. These correlations are moderate to low correlations, suggesting a relationship among the variables of interest. However, the magnitude also suggests that much of the variance in information seeking is unexplained in this study.

Table 7

Correlations Between MDEB-LMK Factors and Justification of Knowledge Items

Factor	**Simple Certain**	**Questioning**	**Omniscient Authority**
Take the information at face value because I trust the source(s).	.30	.15	.14
Compare the information from different sources.	**-.20**	**-.36**	**-.13**
Go with the information that makes the most sense to me.	.00	-.18	-.12
Go with the information that feels right to me.	.01	-.11	-.07
I don't evaluate the information because it is too confusing.	**.35**	**.27**	**.27**
Talk the information over with my sources.	-.08	-.22	-.04
Just think about the information.	.04	.07	.03

Note: Significant correlations are bold.

Structural Analysis of the MHLC

Structural analysis of the 24-item MHLC scale began with PAF. First, the inter-item correlation matrix was inspected, and values ranged in absolute magnitude from .00 to .90. The highest correlations were among the four items that comprise the God Subscale, with absolute values ranging from .80 to .90. To further verify that the inter-item correlation matrix was suitable for factor analysis, KMO and Bartlett's test of sphericity were utilized. KMO was .872 and Bartlett's test of sphericity was significant [χ^2 (276) = 6072.1; $p < .001$]. These results indicate that the inter-item correlation matrix was appropriate for factor analysis.

During PAF, two criteria were compared to determine the number of factors to extract: the Kaiser criterion and Cattell's scree plot. Five eigenvalues were found to be greater than one, which accounted for 53.1% of the total variance. The scree plot included as Figure 3 appeared to indicate a four- or five-factor solution. While the five-factor solution is supported by the theoretical structure of the scale, both four- and five-factor solutions were rotated with Direct Oblimin and compared for appropriateness of interpretation. The four-factor solution accounted for 50.0% of the total variance, with Factor 1 accounting for 25.1% of the total variance (λ = 6.0), Factor 2 accounting for 11.0% of the total variance (λ = 2.6), Factor 3 accounting for 8.4% of the total variance (λ = 2.0), and Factor 4 accounting for 5.5% of the total variance (λ = 1.3). The items loaded onto factors mostly as theorized. However, some items from the Powerful Others subscale loaded onto the Chance subscale.

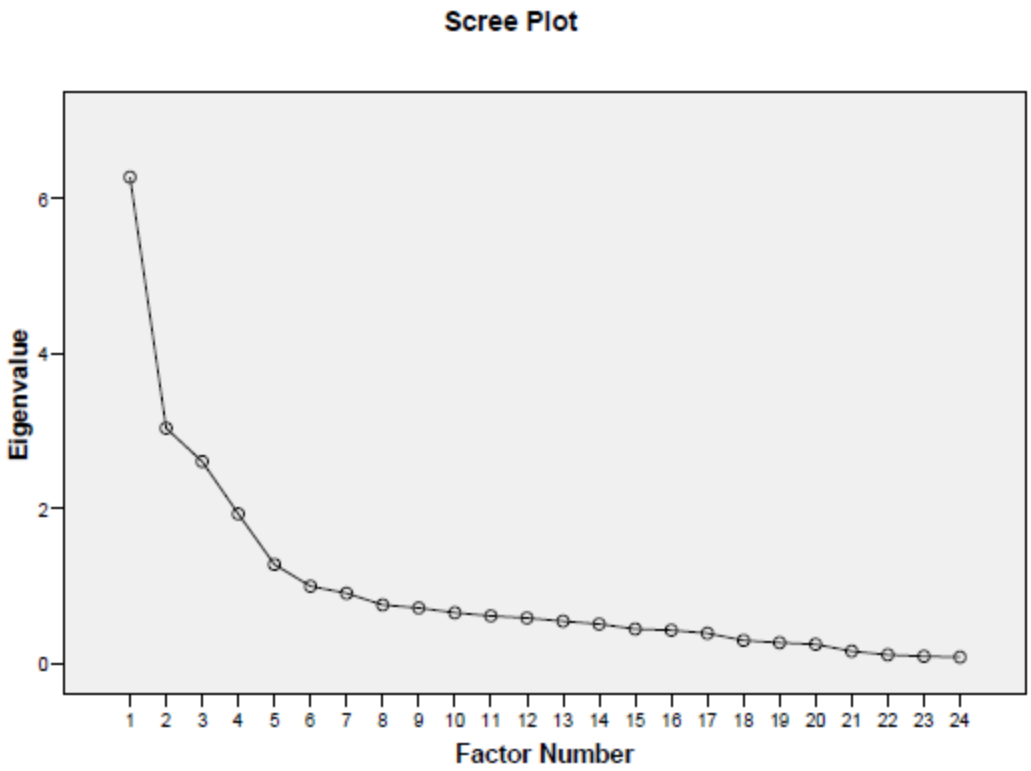

Figure 3. MHLC Five Factor Solution Scree Plot

The five-factor solution accounted for 53.1% of the total variance, with Factor 1 accounting for 25.1% of the total variance (λ = 6.0), Factor 2 accounting for 11.1% of the total variance (λ = 2.7), Factor 3 accounting for 8.4% of the total variance (λ = 2.0), Factor 4 accounting for 5.6% of the total variance (λ = 1.3), and Factor 5 accounting for 2.8% of the total variance (λ = 0.7). All items loaded as theorized onto these five factors, with structure coefficients ranging from 0.96 to 0.33. Structure coefficients and communalities are presented in Table 8.

Table 8

MHLC Structure Coefficients and Communalities

	God	Chance	Int.	Doc.	PO	h^2
Whether or not my condition…	.95 (.96)					.91
God is in control of my …	.92 (.95)					.85
Whatever happens to …	.92 (.94)					.85
God is directly …	.91 (.90)					.83
Most things that affect …	.91 (.89)					.83
If my condition worsens…	.91 (.89)					.82
Whatever improvement …		.81 (.77)				.68
If I am lucky, my condition …		.80 (.85)				.67
If my condition worsens…		.79 (.76)				.63
Luck plays a big part …		.74 (.76)				.59
Most things that …		.53 (.45)				.31
As to my condition, what will …		.40 (.33)				.25
I deserve the credit when …			.70 (.68)			.49
Whatever goes wrong with …			.63 (.64)			.46
I am directly responsible for …			.58 (.56)			.40
If my condition takes a turn …			.54 (.52)			.33
If my condition worsens, it is …			.49 (.49)			.24
The main thing which affects …			.48 (.50)			.32
Whenever my condition worsens…				.68 (.68)		.50
Following doctor's orders to …				.59 (.59)		.37
If I see my doctor regularly…				.56 (.56)		.34
The type of help I receive from…					-.63 (-.64)	.40
In order for my condition …					-.59 (-.53)	.43
Other people play a big role…					-.49 (-.44)	.26

Table 8 Continued

MHLC Structure Coefficients and Communalities

	God	Chance	Int.	Doc.	PO	h^2
Eigenvalue	6.28	3.04	2.61	1.93	1.28	
Percentage of Variance	26.17	12.67	10.87	8.06	5.34	
Sums of Squared Loadings	6.03	2.66	2.02	1.35	.68	

Note: Coefficients in parentheses are pattern coefficients.

These five scales and their respective items were subjected to reliability analysis. The God scale, comprised of six items, had an internal consistency reliability estimate of 0.97. The Chance scale, comprised of six items, had an internal consistency reliability estimate of 0.83. The Internal scale, comprised of six items, had an internal consistency reliability estimate of 0.73. The Doctor scale, comprised of three items, had an internal consistency reliability estimate of 0.64. The Powerful Others scale, comprised of three items, had an internal consistency reliability estimate of 0.58. The overall coefficient alpha of the 24-item MHLC scale was 0.85 which is comparable, but higher, than other reported coefficients of internal reliability reported in other research. The MHLC has been used in hundreds of studies with coefficient alphas reported in the range of .60 to .75, but at times as high as .86 (B. D. Wallston & Wallston, 1978; K. A. Wallston, Wallston, & DeVellis, 1978). There would be no substantial gain in coefficient alpha through deletion of any items with low inter-item correlations. Therefore, no items were deleted from any of the subscales or overall MHLC scale.

Structural Analysis of the PICS

Structural analysis of the 13-item PICS scale began with PAF. First, the inter-item correlation matrix was inspected and values ranged in absolute magnitude from .00 to .53. To further verify that the inter-item correlation matrix was suitable for factor analysis, KMO and Bartlett's test of sphericity were utilized. KMO was .785 and Bartlett's test of sphericity was significant [χ^2 (78) = 1264.5; $p < .001$]. These results indicate that the inter-item correlation matrix was appropriate for factor analysis.

During PAF, two criteria were compared to determine the number of factors to extract including the Kaiser criterion and Cattell's scree plot. Three eigenvalues were found to be greater than one, which accounted for 37.4% of the total variance. The scree plot included in Figure 4 appeared to indicate a three-factor solution as well. This matches the three-factor solution supported by the theoretical structure of the scale.

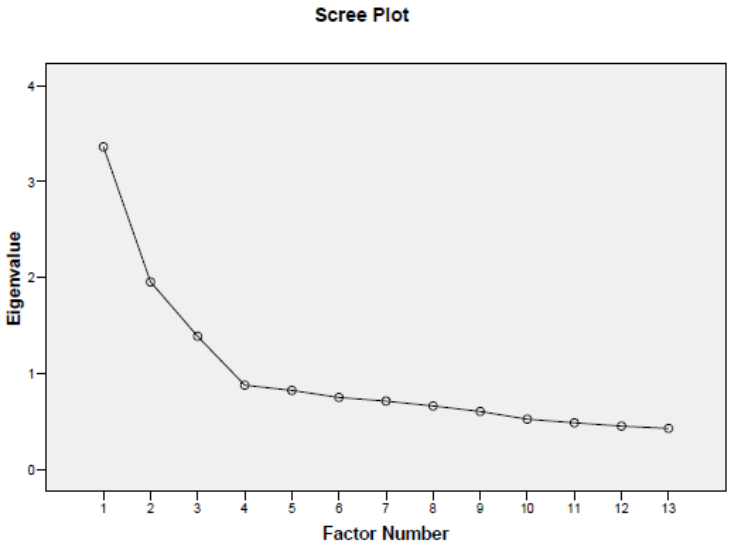

Figure 4. PICS Three Factor Solution Scree Plot

The three-factor solution was extracted and rotated with Direct Oblimin, and this solution accounted for 37.4% of the total variance, with Factor 1 accounting for 21.2% of the total variance (λ = 2.7), Factor 2 accounting for 10.3% of the total variance (λ = 1.3), and Factor 3 accounting for 5.8% of the total variance (λ = 0.8). The items loaded onto factors as theorized. Structure coefficients and communalities are presented in Table 9.

Table 9

PICS Structure Coefficients and Communalities

	Patient Info.	Doctor Facilitation	Decision Making	h^2
I asked my doctor a lot of questions …	.72 (.71)			.52
I asked my doctor to explain the …	.61 (.63)			.38
I asked my doctor for recommendation …	.56 (.55)			.32
I went into great detail about my medical…	.54 (.51)			.30
Doctor encouraged me to give my opinion…		-.75 (-.75)		.58
My doctor asked me whether I agree with …		-.65 (-.65)		.43
My doctor encouraged me to talk about …		-.64 (-.63)		.42
My doctor asked me what I believe is …		-.58 (-.58)		.33
Doctor gave me a complete explanation …		-.51 (-.51)		.26
I insisted on a particular kind of test …			.62 (.65)	.39
I suggested a certain kind of medical …			.60 (.60)	.37
I gave my opinion about the types of tests …			.52 (.43)	.36
I expressed doubts about the tests …			.46 (.44)	.22
Eigenvalue	3.36	1.95	1.39	
Percentage of Variance	25.9	15.0	10.7	
Sums of Squared Loadings	2.76	1.34	.76	

Note: Coefficients in parentheses are pattern coefficients.

These three scales and their respective items were subjected to reliability analysis. The Patient Information scale, comprised of four items, had an internal consistency reliability estimate of 0.70. The Doctor Facilitation scale, comprised of five items, had an internal consistency reliability estimate of 0.76. The Patient Decision-Making scale, comprised of four items, had an internal consistency reliability estimate of 0.63. The overall coefficient alpha of the 13-item PICS scale was 0.76. There would be no substantial gain in coefficient alpha through deletion of any items with low inter-item correlations. Therefore, no items were deleted from any subscale or overall PICS scale.

Relationship with Health Locus of Control

Canonical correlation was performed to explore the relationship between epistemology of medical knowledge and health locus of control. Variables included in the analysis were factor scores from the MDEBS-LMK for Simple/Certain, Questioning, and Source of Knowledge. Factor scores from the MHLC for the factors of Internal, Chance, Powerful Others, Doctors, and God were included.

Three canonical variates were possible, but only the first two variates were found to be significant. With all three variates entered into the analysis, the results were significant, χ^2 (15) = 153.9, $p < .001$ (Canonical $R^2 = 0.26$). With the first variate removed, the results were significant, χ^2 (8) = 27.6, $p < .001$ (Canonical $R^2 = 0.06$). With the first two variates removed, the final variate was not significant, χ^2 (3) = 3.4, $p = .34$ (Canonical $R^2 = 0.01$).

Canonical loadings for the MDEBS-LMK factors are included in Table 10. The first canonical correlation is relating a belief that medical knowledge is certain and

simple on the MDEBS-LMK with the belief that health status is determined by chance and by God, and to some degree powerful others, on the MHLC. The second canonical correlation is relating a belief that one should participate in shared decision-making on the MDEBS-LMK with a belief that health status is determined by internal behavior and actions on the MHLC. The third canonical variate, which is not significant, is not interpretable.

Table 10

Canonical Variate Loadings for MDEBS-LMK and MHLC

Factor	**Variate 1**	**Variate 2**	**Variate 3**
MDEBS-LMK			
Certain/Simple	0.95	0.21	0.24
Questioning	0.35	-0.87	0.35
Source of Knowledge	0.60	-0.28	-0.75
MHLC			
Internal	0.43	0.82	0.37
Chance	0.72	-0.21	-0.04
PO	0.50	0.29	-0.79
Doctors	0.28	0.24	-0.51
God	0.78	-0.39	0.18

Of the MDEB-LMK factors, 100% of the variance was extracted and from the MHLC factors, 74.1% of the variance was extracted. Of the MDEBS-LMK variates,

13.8% of the variance was accounted for by the variates from the MHLC variates. Conversely, 9.8% of the variance in the MHLC variates was accounted for by the MDEBS-LMK variates. This is consistent with the 17% of variance accountable in the DEBS-LMK items by the MHLC items reported by Barnes et al. when DEBS-LMK items served as dependent variables and MHLC items served as predictors in a multivariate regression analysis (2012). The proportion of variance accounted for in the canonical variates by the first canonical variate is 25.9% and by the second canonical variate is 5.6%. For the third non-interpretable canonical variate, the proportion of variance accounted for is 3.4%. Canonical loading and amount of variance explained is low in this analysis. This shows that while a relationship is indicated between the variables as suggested by the correlations and loadings, additional information is needed to fully explain this relationship.

Relationship with Perceived Involvement in Care

Canonical correlation was performed to explore the relationship between epistemology of medical knowledge and perceived involvement in care. Variables in the analysis include factor scores from the MDEBS-LMK for Simple/Certain, Questioning, and Source of Knowledge. Factors scores from the PICS for the factors of Doctor Facilitation, Patient Information, and Decision Making were included.

Three canonical variates were possible, and one variate was found to be significant. With all three variates entered into the analysis, the results were significant, χ^2 (9) = 29.8, $p < .001$ (Canonical $R^2 = 0.05$). With the first variate removed, the results were not significant, χ^2 (4) = 4.9, $p = .30$ (Canonical $R^2 = 0.01$). With the first two

variates removed, the final variate was not significant, χ^2 (1) = 0.1, p = 0.78 (Canonical R^2 = 0.00).

Canonical loadings for the MDEBS-LMK and PICS factors are included in Table 11. The first canonical variate is relating a positive correlation for the MDEBS-LMK factor for Source of Knowledge to a negative correlation for the PICS factor of Decision Making. This indicates that a belief of the source of medical knowledge residing with an omniscient authority or physician is associated with the tendency for a person to let a physician make their health care decisions rather than making those decisions on their own. The second and third canonical variates were neither significant nor interpretable.

Table 11

Canonical Variate Loadings for MDEBS-LMK and PICS

Factor	**Variate 1**	**Variate 2**	**Variate 3**
MDEBS-LMK			
Certain/Simple	-0.27	0.90	-0.33
Questioning	0.50	0.62	0.60
Source of Knowledge	0.71	0.33	-0.62
PICS			
Doctor Facilitation	0.20	0.96	-0.22
Patient Information	-0.42	0.14	-0.89
Decision Making	-0.90	0.42	0.12

Of the MDEB-LMK factors, 100% of the variance was extracted, and from the PICS factors, 100% of the variance was also extracted. Of the MDEBS-LMK variates, 2.0% of the variance was accounted for by the variates from the PICS variates. Conversely, 2.3% of the variance in the MHLC variates was accounted for by the PICS variates. The proportion of variance accounted for in the canonical variates by the first canonical variate is 5.4%. The second and third canonical variates are not interpretable, however the proportion of variance accounted for by the second canonical variate is 1.1% and by the third canonical variate is 0.02%. As was found with the examination of its relation to MHLOC scales, the canonical loading and amount of variance explained is low in this analysis of the MDEBS-LMK. This shows that while a relationship is indicated between the variables as suggested by the correlations and loadings, additional information is needed to fully explain this relationship.

CHAPTER V

DISCUSSION

The purpose of this study was to modify an existing measure of discipline-specific epistemological beliefs related to lay medical knowledge, assess the resulting psychometric properties after development, and explore the relationship shared between the epistemology of medical knowledge with other health-related constructs including health locus of control and perceived involvement in care. Using the content development process outlined by Crocker and Algina (2008), the items of the DEBS-LMK were modified with the goal to better represent the content domain and to distinguish between the factors underlying the epistemology of medical knowledge. However, after following this content development process, the theorized factor structure was not realized as investigated through CFA (Hofer, 2000). As a result of the unrealized theoretical factor structure, EFA was conducted, and this analysis revealed that while the factors did not realize as predicted, the beliefs laypeople hold about medical knowledge are multidimensional, and this structure of multidimensional beliefs has been found in previously completed research (Barnes et al., 2012). Moreover, epistemological beliefs

about medical knowledge was related to both health locus of control and perceived involvement in care in predictable ways. These relationships were explored using canonical correlation, finding how factors in the MDEBS-LMK were related to factors in health locus of control and perceived involvement in care scales.

For the purposes of this research, beliefs about medical knowledge are considered either availing or non-availing. Availing beliefs are beliefs that can be used to the advantage of a person in the context of medical care. Availing epistemological beliefs can be considered beliefs that medical knowledge is tentative and evolving; that a patient has the right, ability, and authority to question a doctor's decision making process; and that a patient is a co-creator of medical knowledge. Being a co-creator of medical knowledge means that the patient becomes a partner in the creation of new knowledge with their health care provider which translates into improved quality of care, improved health outcomes, and innovations in care. An example of this would be a patient who is experiencing and reporting symptoms to their doctor, and based upon that doctor's limited medical knowledge he or she makes a diagnosis the patient feels may be inaccurate. The patient seeks new information and knowledge about their symptoms and possible alternate diagnoses, and relays this information to their doctor. The doctor receives this information and subsequently seeks new information and knowledge about these symptoms and alternate diagnoses for which he or she previously had no knowledge. The patient and their doctor are participating in the process of creating new knowledge.

Conversely non-availing epistemological beliefs, beliefs that are not to the advantage of the patient, are beliefs that medical knowledge is certain and simple, that

patients should not question a doctor's decision making process and that laypeople are unable to understand medical knowledge and this understanding belongs exclusively to the domain of an all-knowing, omniscient authority such as a physician or scientist.

Availing epistemological beliefs are related to beliefs about powerful others involved in health locus of control and whether internal or external actions determine health status. If a person believes that medical knowledge is contingent and contextual, that they should question their doctor's advice and that they co-create medical knowledge with physicians, they believe that they do have some power over their own health. They are not at the mercy of powerful others or an omniscient authority related to their health. Moreover, with these similar epistemological beliefs a person will tend to be more involved in their own health care. The following discussion details the results and conclusions of the findings of the research questions directing this study as well as the limitations and implications of this research.

Summary of Findings

The first research question of this study, *What are the psychometric properties of the Modified Domain-Specific Epistemological Beliefs Scale – Lay Medical Knowledge?*, was first approached through a structured content validation process (Crocker & Algina, 2008), followed by CFA. As the data did not appear to be appropriate for the hypothesized model, structural analysis including EFA was utilized to investigate the structure of the data.

The content validation process utilized in this study was outlined by Crocker and Algina (2008) and is a strength of this research. With medicine as the domain of interest,

panels of content experts in medicine and epistemology were approached for their interest in this study. Those agreeing to participate included eight Medical SMEs including osteopathic physicians, allopathic physicians, a registered nurse, and a licensed clinical psychologist. Two epistemological SMEs who had conducted research and published scholarly articles related to Epistemology also agreed to assist in the content validation process. During these interviews with the content experts, an outline for the content validation process was agreed upon, the construct of epistemology was clarified, and future meeting dates were scheduled.

Medical SMEs reviewed the items of the DEBS-LMK and made suggestions for improvements to these items. During this review, the SMEs verified the items representing the domain of medicine. However, when the Medical SMEs thought that modifications to the items were warranted to better represent the domain of medicine, this was discussed and integrated into a spreadsheet into which suggestions from each Medical SME was recorded. After input was received from each Medical SME, the comments were integrated into a comprehensive list of suggested items, and this list was reviewed with the Epistemological SMEs. In this review, the items were discussed individually to integrate the medical and epistemological constructs. Further, four items were developed to obtain information from the study subjects related to the Justification of Knowledge construct. After this review, the items excluding the four Justification of Knowledge items were included in an electronic survey and submitted to the Medical SMEs for further content validation.

This part of the content validation process follows established guidelines to improve the ability of developed items to measure a specific domain of interest. This

continues the process that was established in previous research when two Medical SMEs refined the items in the DEBS-LMK, but expands and formalizes that process in an effort to further refine the items so that they do a better job of measuring the domain of interest, the epistemology of medical knowledge (Barnes et al., 2012).

In an effort to expand the content validation process, the SMEs were asked to take the list of developed items and match them to the domains for which they were developed. This was the final phase of the content validation process. The Medical SMEs reviewed items individually and matched the item to the content domain for which they believe the item was developed to measure. The responses to this survey included whether the Medical SMEs correctly matched the items to the domains for which they were developed. Items retained for the final version of the MDEBS-LMK included those items with the most agreement of the Medical SMEs. In the Source of Knowledge domain, two out of ten items had perfect agreement, four items had 75% agreement, and four items had 50% agreement. In the Certainty of Knowledge Domain, five items had 50% agreement, four items had 25% agreement, and one item received no agreement. In the Simplicity of Knowledge domain, one item received 100% agreement, four items received 75% agreement, two items received 50% agreement, two items received 25% agreement, and one item received no agreement.

While this part of the content validation process does expand and improve upon the process used in the development of the original DEBS-LMK, there are still items that received no agreement from the SMEs. However, there are items in two domains that received perfect agreement from the SMEs indicating that those items are measuring the intended domain. The items intended to measure the Certainty of Knowledge received

only minimal agreement of the SMEs indicating either confusion about the content domain, a need for item improvement, or both. This suggests that the content development process did improve some of the items used in the MDEBS-LMK, but that there are still items that do not adequately represent the target domain.

Prior to submitting the responses and items to statistical analysis, missing data and characteristics of the data were investigated to verify they are appropriate for analysis. After responses and items which exceeded specified thresholds were removed from the analysis, reliability was assessed through Cronbach's alpha, a measure of internal consistency. Internal consistency is calculated from the pairwise correlations between items and is used to measure how items measure the same general construct, with the goal of unique contribution of individual items measuring the same latent construct in such a way that the correlations among the items are as high as possible without becoming redundant. Cronbach's alpha ranges from 0 to 1 with scores closer to 1 being more internally reliable. Various guidelines have been reported for what is considered to be an acceptable coefficient of internal reliability. Nunnally (1978) says that a coefficient alpha of .7 may be an acceptable minimal value in basic research but that in applied research values of .8 would be an acceptable minimum value, and that when important decisions were going to be made on the basis of test scores values of .9 or .95 should be the goal (p. 245). The coefficient of internal reliability for the MDEBS-LMK was .75. Subscale coefficient alphas were .63 for Source of Knowledge, .49 for Certainty of Knowledge and .53 for Structure of Knowledge and these scores are considered poor or questionable measures of internal consistency. This indicates that while the overall measure may have a barely acceptable minimum value for Cronbach's

alpha in basic research, and unacceptable in applied research, the poor to questionable scores on the subscales indicate that the items do not measure the same latent construct to the degree which was desired. While the process for eliminating responses with excessive missing data and removing data which was not appropriate for the analysis was successful, it did not improve to a sufficient degree the estimate of internal reliability. Further investigation of the scales and efforts to improve the reliability of the subscales is needed.

One of the arguments of this study was that through a structured process of content validation, items would be developed that would more adequately reflect the hypothesized factor structure. This factor structure is theorized to be multidimensional in nature as hypothesized by Hofer and Schommer (Hofer, 2000; Schommer, 1989). Specifically, Hofer's (2000) theory of epistemology was adopted in which the dimensions of epistemology include the Structure of Knowledge, the Simplicity of Knowledge, the Source of Knowledge, and Justification of Knowledge.

To determine if the efforts in content validation aided in replicating the theorized factor structure, a CFA was conducted. Normality was assessed, and any variables with kurtosis greater than 3.0 were removed from the analysis, and multivariate outliers were also removed. After these variables and responses were removed from the analysis, measures of goodness of fit for the model were reviewed. The CMIN/DF was 3.58 and the suggested cutoff is ≤ 2. The CFI was .51 and the suggested cutoff is $\geq .95$. The RMR was .21, with 0.0 indicating a perfect fit. Finally the RMSEA was .08 and the suggested cutoff is .06 to .08. While cutoff criteria for the reported goodness of fit measures are not absolute, they do indicate that the data may be a poor fit for the hypothesized model. It

has been previously reported that the domain of epistemology is difficult to measure, and this lack of fit in the theorized model while disappointing is not entirely surprising (DeBacker et al., 2008; Wheeler, 2007)

Since the theorized factor structure was not realized in the CFA, efforts were taken to ascertain the underlying factor structure of the data. To investigate these latent factors, EFA was conducted using PAF analysis with oblique rotation. This process follows recommended procedures for scale analysis (Gorsuch, 2008). Cattell's scree plot suggested a three-factor solution, which fit the hypothesized nature of the construct (Hofer, 2000). These three factors were extracted and obliquely rotated using Direct Oblimin for interpretation. Variance accounted for, communalities and pattern and structure coefficients were unremarkable, allowing for sufficient interpretation of results but indicating further need for refinement of the items.

The three factors that were extracted and rotated were interpreted as Simple/Certain, Questioning, and Omniscient Authority. The Simple/Certain factor comprised 16 items that were originally developed for the Structure of Knowledge and Certainty of Knowledge domains. While this factor was not theorized, it is a factor that was realized in previous research related to lay beliefs of medical knowledge (Barnes et al., 2012). Participants who agree with this factor believe that medical knowledge is absolute and certain, and that this knowledge is made up of isolated, knowable facts. Those who would disagree with this factor would believe that medical knowledge is tentative, evolving, and contextual.

The three items that loaded onto the Questioning factor were originally developed for the Source of Knowledge and Certainty of Knowledge domains. Those who agree with this item would believe that they should not question a doctor's treatment decision since the doctor has superior knowledge about their health condition, and they would prefer not to have the reason behind that treatment decision explained to them. The five items that loaded onto the Omniscient Authority factor were all developed for the content domain. People who would agree with this factor believe that doctors are the ultimate holders of medical knowledge.

Only the Simple/Certain factor has a coefficient of internal reliability of above .7, a coefficient of internal reliability which is considered barely acceptable in basic research and not ideal for applied research (Nunnally, 1978). What this means is that the items may do a sufficient job of measuring the same latent construct in basic research, but that for applied research more improvement will need to be made to the items so that the items do actually measure what they were intended to measure. The coefficients of internal reliability for Questioning and Omniscient Authority were both close to .6, indicating that the items developed to measure those domains do not do an adequate job actually measuring those domains. The items are not sufficient.

Bivariate correlations were investigated to examine the relationship among the factors of the MDEBS-LMK. It was found that these correlations were low to moderate. This does allow for some interpretation of the factors and the relationships they share, but the degree of the relationship in the form of low to moderate correlations indicates that more information needs to be considered to fully explain the relationship among the factors. Taking the low to moderate correlations into consideration, the analysis shows

that Simple/Certain is positively and significantly correlated with both Questioning and Omniscient Authority. What this indicates is that people who believe that doctors are the authority in medical knowledge that is simple and certain may not question their doctors' diagnoses or treatment decisions and would perhaps rather not participate in the decision making process. Comparatively, people who believe that doctors are not always the authority in medical knowledge, which is tentative and contextual, may question their doctors' diagnoses and treatment plan and would like to be involved in the medical decision-making process. This describes the developmental process from which a person moves from a holder of meaning to a maker of meaning that has been realized in other studies (Barnes et al., 2012; Chan & Elliott, 2002; Schommer, 1989, 1990).

The responses to the Justification of Knowledge items indicated that people who do not question their doctors' medical decisions tend to access fewer sources of medical knowledge as the number of sources of medical knowledge accessed was negatively and significantly correlated with agreement of the Questioning factor. Further, it was found that those who agree with the Certain/Simple, Questioning, and Omniscient Authority factors have a tendency to either not compare medical information from different sources or do not evaluate information from different sources because it is too confusing. This follows arguments that suggest that there are some people who are monitors and those who are blunters, and also people for who the strength of ties with other people determine how they obtain information (Baker & Pettigrew, 1999). Those who agree with Certain/Simple, Questioning, and Omniscient Authority share traits with blunters who avoid information when dealing with stressful situations (p. 446). Those who disagree with the same factors share characteristics with those who are monitors, or those people

who seek out information in order to manage the difficult emotions and situations that arise from stressful health related situations (p. 446). “People who are monitors will want all the information available on a topic, while blunters may prefer only one or two general items or none at all” (p. 447). It may be that the sources of information that a person accesses is also due to the strength of tie that person feels in relationship to the source of medical knowledge. If they have a strong tie, they may be more likely to access information from that source. However, if the strength of the tie with that information source is weak, they may be less likely to access that particular piece of information (p. 447).

Relationship of MDEBS-LMK with Other Health-Related Constructs

The second research question of this study, *What is the nature of the relationships between epistemological beliefs about medicine, health locus of control and desire to participate in health care?*, was first approached through a structural analysis of the MHLC and PICS scales followed by canonical correlation. The MHLC data were appropriate for factor analysis with the five-factor solution supported by the theoretical structure as reported in previous research (Wallston et al., 1978). There were also similar amounts of accounted variance, structure coefficients, and an estimate of reliability that exceeded the coefficients reported in the development of the instrument. The PICS data were also found to be appropriate for factor analysis. The three-factor solution and accompanying scale statistics were supported by the theoretical structure of the scale (Lerman et al., 1990). The estimate of reliability for the original instrument was below the coefficient alpha reported for the current study. Based upon the structural analysis of the MHLC and PICS data, it was appropriate for continued analysis investigating the

relationship between the factors these items were developed to measure and the MDEBS-LMK.

The relationship of the MDEBS-LMK with MHLC was explored through canonical correlation. Of the three possible canonical variates, two were statistically significant, allowing for interpretation of these two significant variates. While significant, the canonical correlations are low to moderate and the amount of variance explained is low. A relationship does exist between the factors of the MDEBS-LMK and the MHLOC. However, this relationship may not be practically significant. More variance needs to be accounted for to better examine the relationship between the factors in the MDEBS-LMK and the MHLC.

The first canonical variate is relating a belief that medical knowledge is certain and simple on the MDEBS-LMK with the belief that health status is determined by chance and by God, and to some degree powerful others, on the MHLC. What this implies is that people who believe that medical knowledge is absolutely right or absolutely wrong, and is composed of isolated knowable concepts, may believe that either doctors or God determine their health status. If people have a non-availing view of medical knowledge, they may have a belief that an omniscient authority dictates their health status. What they do, or the actions they take, does not contribute to their health. The second canonical variate is relating a belief that one should participate in shared decision-making on the MDEBS-LMK with a belief that health status is determined by internal behavior and actions on the MHLC. If people believe that they should question their doctors' advice and guidance, they may believe that their internal behavior has a

great impact on their health status. Both of the above canonical variates have loadings that relate to the MDEBS-LMK and MHLC scales in predicable ways.

This relationship between epistemological beliefs about medical knowledge and health locus of control has been studied both in this research and that which was completed by Barnes et al. (2012). Both studies, the Barnes et al. study using multivariate regression analysis and this study using canonical correlation analysis, have found that the dimensions of epistemological beliefs of lay medical knowledge are related to dimensions of health locus of control in predictable ways. This research finds beliefs that medical knowledge is certain and simple is related to beliefs that health status is determined by chance and by God, and to some degree powerful others. This was also found in the Barnes et al. study where perceptions of medical knowledge as simple and certain were a positive predictor of powerful others. Internal health locus of control was found to be related to shared decision-making in this research. In the Barnes et al. study, lower scores on quick learning was significantly predicted by higher internal health locus of control. What this shows is that these variables are related as expected, or as people have more availing beliefs such as being willing to participate in the health care decision making process, things worth knowing are not always easy to understand and knowledge is contingent and contextual, they have more internal locus of control.

Barnes et al. stated that "the study of EB has implications for understanding individual differences in the desire for shared decision-making in general, and information-seeking in particular" (p. 11). This conclusion is supported by this research. This suggests that through the study of the beliefs people hold about medical knowledge, their epistemological beliefs, interventions may be aided in helping patients participate in

shared decision-making and in information-seeking. It may be possible to help patients who resist making decisions with their care provider participate in the decision making process as a health care partner rather than as a health care object. Moreover, aid may be given in helping patients seek information where patients must decide what medical information is credible, especially when that information is contradictory, and help them integrate that medical information into their decision making process.

The relationship of the MDEB-LMK with the PICS scale was also explored through canonical correlation. Of the possible three canonical variates one was statistically significant accounting for a limited 5.4% of the variance, but still allowing for interpretation of that single variate. The canonical correlations, while significant, are low to moderate. Moreover the amount of variance explained is low. This indicates that while a relationship can be explained, there is more that needs to be considered in the model to fully explain the relationship between the two sets of variables.

The first canonical variate is relating a positive correlation for the MDEBS-LMK factor for Source of Knowledge to a negative correlation for the PICS factor of Decision Making. This indicates that a belief of the source of medical knowledge residing with an omniscient authority or physician is associated with the tendency for people to let a physician make their health care decisions rather than making those decisions on their own. In other words, if people believe that their doctors are the ultimate authority related to their medical care, they may let the doctors make all of their health care decisions, eschewing participation and responsibility in the health care decision-making process. This canonical variate has a loading that relates the MDEBS-LMK and PICS scales in a predictable way.

Limitations

Limitations of this study may exist in the following areas. The content validation process utilized was limited in scope. The sample utilized was a non-random sample. The sample was comprised of participants who were primarily female and highly educated. The sample was comprised of subjects for which little was known about their health status. The survey took approximately 30 to 45 minutes to complete. Finally, many of the responses to the survey contained greater than 10% of missing data or were responses that were multivariate outliers.

While the content validation for the MDEBS-LMK was a more rigorous and structured process than used in the DEBS-LMK, many of the items that were utilized on the final version of the instrument had either low or no agreement among the SMEs that the items measured the specified domain. These items with poor agreement ratings may not be the most suitable items for the domains of interest, and may contribute to the unrealized factor structure in the CFA.

The sample for this study was a non-random sample. Specifically it was a sample of convenience that included a snowball sampling methodology. This limits the generalizability of the results to a specific population. A random sample, or another more rigorous sampling methodology, would yield results that would be more generalizable to a respective population. Further, the sample was comprised of participants who were primarily female (70.5%) and highly educated (40.1%). This further limits the generalizability of the results to any population other than females who are highly educated.

The sample was comprised of subjects for which little was known about their health status or medical training. In response to the question that asked whether the participants had a medical condition for which they took medication, 20.7% responded that they did have such a medical condition. Some of the responses to the question about medical conditions consisted of answers ranging from flu and cold to severe conditions of cancer and multiple sclerosis. The intent of this question was to assess the experience of the patient in making decisions that required the respondent to either clearly participate or not participate in health-care decisions. However, because of the lack of consistency in the responses to this question, it is not clear whether the severity of the health condition, or lack thereof, would be an indication of the desire to participate in the health care decision-making process. In the demographics survey, the questions related to medical training and medical conditions lacked specificity. The question related to medical training had responses ranging from massage therapy to physician. While 27.5% of the participants responded that they did have medical training, it is not clear whether that medical training would have given the participant the training or knowledge that would have influenced their answers to the survey questions. Moreover, there was no way to determine if the respondents did not have medical training, but through parallel experience such as care for a loved one, they have experience that would influence their responses. The question needs to be worded so that it is possible to tell if the medical training that they have received, or experience to which they have access, has an impact on their medical decision-making process.

The survey took approximately 30 to 45 minutes to complete and was administered online. Because of the length of the survey and the mode of administration,

many respondents did not complete all of the answers or left the survey prior to completion resulting in missing data. This impact of fatigue possibly contributed to the responses that contained greater than 10% of missing data or were responses that were multivariate outliers.

Conclusions

The analyses completed as a result of the research questions driving this study has led to the following five conclusions.

- The theorized factor structure was not realized. However, the factor structure that has been realized has been reported in part in previous epistemological research and specifically epistemological research related to lay medical knowledge. The Simple/Certain factor has been realized in research by Hofer (2000) specific to epistemology and has been realized by Barnes et al. (2012) specific to epistemology of medical knowledge among laypersons. Moreover, the Questioning factor realized in this research contains the same items which loaded onto the Patient Autonomy factor within Omniscient Authority by Barnes et al. suggesting a similarity between these factors.
- Bivariate correlations and canonical correlations suggest that there is a tendency for items and factors to be related in predictable ways. In respect to MHLC, non-availing epistemological beliefs are associated with health status being a matter of chance and being determined by powerful others or an omniscient authority. Conversely, availing epistemological beliefs are associated with internal health locus of control. In relationship to the PICS scale, non-availing epistemological

beliefs are associated with the tendency for people to let a physician make their health care decisions.

- Low correlations among the factors are due in part to measurement error.
- Low amounts of variance accounted for suggests that there may be other issues not yet identified which may impact the relationship between the MDEBS-LMK, MHLC, and PICS factors.
- A consistently reproduced factor structure of epistemology of medical knowledge that is related to health constructs in predictable ways indicates that the beliefs people hold about medical knowledge has implications for health behavior including health locus of control and perceived involvement in care.

Implications for Research

In this research, the data did not appear to be a good fit to the hypothesized model as found through the CFA. Instead, the Simple/Certain and Questioning factors were realized from items that were developed for other content domains. While the Simple/Certain factor has been realized in previous research, the Questioning factor appears to be unique to this research. As the Simple/Certain factor has been found in previous research, in particular in relationship with lay beliefs about medical knowledge, further research in the specified domain would be suggested to see if this factor is repeatable. It may be that laypersons' medical knowledge is not extensive enough to distinguish between the Simplicity of Knowledge and Certainty of Knowledge domains. For physicians the simplicity—complexity dimension may be relevant in a developmental sense since as one progresses from novice to expert, their ways of conceptualizing and integrating all kinds of medical knowledge changes; however, for novice laypersons such

a distinction may be less relevant. Another possibility is that the items lack the sensitivity to distinguish between the constructs. Repeating this study on a different population using a random sampling methodology may show a factor structure that may be more generalizable.

The Justification of Knowledge domain is associated with how people evaluate claims about knowledge and what role any evidence they consider, the authority from which they obtained that evidence and competing knowledge claims, are taken into consideration. This domain was not included in the DEBS-LMK, and there were four items developed for the MDEBS-LMK that were intended to gain insight into this construct. One of these questions asked the respondents to indicate how many sources of information they access from a list of possible sources of information. These sources of knowledge are similar to those utilized in the Health Information National Trends Survey (HINTS) 2012 Cycle 1 survey in which data were collected from October 2011 through February 2012. Another question asked what role, if any, those sources of information played in their decision making process. While this does begin the process of investigating this domain, the implications for the domain of medical knowledge go far beyond the scope of these questions.

While the estimate of internal reliability for the MDEBS-LMK subscales were moderate including Simple/Certain ($\alpha = 0.75$), Questioning ($\alpha = .61$), and Omniscient Authority ($\alpha = .58$), with further research related to the epistemology of medical knowledge, additional improvements may be made in the development of the subscales comprising this scale. With additional improvements to the items, an improved estimate of internal reliability would be desired.

Correlations between MDEB-LMK factors and Justification of Knowledge items while significant are low correlations. Moreover, the canonical correlations were small between the MDEBS-LMK factors, MHLC factors and PICS factors, with only a small amount of variance being accounted for with the analysis. The statistical significance of these findings may not translate into practical significance. There are two issues which may account for these low correlations. The first possible source of these low correlations is measurement error. The items may need further refinement so that they do a better job of measuring the objective domain. Further, there may be structural issues that are not accounted for within the current experimental design. These can be structural issues of the different health care systems such as United States Health Care Systems as opposed to European Health Care Systems, or issues related to the lack of empowerment of patients in the United States Health Care System.

Implications for Theory and Practice

The beliefs a layperson holds about medical knowledge is a new and emerging area of study warranting increased attention as further light is shed on those who experience lack of health care and the ability of these people to navigate the health care system which can be difficult even for the highly educated. In the medical encounter the ability of a health care professional or employee within that organization to assess the beliefs people may hold about medical knowledge, their epistemology of medical knowledge, is severely limited. If a short, concise instrument were to be developed that could assess these beliefs, the care provider could deliver the medical information during that visit in a way that takes into account their beliefs. If people believe that they can co-create knowledge with the health care providers, that they will need to integrate a wide

variety of concepts with knowledge that is not necessarily right or wrong, and willingly question their health care providers, they will interact in a much different way with their care providers than people who hold opposing beliefs. As one medication is not a panacea of all illnesses, one method of interaction with a patient is not the best way to interact with all patients. If beliefs that a patient holds about medical knowledge were taken into account when interacting with a patient, health care providers could help patients who hold non-availing epistemological beliefs make more informed health care decisions and empower the patient to participate in the health care decision-making process if needed.

Many interventions are in place with the intent to modify behavior related to medical decision-making and the role that the patient plays in the decision making process. However, these interventions do not address the underlying beliefs they may have about medical knowledge. If the patient believes that medical knowledge is simple and certain, that knowledge is absolutely right or wrong and is made up of isolated pieces of knowable information, the patient may not see the need to develop and integrate a knowledge base about their health condition. If the patients do not believe they have the right or ability to question a doctor or other health care authority about their medical condition, the patient may not participate in the medical decision-making process. If the patient believes that the doctor is the ultimate authority related to medical knowledge, they may not seek information outside of that source to compare or co-create knowledge. If these beliefs are not addressed, the interventions aimed at specific behaviors may have little benefit. It stands to reason that future interventions would be aided by a more thorough understanding of the beliefs a person may hold about medical knowledge.

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APPPENDICES

APPENDIX A

IRB APPROVAL LETTER

IRB APPROVAL LETTER

Oklahoma State University Institutional Review Board

Date:	Monday, November 14, 2011
IRB Application No	ED11196
Proposal Title:	The Modified Discipline-Specific Epistemological Beliefs Scale - Medical: Development and Validation
Reviewed and Processed as:	Exempt

Status Recommended by Reviewer(s): Approved Protocol Expires: 11/13/2012

Principal Investigator(s):

Danny Stout
1111 S. St. Louis Ave.
Tulsa, OK 74112

Laura Barnes
700 N. Greenwood
Tulsa, OK 74106

The IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

X The final versions of any printed recruitment, consent and assent documents bearing the IRB approval stamp are attached to this letter. These are the versions that must be used during the study.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted with the appropriate signatures for IRB approval.
2. Submit a request for continuation if the study extends beyond the approval period of one calendar year. This continuation must receive IRB review and approval before the research can continue.
3. Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of this research; and
4. Notify the IRB office in writing when your research project is complete.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact Beth McTernan in 219 Cordell North (phone: 405-744-5700, beth.mcternan@okstate.edu).

Sincerely,

Shelia N. Kennison

Shelia Kennison, Chair
Institutional Review Board

APPENDIX B

RESEARCH SURVEY

Default Question Block

Information Sheet for
Consent to Participate in a Research Study

Project Title: The Modified Discipline-Specific Epistemological Beliefs Scale – Lay Medical Knowledge: Development and Validation

Investigator: Danny W. Stout, MHR, Oklahoma State University

Purpose: This purpose of this research is to study how to measure beliefs about medical knowledge and explore the relationship between beliefs and other health related ideas. We need a wide range of beliefs about medical knowledge for this study, and you are being asked to participate because your beliefs will help to provide a better understanding of the study topic.

Procedure: If you agree to be in this study, you will be asked to complete an on-line questionnaire taking approximately 15 to 30 minutes to complete. You will answer questions about beliefs about medical knowledge and other health related topics as well as general demographic questions.

Risks of Participation: There are no known risks associated with this project which are greater than those ordinarily encountered in daily life.

Benefits: There are no direct benefits for participation.

Voluntary Nature of the Study: Participation in this study is voluntary. Your decision whether or not to participate will not result in penalty or loss of benefits to which you are otherwise entitled. If you decide not to participate, that is ok. If you decide to participate, you can choose not to answer any of the questions on the survey or quit at any time.

Confidentiality: Your results are anonymous. There will be no ability for anyone to identify you as a research participant. Research records will be stored securely on a password protected server available only to the researcher, advisor or individuals responsible for research oversight. This data will be kept for the length of the study and five years after publication. At that time, all electronic records will be destroyed and aggregate data will be printed and stored in a locked facility.

Compensation: You will not be compensated for participation in this study.

Contacts and Questions: If you have concerns or complaints about the research I can be contacted at (918) 691-6728 or dwstout@okstate.edu. If you wish to talk to someone other than me, or if you cannot reach me, you may want to contact my advisor or the Oklahoma State University Institutional Review Board. To contact my advisor, Dr. Laura Barnes, Associate Professor, Oklahoma State University, please call 918-594-8517 or email laura.barnes@okstate.edu. For the IRB you may contact Dr. Shelia Kennison, IRB Chair, 219 Cordell North, Stillwater, OK 74078, 405.744.3377 or **irb@okstate.edu.**

Please print and keep this information sheet for your records. (Okla. State Univ. IRB - Approved 11/14/11, Expires 11/13/12, IRB# ED-11-196)

By clicking on the "I agree to participate" button, you are agreeing to participate in this study. If you do not choose to participate in this study, please click the "I do not agree to participate" button. Thank you.

- ○ I agree to participate.
- ○ I do not agree to participate.

Beliefs about Medical Knowledge

Instructions: Check the answer to the right of each statement which best represents your level of agreement with that statement. For example, if you strongly agree with a statement, select the circle on the very end to the right. If you strongly disagree with a statement, select the first circle to the far left. This is a measure of your personal beliefs; there are no right or wrong answers.

		Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
If patients follow their doctors advice, their health will improve.		○	○	○	○	○	○
Doctors should know whether a treatment will work or not.		○	○	○	○	○	○
Doctors should not be creative when they treat a patient.		○	○	○	○	○	○

		Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
Medical science is a puzzle. You just need all the pieces for an answer.		○	○	○	○	○	○
Medical science has too many theories and not enough facts.		○	○	○	○	○	○
Simple explanations are usually the best.		○	○	○	○	○	○
There is usually more than one way to understand a medical problem.		○	○	○	○	○	○
Medical truths are generally unchanging.		○	○	○	○	○	○
		Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
Medical knowledge is what is true about the human body.		○	○	○	○	○	○
There is usually one best way to solve a health problem.		○	○	○	○	○	○
If doctors give the wrong diagnosis it is because they don't gather all the facts.		○	○	○	○	○	○
Just knowing that a treatment works isn't enough; doctors have to know why.		○	○	○	○	○	○
Facts are more important than theories in medical science.		○	○	○	○	○	○
Doctors should give the same medical treatment to all patients who have the same problem.		○	○	○	○	○	○
Medical information isn't that difficult to understand.		○	○	○	○	○	○
I would want my doctor to explain to me the reason behind a treatment.		○	○	○	○	○	○
		Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
People should question their doctors' diagnosis or treatment if they aren't sure about it.		○	○	○	○	○	○
It is more important to know "what works" rather than "why it works".		○	○	○	○	○	○
Patients can learn enough to know as much about their health condition as their doctor.		○	○	○	○	○	○
Medical books and research reports are too difficult for most people to understand.		○	○	○	○	○	○
Truth does not change in medical science.		○	○	○	○	○	○
Patients don't know more about their medical conditions than their doctors.		○	○	○	○	○	○
Doctors don't know everything about treating health conditions.		○	○	○	○	○	○
Medical information is too complex for the untrained person to understand.		○	○	○	○	○	○
		Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
The human body will always be a mystery.		○	○	○	○	○	○

	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
Patients can't teach their doctors anything new about medical conditions.	○	○	○	○	○	○
If doctors had all the facts, they would be able to diagnose and treat most conditions.	○	○	○	○	○	○
When I hear medical information from one doctor that is different from medical information from another doctor, it makes me think they don't really know that much.	○	○	○	○	○	○
What is learned about one medical problem can be applied to other medical problems.	○	○	○	○	○	○
A person can't understand complex medical problems unless they have medical training.	○	○	○	○	○	○
	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree

Beliefs about Medical Knowledge

As you answer the questions on this page, imagine you have just been diagnosed with a serious health condition. Answer the questions accordingly.

Instructions: Imagine you have just been diagnosed with a serious health condition. In regards to that health condition, mark all of the sources of information you would consult.

- ☐ Alternative Practitioner (Nutritionist, Chiropractor, Naturopath, Acupuncturist, etc.)
- ☐ Book, Magazine, Article
- ☐ Family Member
- ☐ Friend
- ☐ God
- ☐ Medical Doctor
- ☐ No One
- ☐ Nurse
- ☐ Other Person with Same Condition
- ☐ Pastor, Priest, Rabbi, Imam or Other Spiritual Authority
- ☐ Pharmacist
- ☐ Physician's Assistant or Nurse Practitioner
- ☐ Radio/TV
- ☐ Reputable Internet Site (WebMD, Professional Association Sites, etc.)
- ☐ Self
- ☐ Support Group
- ☐ Other (As Indicated Above)

Instructions: Imagine you have just been diagnosed with a serious health condition. Rate how likely you would be to consult the following sources for information about that condition.

	Very Unlikely	Unlikely	Somewhat Unlikely	Somewhat Likely	Likely	Very Likely
Alternative Practitioner (Nutritionist, Chiropractor, Naturopath, Acupuncturists, etc.)	○	○	○	○	○	○
Book, Magazine, Article	○	○	○	○	○	○
Family Member	○	○	○	○	○	○

	Very Unlikely	Unlikely	Somewhat Unlikely	Somewhat Likely	Likely	Very Likely
Friend	○	○	○	○	○	○
God	○	○	○	○	○	○
Medical Doctor	○	○	○	○	○	○
No One	○	○	○	○	○	○
Nurse	○	○	○	○	○	○
Other Person with Same Condition	○	○	○	○	○	○
Pastor, Priest, Rabbi, Imam or Other Spiritual Authority	○	○	○	○	○	○
Pharmacist	○	○	○	○	○	○
Physician's Assistant or Nurse Practitioner	○	○	○	○	○	○
Radio/TV	○	○	○	○	○	○
Reputable Internet Site (WebMD, Professional Association Sites, etc.)	○	○	○	○	○	○
Self	○	○	○	○	○	○
Support Group	○	○	○	○	○	○
Other (If other, what source is this?)	○	○	○	○	○	○

Instructions: Imagine you have just been diagnosed with a serious health condition. Rank each of the sources you may go to for information about that condition in order of importance by dragging your most important source to the top of the list assigning it to position 1. Then drag your 2nd most important source to the next spot, and so on until you rank all of the sources below.

Alternative Practitioner (Nutritionist, Chiropractor, Naturopath, Acupuncturist, etc.)

Book, Magazine, Article

Family Member

Friend

God

Medical Doctor

No One

Nurse

Other Person with Same Condition

Pastor, Priest, Rabbi, Imam or Other Spiritual Authority

Pharmacist

Physician's Assistant or Nurse Practitioner

Radio/TV

Reputable Internet site (WebMD, Professional Association Sites, etc.)

Self

Support Group

Other (As Indicated Above)

Instructions: Considering the information you have consulted in regards to your imagined health condition, mark below how you would you rate the quality of this information?

	Least Like Me	Somewhat Unlike Me	Undecided	Somewhat Like Me	Most Like Me
Take the information at face value because I trust the source(s).	○	○	○	○	○
Compare the information from different sources.	○	○	○	○	○
Go with the information that makes the most sense to me.	○	○	○	○	○

	Least Like Me	Somewhat Unlike Me	Undecided	Somewhat Like Me	Most Like Me
Go with the information that feels right to me.	○	○	○	○	○
I don't evaluate the information because it is too confusing.	○	○	○	○	○
Talk the information over with my sources.	○	○	○	○	○
Just think about the information.	○	○	○	○	○

Health Locus of Control

Instructions: Each item below is a belief statement about medical conditions with which you may agree or disagree. Beside each statement is a scale which ranges from strongly disagree to strongly agree. For each item we would like you to click the option that represents the extent to which you agree or disagree with that statement. This is a measure of your personal beliefs; there are no right or wrong answers.

	Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree
If my condition worsens, it is my own behavior which determines how soon I will feel better again.	○	○	○	○	○	○
As to my condition, what will be will be.	○	○	○	○	○	○
If I see my doctor regularly, I am less likely to have problems with my condition.	○	○	○	○	○	○
Most things that affect my condition happen to me by chance.	○	○	○	○	○	○
Whenever my condition worsens, I should consult a medically trained professional.	○	○	○	○	○	○
I am directly responsible for my condition getting better or worse.	○	○	○	○	○	○
	Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree
Other people play a big role in whether my condition improves, stays the same, or gets worse.	○	○	○	○	○	○
Whatever goes wrong with my condition is my own fault.	○	○	○	○	○	○
Luck plays a big part in determining how my condition improves.	○	○	○	○	○	○
In order for my condition to improve, it is up to other people to see that the right things happen.	○	○	○	○	○	○
Whatever improvement occurs with my condition is largely a matter of good fortune.	○	○	○	○	○	○
The main thing which affects my condition is what I myself do.	○	○	○	○	○	○
	Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree
I deserve the credit when my condition improves and the blame when it gets worse.	○	○	○	○	○	○
Following doctor's orders to the letter is the best way to keep my condition from getting any worse.	○	○	○	○	○	○
If my condition worsens, it's a matter of fate.	○	○	○	○	○	○
If I am lucky, my condition will get better.	○	○	○	○	○	○

	Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree
If my condition takes a turn for the worse, it is because I have not been taking proper care of myself.	○	○	○	○	○	●
The type of help I receive from other people determines how soon my condition improves.	○	○	○	○	○	○
	Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree
If my condition worsens, it is up to God to determine whether I feel better again.	○	○	○	○	○	○
Most things that affect my condition happen because of God.	○	○	○	○	○	○
God is directly responsible for my condition getting better or worse.	○	○	○	○	○	○
Whatever happens to my condition is God's will.	○	○	○	○	○	○
Whether or not my condition improves is up to God.	○	○	○	○	○	○
God is in control of my condition.	○	○	○	○	○	○
	Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree

Perceived Involvement in Care

Instructions: According to your last medical visit, answer whether you disagree or agree with the statement by clicking Disagree or Agree.

	Disagree	Agree
My doctor asked me whether I agree with his/her decisions.	○	○
My doctor gave me a complete explanation for my medical symptoms or treatment.	○	○
My doctor asked me what I believe is causing my medical symptoms.	○	○
My doctor encouraged me to talk about personal concerns related to my medical symptoms.	○	○
My doctor encouraged me to give my opinion about my medical treatment.	○	○
	Disagree	Agree
I asked my doctor to explain the treatment or procedure to me in greater detail.	○	○
I asked my doctor for recommendation about my medical symptoms.	○	○
I went into great detail about my medical symptoms.	○	○
I asked my doctor a lot of questions about my medical symptoms.	○	○
I suggested a certain kind of medical treatment to my doctor.	○	○
	Disagree	Agree
I insisted on a particular kind of test or treatment for my symptoms.	○	○
I expressed doubts about the tests or treatment that my doctor recommended.	○	○
I gave my opinion (agreement or disagreement) about the types of tests or treatment that my doctor ordered.	○	○
	Disagree	Agree

Demographics

What is your age?

What is your gender?

- Male
- Female

What is your relationship status?

- Married
- Partnered
- Single
- Other

What is your race/ethnicity? (Mark all that apply.)

- American Indian or Alaska Native (If yes, please let us know the tribal affiliation.)
- Asian
- Black or African American
- Hispanic (e.g., Mexican, Puerto Rican, etc.) If yes, please let us know your Hispanic cultural identity.
- Native Hawaiian/Other Pacific Islander
- White
- Some Other Race or Ethnicity (If yes, please let us know your other racial identity.)

Education

- Some High School
- High School Diploma/GED
- Some College
- Associate College Degree
- Undergraduate College Degree
- Graduate/Professional College Degree

Employment/Student Status (Mark all that apply.)

- [ ] Unemployed
- [ ] Part-time Employment
- [ ] Full-time Employment
- [ ] Part-time Student
- [ ] Full-time Student

Do you have a health condition for which you have taken medication(s) for over three months?

- ( ) Yes (If yes, please let us know what condition.)
- ( ) No

Do you have a serious medical condition?

- ( ) Yes (If yes, please let us know your medical condition.)
- ( ) No

Have you received any type of medical education or medical training?

- ( ) Yes (If yes, please let us know what medical education or training you have received.)
- ( ) No

APPENDIX C

MDEBS-LMK CORRELATION MATRIX

Item	1	2	3	4	5	6	7
MDEBS_1	1	-.118	.138	-.114	-.064	-.002	.226
MDEBS_2	-.118	1	-.180	.089	.142	.237	-.213
MDEBS_3	.138	-.180	1	.090	.078	-.262	.263
MDEBS_4	-.114	.089	.090	1	.375	.061	-.234
MDEBS_5	-.064	.142	.078	.375	1	.085	-.263
MDEBS_6	-.002	.237	-.262	.061	.085	1	-.155
MDEBS_7	.226	-.213	.263	-.234	-.263	-.155	1
MDEBS_8	.181	-.152	.379	-.108	-.112	-.213	.484
MDEBS_9	.290	-.244	.124	-.123	-.238	-.039	.388
MDEBS_10	.132	-.075	.093	-.226	-.302	.026	.401
MDEBS_11	-.047	.106	.042	.111	.067	.133	.057
MDEBS_12	.179	.036	.089	-.226	-.185	.106	.293
MDEBS_13	.272	.013	.110	-.193	-.101	.055	.260
MDEBS_14	.045	.022	.162	.028	.096	-.070	.078
MDEBS_15	.002	.110	.067	.343	.306	.073	-.180
MDEBS_16	.187	-.050	.033	-.141	-.231	.086	.274
MDEBS_17	.128	-.074	.086	-.213	-.202	.009	.291
MDEBS_18	.173	.021	.121	-.217	-.190	.032	.329
MDEBS_19	.221	.027	.085	-.123	.028	.039	.117
MDEBS_20	.297	.068	.129	-.025	-.016	.090	.111
MDEBS_21	.085	-.015	.024	-.051	-.036	.027	.178
MDEBS_22	.115	.155	.054	.147	.072	.085	-.021
MDEBS_23	.147	.009	.092	-.101	.035	.065	.171
MDEBS_24	.034	.059	.064	.001	-.024	.132	.110
MDEBS_25	.232	-.076	.203	-.015	.091	-.036	.138
MDEBS_26	.175	.075	.077	-.074	-.004	.096	.216
MDEBS_27	.302	.032	.177	-.078	.013	.030	.263
MDEBS_28	.139	.113	.054	.052	.114	.027	-.042
MDEBS_29	.040	.117	-.004	.194	.367	.042	-.269
MDEBS_30	.160	.006	.154	-.164	-.127	.093	.266

Item	8	9	10	11	12	13
MDEBS_1	.181	.290	.132	-.047	.179	.272
MDEBS_2	-.152	-.244	-.075	.106	.036	.013
MDEBS_3	.379	.124	.093	.042	.089	.110
MDEBS_4	-.108	-.123	-.226	.111	-.226	-.193
MDEBS_5	-.112	-.238	-.302	.067	-.185	-.101
MDEBS_6	-.213	-.039	.026	.133	.106	.055
MDEBS_7	.484	.388	.401	.057	.293	.260
MDEBS_8	1	.304	.307	.082	.251	.190
MDEBS_9	.304	1	.336	-.068	.245	.175
MDEBS_10	.307	.336	1	.080	.352	.154
MDEBS_11	.082	-.068	.080	1	.136	.040
MDEBS_12	.251	.245	.352	.136	1	.277
MDEBS_13	.190	.175	.154	.040	.277	1
MDEBS_14	.083	.022	-.031	.134	.093	-.046
MDEBS_15	-.079	-.144	-.243	.074	-.203	.017
MDEBS_16	.242	.237	.355	.103	.336	.195
MDEBS_17	.150	.251	.311	.061	.217	.156
MDEBS_18	.204	.210	.357	.118	.544	.263
MDEBS_19	.205	.068	.135	.136	.164	.110
MDEBS_20	.097	.065	.046	.146	.196	.265
MDEBS_21	.153	.122	.209	.180	.201	.124
MDEBS_22	.023	-.029	.014	.019	.017	.167
MDEBS_23	.146	.058	.147	.145	.224	.304
MDEBS_24	.086	-.035	.100	.336	.200	.057
MDEBS_25	.172	.106	.139	.064	.117	.140
MDEBS_26	.166	.010	.174	.237	.279	.203
MDEBS_27	.170	.132	.127	.049	.250	.313
MDEBS_28	-.024	.022	-.058	.049	-.015	.098
MDEBS_29	-.098	-.084	-.244	.041	-.165	-.072
MDEBS_30	.169	.208	.284	.167	.312	.231

Item	14	15	16	17	18	19	20
MDEBS_1	.045	.002	.187	.128	.173	.221	.297
MDEBS_2	.022	.110	-.050	-.074	.021	.027	.068
MDEBS_3	.162	.067	.033	.086	.121	.085	.129
MDEBS_4	.028	.343	-.141	-.213	-.217	-.123	-.025
MDEBS_5	.096	.306	-.231	-.202	-.190	.028	-.016
MDEBS_6	-.070	.073	.086	.009	.032	.039	.090
MDEBS_7	.078	-.180	.274	.291	.329	.117	.111
MDEBS_8	.083	-.079	.242	.150	.204	.205	.097
MDEBS_9	.022	-.144	.237	.251	.210	.068	.065
MDEBS_10	-.031	-.243	.355	.311	.357	.135	.046
MDEBS_11	.134	.074	.103	.061	.118	.136	.146
MDEBS_12	.093	-.203	.336	.217	.544	.164	.196
MDEBS_13	-.046	.017	.195	.156	.263	.110	.265
MDEBS_14	1	.148	-.001	.114	.135	-.030	.158
MDEBS_15	.148	1	-.155	-.182	-.197	.093	.078
MDEBS_16	-.001	-.155	1	.207	.301	.169	.202
MDEBS_17	.114	-.182	.207	1	.303	.125	.137
MDEBS_18	.135	-.197	.301	.303	1	.127	.196
MDEBS_19	-.030	.093	.169	.125	.127	1	.158
MDEBS_20	.158	.078	.202	.137	.196	.158	1
MDEBS_21	-.009	-.062	.226	.158	.215	.080	.012
MDEBS_22	-.008	.170	.045	-.150	-.019	.060	.109
MDEBS_23	.018	-.011	.188	.140	.268	.170	.185
MDEBS_24	.211	.037	.117	.150	.250	.066	.182
MDEBS_25	.150	.101	.117	.046	.154	.181	.154
MDEBS_26	.048	-.018	.173	.187	.262	.264	.271
MDEBS_27	.094	-.059	.174	.175	.171	.162	.354
MDEBS_28	.078	.139	-.017	.090	-.004	.179	.109
MDEBS_29	.057	.316	-.221	-.142	-.256	.087	-.016
MDEBS_30	.088	-.147	.358	.260	.289	.131	.183

Item	21	22	23	24	25	26	27
MDEBS_1	.085	.115	.147	.034	.232	.175	.302
MDEBS_2	-.015	.155	.009	.059	-.076	.075	.032
MDEBS_3	.024	.054	.092	.064	.203	.077	.177
MDEBS_4	-.051	.147	-.101	.001	-.015	-.074	-.078
MDEBS_5	-.036	.072	.035	-.024	.091	-.004	.013
MDEBS_6	.027	.085	.065	.132	-.036	.096	.030
MDEBS_7	.178	-.021	.171	.110	.138	.216	.263
MDEBS_8	.153	.023	.146	.086	.172	.166	.170
MDEBS_9	.122	-.029	.058	-.035	.106	.010	.132
MDEBS_10	.209	.014	.147	.100	.139	.174	.127
MDEBS_11	.180	.019	.145	.336	.064	.237	.049
MDEBS_12	.201	.017	.224	.200	.117	.279	.250
MDEBS_13	.124	.167	.304	.057	.140	.203	.313
MDEBS_14	-.009	-.008	.018	.211	.150	.048	.094
MDEBS_15	-.062	.170	-.011	.037	.101	-.018	-.059
MDEBS_16	.226	.045	.188	.117	.117	.173	.174
MDEBS_17	.158	-.150	.140	.150	.046	.187	.175
MDEBS_18	.215	-.019	.268	.250	.154	.262	.171
MDEBS_19	.080	.060	.170	.066	.181	.264	.162
MDEBS_20	.012	.109	.185	.182	.154	.271	.354
MDEBS_21	1	-.037	.197	.160	.221	.189	.107
MDEBS_22	-.037	1	.074	.035	.091	.056	.117
MDEBS_23	.197	.074	1	.215	.233	.201	.157
MDEBS_24	.160	.035	.215	1	.058	.321	.108
MDEBS_25	.221	.091	.233	.058	1	.125	.198
MDEBS_26	.189	.056	.201	.321	.125	1	.318
MDEBS_27	.107	.117	.157	.108	.198	.318	1
MDEBS_28	-.287	.046	.079	.067	.064	.065	.078
MDEBS_29	-.151	.066	.049	-.066	.046	-.033	-.053
MDEBS_30	.119	.065	.130	.178	.104	.209	.186

Item	28	29	30
MDEBS_1	.139	.040	.160
MDEBS_2	.113	.117	.006
MDEBS_3	.054	-.004	.154
MDEBS_4	.052	.194	-.164
MDEBS_5	.114	.367	-.127
MDEBS_6	.027	.042	.093
MDEBS_7	-.042	-.269	.266
MDEBS_8	-.024	-.098	.169
MDEBS_9	.022	-.084	.208
MDEBS_10	-.058	-.244	.284
MDEBS_11	.049	.041	.167
MDEBS_12	-.015	-.165	.312
MDEBS_13	.098	-.072	.231
MDEBS_14	.078	.057	.088
MDEBS_15	.139	.316	-.147
MDEBS_16	-.017	-.221	.358
MDEBS_17	.090	-.142	.260
MDEBS_18	-.004	-.256	.289
MDEBS_19	.179	.087	.131
MDEBS_20	.109	-.016	.183
MDEBS_21	-.287	-.151	.119
MDEBS_22	.046	.066	.065
MDEBS_23	.079	.049	.130
MDEBS_24	.067	-.066	.178
MDEBS_25	.064	.046	.104
MDEBS_26	.065	-.033	.209
MDEBS_27	.078	-.053	.186
MDEBS_28	1	.246	.034
MDEBS_29	.246	1	-.182
MDEBS_30	.034	-.182	1

APPENDIX D

SME STUDY INTRODUCTION EMAIL

AND INFORMATION FORM

SME INTRODUCTORY CORRESPONDENCE

For my dissertation, I am taking a domain specific epistemological beliefs scale for lay medical knowledge (DEBS-LMK) and trying to improve how it performs. I want to find out what beliefs people have about medical knowledge. Before I start collecting data I need to consult with SMEs (a.k.a. Subject Matter Experts) to see how I can improve the items on the existing scale. Would you have the time and willingness to help me with this? If you don't just let me know but if you do, thank you so much!

The items to be included on this measure are for the four domains below.

Certainty of Knowledge (C)
The degree to which one sees knowledge as fixed or fluid appears throughout the research, with developmentalists likely to see this as a continuum that changes over time, moving from a fixed to a more fluid view. At lower levels, absolute truth exists with certainty. At higher levels, knowledge is tentative and evolving.

Simplicity of Knowledge (SI)
The lower level view of knowledge is seen as discrete, concrete, knowable facts; at higher levels individuals see knowledge as relative, contingent, and contextual.

Source of Knowledge (S)
At lower levels knowledge originates outside the self and resides in external authority, from whom it may be transmitted. The evolving conception of self as knower, with the ability to construct knowledge in interaction with others, is a developmental turning point.

Justification for Knowing (J)
This dimension includes how individuals evaluate knowledge claims, including the use of evidence; the use they make of authority and expertise; and their evaluation of experts. Individuals at lower levels justify beliefs through observation or authority, or on the basis of what feel right, when knowledge is uncertain. Only at higher stages do individuals use rules of inquiry and begin to personally evaluate and integrate the views of experts.

On the attached spreadsheet you will see the list of currently existing items for each construct. If you would, please write what you think would be a better item if any to gauge what a person believes about medical knowledge in the appropriate column. Please keep in the forefront these items are to gauge beliefs about medical knowledge. In the next column, please include any comments you think I should consider in including this item. If you think of items that are better than what is there currently put those in too.

After you are finished, shoot me and email and I'll come over to meet with you if you have the time so that I can answer any questions you may have.

After this is finished and I have your answer back, I'll compile the items you have helped me modify, and ask for you to rate which items best represent the domains they were constructed to measure.

If possible, I would like to have your input back by October 24th.

Thanks so much for considering helping me with this.

Regards,

Danny

Attached Spreadsheet:

Item	DEBS-LMK Statement	Recommended Statement
S1	Doctors are the best source of information regarding medical conditions	
S2	Physicians know more about the patient's condition than does the patient	
S3	If patients followed their doctor's advice, their condition would improve	
S4	Most doctors know what they are talking about regarding their patients' conditions	
S5	Patients who spend time researching their condition can become as informed as their physician	
S6	Medical literature is too difficult for most people to really understand	
S7	People should follow their doctors' advice regarding treatment	
S8	Physicians don't know everything about how to treat a patient's condition	
S9	Patients should challenge their physician's diagnosis or proposed treatment if they aren't sure about it	
S10	Patients who challenge their physician's knowledge are getting in the way of their own recovery	
S11	Medicine isn't that difficult to understand	
S12	If I read and studied, I could learn enough about my medical condition to make decisions about my treatment	
S13	I would challenge my physician if I weren't sure about the direction he/she was taking (with my treatment??)	

Item	DEBS-LMK Statement	Recommended Statement
S14	I am capable of understanding medical literature	
S15	A person without medical training can't understand complex medical problems	
S16	Medicine is too complex for the untrained person to understand	
S17	I wouldn't try to understand medical jargon	
S18	Medicine is too full of science for me to understand	
S19	Medical school takes years - how can anyone without that training expect to understand medical stuff?	
S20	It is ridiculous to think that patients know more than their physicians about a medical condition	
S21	Patients cannot teach their physicians anything about medicine	
S22	My doctor knows what is best for me	
S23	I would be capable of communicating new medical ideas to my medical team.	
S24	Sometimes it is up to the patient to educate medical experts about their condition.	
C1	When I hear of conflicting research findings…it makes me think that medical experts don't really know much	
C2	Medical experts should be able to diagnose most illnesses.	
C3	It is possible that everything we need to know about medicine can be known	
C4	Medical truths are generally unchanging	
C5	If medical experts disagree on something like a diagnosis or course of treatment, one of them must be wrong	
C6	Medical knowledge is based on learning what is true about the human body	
C7	If there were enough time and money, just about all disease and illness could eventually be cured	
C8	I believe that eventually medical science will find a cure for nearly all medical conditions	

Item	DEBS-LMK Statement	Recommended Statement
C9	Much of what medical scientists think they know today will change in the future	
C10	Medical knowledge is constantly changing	
C11	The human body is a mystery and will remain so	
C12	There are some things medical science will never know	
C13	Most of what is true in medicine is already known	
C14	Medical diagnosis is just a matter of asking the right questions	
C15	When it comes to medical diagnosis, a good computer program can do the job	
C16	There is usually more than one way to think of a medical problem	
C17	Medicine is more of an art than a science	
C18	There is usually one best way to solve a medical problem	
C19	In medicine, the answers (e.g., diagnosis, treatment) are always either right or wrong	
C20	Creativity has no place in medicine	
C21	All medical scientists would probably come up with the same answers to questions in their field	
C22	Truth is unchanging in medicine	
C23	Answers to questions in medicine change as experts gather more information	
C24	Medical experts should be able to tell patients whether a treatment will or won't work	
ST1	It is more important to know "what works" rather than "why it works"	
ST2	What is learned in one area of medicine can be applied to other medical problems	
ST3	Facts are more important than theories in medicine	
ST4	Medicine has too many theories and not enough facts	
ST5	Too many theories just complicate things	
ST6	Simple theories are usually the best	

Item	DEBS-LMK Statement	Recommended Statement
ST7	The reason physicians misdiagnose patients is that they don't gather all the facts	
ST8	If medical experts had all the facts, they would be able to diagnose and treat most conditions	
ST9	Theories are more important than facts in medicine.	
ST10	Without theory to connect the facts, medicine can't advance.	
ST11	I would want my physician to explain to me the theory behind a proposed treatment.	
SI12	Medicine is as much of an art as it is a science.	
SI13	Medical information about the same thing should not conflict.	
SI14	Doctors should give the same medical information for the same problem.	
SI15	Sometimes medical information I need is different than what someone else needs.	
SI16	I have to relate medical information I receive to my life as a whole.	
SI17	Medical information is just facts, figures and stuff to be memorized.	
SI18	Mistakes in medical knowledge help to find better answers.	
SI19	Medical information for one condition may be wrong for another condition.	
SI20	Once medical information is found, it is good forever.	
J1	I can tell medical information is good because my doctor gave it to me.	
J2	I need medical information from many sources before I make up my mind what I believe.	
J3	By seeing what medical information my friends trust, I know what information to trust.	
J4	If what I'm told about medical information doesn't feel right, I don't think it's going to be the right answer for me.	
J5	I have a process I go through to tell whether or not what I'm being told about medical information is right.	
J6	I don't take what my nurse tells me about medical information at face value.	

Item	DEBS-LMK Statement	Recommended Statement
J7	If I see my doctor has a medical license, it must mean he knows what he is talking about.	
J8	I want to hear opinions from many people about the medical information I have received, then make up my mind what I think about it.	
J9	If I find medical information on the internet, it must be good information.	
J10	When someone tells me medical information, I want to see some evidence about it.	
J11	When I make up my mind about medical information, I use evidence and what experts tell me to make up my mind.	
J12	If a medical expert tells me medical information is good, I trust them.	
J13	A doctor is just another person like me.	
J14	I consider myself a member of a team with my doctors and nurses to make decisions about medical information.	
J15	When medical information seems uncertain, I discard it.	
J16	When medical information seems uncertain, I ask more questions about it.	
J18	In the end, I am the person who says whether medical information is good or not.	
J19	It doesn't matter what I feel about medical information. It's what the expert thinks that matters.	
J20	When my doctor tells me something, I don't want to listen to anyone else tell me what to do.	

APPENDIX E

MDEBS-LMK ITEM-TOTAL CORRELATIONS AND SUBSCALE RELIABILITY COEFFICIENTS

MDEBS-LMK Item-Total Correlations

Scale Item	Item-Total Correlations
Source of Knowledge	
Following doctors' advice improves health...	.25
Patients can learn as much as their doctor...	.21
Medical information is too difficult to understand…	.27
Doctors don't know everything about treating health ...	.23
People should question their doctors' diagnosis ...	.30
Medical information is too complex for untrained…	.22
Patients don't know more than doctors about their own…	.45
Patients can't teach their doctors anything new…	.43
Medical information is too complex for untrained…	.35
Certainty of Knowledge	
Doctors should not hold differing opinions about …	.10
Medical truths are unchanging…	.41
Medical knowledge is what is true…	.31
The human body will always be a mystery…	-.08
There is usually more than one way to treat…	.12
There is usually one best way to treat…	.39
Doctors should not be creative in treating…	.26
Doctors should know whether a treatment works…	.24
Medical science is a puzzle. You just …	.25

Structure of Knowledge

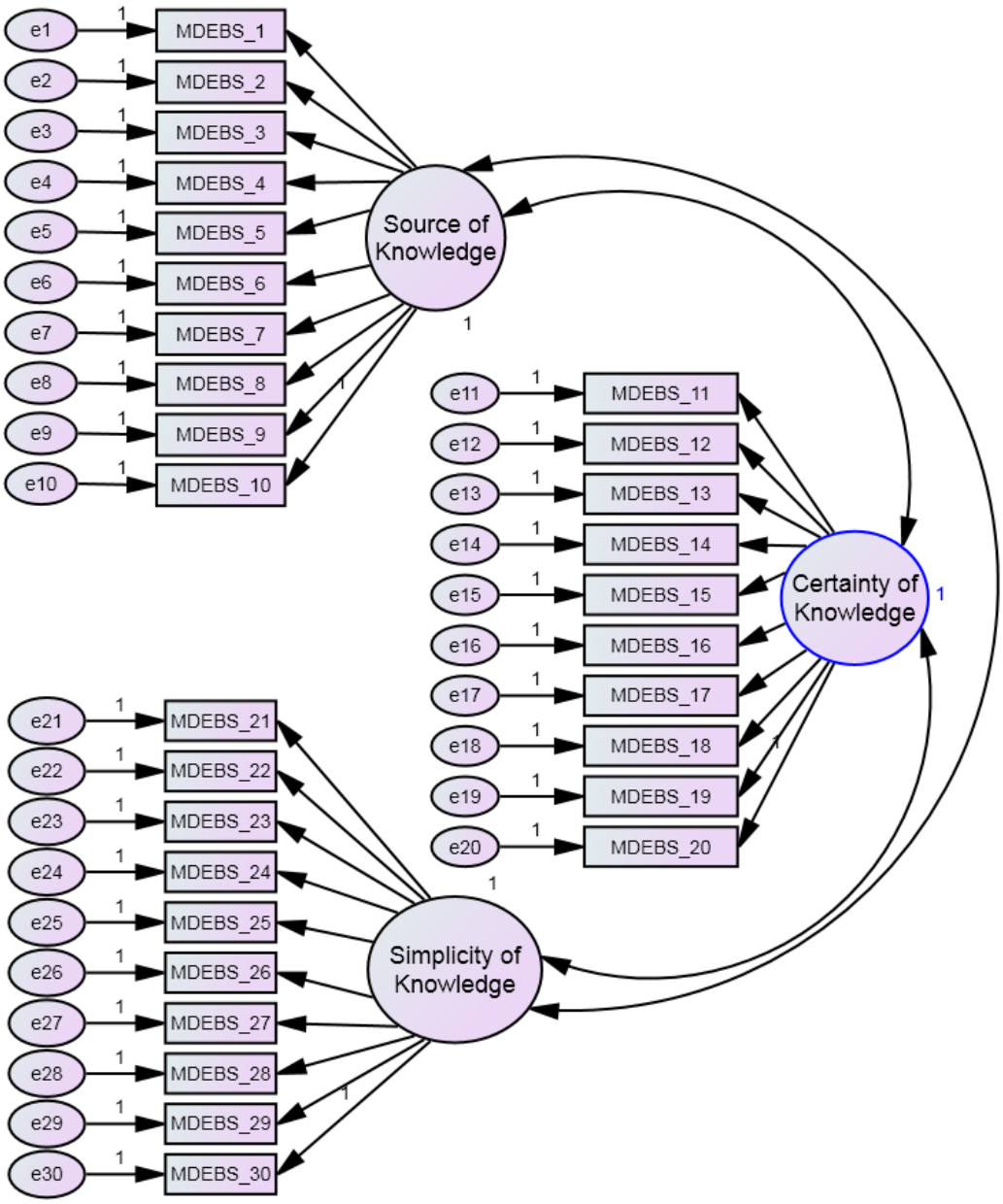
It is more important to know "what works" …	.34
What is learned about one medical problem applies to …	.08
Facts are more important than theories …	.30
Medical science has too many theories …	.27
Simple explanations are usually the best…	.24
If doctors give the wrong diagnosis it is lack of facts…	.36
If doctors had all the facts, they would treat most…	.31
Just knowing that a treatment works isn't enough…	.01
I would want my doctor to explain to me the reason…	.31
Doctors should give the same medical treatment to all…	.14

Note: Italicized items are reverse scored. Overall Coefficient Alpha = .745

APPENDIX F

HYPOTHESIZED MODEL OF THE EPISTEMOLOGY OF MEDICAL KNOWLEDGE

Hypothesized Model of the Epistemology of Medical Knowledge



APPENDIX G

TABLE OF ACRONYMS AND DEFINITIONS

Table of Acronyms

Acronym	Definition
CFA	Confirmatory Factor Analysis
CLEV	Checklist of Educational Values
DEBS-LMK	Discipline-Specific Epistemic Beliefs Scale – Lay Medical Knowledge – the original Barnes et al. instrument
DSBQ	Domain Specific Belief Questionnaire
EBI	Epistemic Beliefs Inventory
EBS	Epistemological Beliefs Survey
EBSM	Epistemological Belief Survey for Mathematics
EFA	Exploratory Factor Analysis
EQ	Epistemological Questionnaire
GLHC	God Locus of Health Control Scale
HINTS	Health Information National Trends Survey
MDEBS-LMK	Modified Discipline-Specific Epistemic Beliefs Scale – Lay Medical Knowledge – the instrument developed for this study
MHLC	Multidimensional Health Locus of Control
PAF	Principal Axis Factor
PASW	Predictive Analytics SoftWare
PICS	Perceived Involvement in Care Scale
RJM	Reflective Judgment Model
SEM	Structural Equation Modeling
SME	Subject Matter Expert
TIDE	Theory of Integrated Domains in Epistemology

VITA

Danny William Stout

Candidate for the Degree of

Doctor of Philosophy

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Pages in Study: 153 Candidate for the Degree of Doctor of Philosophy

Major Field: Educational Psychology, Research, Evaluation, Measurement and Statistics

Scope and Method of Study: The purpose of the study was to modify an existing measure of epistemological beliefs about medical knowledge specific to the layperson and further to investigate the relationship of this epistemological beliefs with other health related constructs, health locus of control and perceived involvement in care. To achieve these purposes, item analysis, confirmatory factor analysis and exploratory factor analysis were conducted to explore the structure of the Modified Domain-Specific Epistemological Beliefs Scale – Lay Medical Knowledge. Psychometric analysis included reliability analysis and evidence in support of content validity was presented. Relationships with other health related constructs were investigated with canonical correlation analysis.

Findings and Conclusions: After item analysis, the confirmatory factor analysis was completed and the data did not appear to fit the theorized model consisting of domains for Certainty of Knowledge, Simplicity of Knowledge, Source of Knowledge, and Justification of Knowledge. As such, exploratory factor analysis was conducted which revealed a three-factor solution interpreted as Simple/Certain, Questioning and Omniscient Authority. Coefficients of internal reliability for all three factors were below .80 indicating that further improvement is needed on the items comprising the scale. The factors of the MDEBS-LMK were related to Health Locus of Control and Perceived Involvement in Care scale factors in predictable ways. The findings support the need for further instrument development, specifically item improvement, improved sampling methodology as the sample was primarily female and highly educated, and a shorter length decreasing the impact of fatigue.

ADVISER'S APPROVAL: Laura L. B. Barnes