CONSTRUCT VALIDATION OF THE DOCTOR EXPERTISE SCALE IN A

PRIMARY CARE SETTING

by

LEIGH ALISON PHILLIPS

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ABSTRACT OF THE THESIS

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By LEIGH ALISON PHILLIPS

Thesis Director:
Howard Leventhal, PhD

The construct of Doctor Expertise is introduced and an initial measure of the construct is presented along with its construct validation in the context of a primary care medical setting. The Doctor Expertise Scale is theorized to measure important, predictive relationships between Doctor Expertise, or the general ability of a doctor to elicit a patient's mental model of his/her presenting problem and to communicate differences between the patient's model and the medical model, and health outcomes, such as patient treatment adherence and problem resolution. Content-related, criterion-related, and construct-related validity evidence is demonstrated and further steps for scale validation are presented.

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Introduction

Problems in patient health care are pervasive and largely due to an ineffective treatment process, through patient non-adherence to treatment or improper treatment prescription by physicians (Thier et al, 2008). One focus of this paper is to address specific reasons for patient non-adherence, specifically those which can be ameliorated by the physician during brief doctor-patient interactions in the primary care setting. We propose how doctors can be effective in getting patients to adhere to treatments (or at least in laying the ground work for patient adherence) within health psychological theory—a construct called "Doctor Expertise." Doctor Expertise is defined by a process of engagement by the doctor of his/her medical knowledge with the patient's mental model of his/her health and illness. It is *not* defined by what is traditionally thought of as doctor expertise, which is purely medical knowledge and experience in treating diseases (not patients). Doctor Expertise is also not merely a communication process between doctors and patients, because it is not merely the doctor communicating the medical model to the patient. The process is explicated below in three steps, which are theoretically based on the health psychological model of Common Sense Self-Regulation of Illness (Leventhal, Brissette, and Leventhal, 2003) and which involve the elicitation of patient illness beliefs and behaviors through effective probing/questioning or the inference of patient illness beliefs and behaviors from patient reports of symptoms and behaviors, the negotiation of patient beliefs with the medical model, and finally the resolution of contradictions between the two models that would lead to doubts about treatment efficacy and non-adherence.

The importance of Doctor Expertise lies in the consequences it has for patient health outcomes—the path to outcomes being laid through patient understanding of and belief in the medical model of illness and consequent adherence to the prescribed treatment. The construct of Doctor Expertise exists in a nomological network (i.e.

usually a diagram illustration of the theoretical relationships of a construct—Doctor Expertise in this case— with other constructs; Cronbach & Meehl, 1955) of these and other related constructs that explain in theoretical terms how doctors can achieve better patient health outcomes. Others have studied doctor-patient communication and its effect on patient adherence (see for example, Inui, Yourtee, and Williamson, 1976, and Roter et al, 1997), but the findings have never been placed within a useful, theoretical framework that specifies the mechanisms involved in the communication of those knowledge units essential for adherence and positive health outcomes. The focus has been on "patient-centered care" and getting the patient to be more involved in his or her own health care without specifying the types of beliefs, the key aspects of an illness, or the consequent behaviors that are necessary for effective adherence to specific treatments.

The aim of this paper is to present a scale to measure the construct of Doctor Expertise and to test the theoretical hypothesis that this mechanism is important for adherence and health outcomes. Validation of the Doctor Expertise Scale (DES) is presented and results are discussed in the context of their implications for not only the quality of the DES and the improvements it requires but also for the theoretical standing of the construct of Doctor Expertise in its proposed nomological network. The definition of Doctor Expertise provided above and described further below has implications for how the DES was constructed, and the nomological network described below has implications for how the DES was and will continue to be validated.

Treatment adherence is notoriously difficult to obtain in patient populations of every age, gender, illness, and social group (Kripalani, Yao, and Haynes, 2007). Non adherence is related to a variety of factors in the treatment, the patient's context, and the patient. For example, the treatment may be too difficult for the patient to maintain over long periods of time, the cost of a prescription may be too high for a patient to purchase the medicine regularly (Kessler, 2007), or the patient may just forget to take his/her medication on some days. In 2003, the Boston Consulting Group conducted a survey on reasons for non-adherence to prescribed medication and found that 24 percent of non-adherence was due to patients forgetting to take their pills or to refill their prescription, 20 percent was due to patient concern about side effects, 14 percent was due to patients thinking they did not need the medication, and 17 percent was due to cost-related issues (21 percent cited other reasons; see Thier et al, 2008). A systematic review of medication adherence found that roughly 20 to 50 percent of patients are non-adherent to prescribed treatment, resulting in poorer medical outcomes, higher health care costs, and higher rates of emergency care usage; these effects are most noticeable for non-adherence to chronic conditions (Kripalani et al, 2007). Prescribed diet and exercise adherence was found to have an even greater effect on health outcomes than medication adherence (DiMatteo et al, 2002). The pervasive effect of treatment non-adherence on health care in general has led adherence to be called “the key mediator between medical practice and patient outcomes” (Kravitz & Melnikow, 2004).

Many reasons for non-adherence are due to a conflict between the patient’s common sense model of self regulation (CS/SR model), i.e. his/her mental representations of the illness, and prescribed treatment and the “medical model”, the latter more closely representing the biological mechanisms underlying the illness and how it is affected by the prescribed treatment. Patient’s CS/SR models have five domains into which his/her health and illness beliefs fall: identity (illness label/diagnosis; symptoms that are associated with the illness and symptoms that are not but thought to reflect the condition because of their location and/or pattern), cause (environmental, biological, or lifestyle causal factors, or an antecedent event that generates similar symptoms – e.g., a blow to a limb that causes a harmless lump can then be seen as a cause of a lump in the breast), timeline (how long the illness will last; whether the illness is acute, chronic, or cyclical, the trajectory of symptoms), control (actions taken by patients and/or doctors that are expected to control symptoms and do or do not), and consequences (side effects of treatment that are distressing and/or raise concerns about harm; social and financial costs of the illness and treatment). Conflict between illness beliefs from any of the domains and the medical model of illness, including the treatment prescribed to the patient, can result in treatment non-adherence.

Examples of health outcomes and adherence being affected by conflict between patient and medical models for each of the domains are documented in the literature. Some individuals with congestive heart failure (CHF) have demonstrated “conflict” between their identity CS/SR model domain and the medical model in that they do not recognize associated symptoms of CHF include swollen legs and fluid in the lungs, because they identify only symptoms near the heart (e.g., chest pain) with their “heart problem.” Therefore, when these symptoms are experienced, CHF patients often do not seek medical treatment when they need it (Horowitz, Rein, & Leventhal, 2004). Some individuals accidentally forget to take their daily medications, whereas others decide to skip their daily medicines. For example, Hypertension patients, who have conflicting causal CS/SR beliefs with the medical model, cite stress as a cause of high blood pressure (stress creates tension and awareness of heart beats), and therefore think that proper treatment of hypertension includes (or consists entirely of) avoiding stressful situations. They therefore often do not adhere to their hypertension medication, because they believe they can control their blood pressure by removing stressors from their lives (Heurtin-Roberts & Reisin, 1992).

The case of asthma and timeline beliefs provides a last example of the importance of CS/SR beliefs for adherence: in a recent study, over half of the patients hospitalized with severe attacks of asthma did not adhere to their daily preventive medication because of a conflict between their timeline beliefs and the medical model.

Although an overwhelming number of these patients reported that they would have asthma for the rest of their lives, over half agreed that they had asthma only when they had symptoms. Those who answered that they have asthma only when they have symptoms, i.e. they believe asthma is an acute rather than a chronic illness did not take their preventer medication (inhaled cortico-steroids) which are used to reduce pulmonary inflammation and taken when asymptomatic. The health outcomes for these acute-timeline believers are much worse than for those who correctly believe that asthma is a chronic condition, solely because the latter do not adhere to their medications on a daily basis (when they do not have symptoms) and the former individuals adhere all of the time (Halm, Mora, & Leventhal, 2006).

Given the importance of patients' CS/SR beliefs for adherence and health outcomes, the role of the doctor is therefore of primary importance, not just for diagnosing and prescribing, but for insuring that a conflict of beliefs is not causing non-adherence. A doctor cannot control *all* factors related to patient adherence, such as external barriers (e.g., finances, memory, and physical ability of patient), but he/she can play a significant role in addressing and shaping patient's beliefs and behavioral intentions, according to the Doctor Expertise theory. In order to dispel any conflict between patient and medical models of an illness and treatment, I propose that during a medical encounter the physician must engage the patient in a three stage process of "model-assimilation:" (1) elicitation or inference of the patient's model, (2) negotiation of patient model with the medical model, and (3) communication (even demonstration) of conflict and creation of a shared, agreed upon model that can serve as the base for appropriate use of treatment.

First, a doctor must elicit or infer the patient's CS/SR model of the illness or symptoms being discussed—the cause, consequences, perceived control, timeline, and identity of the illness/symptoms. This stage is unnecessary if a patient is in good control of a pre-existing illness and does not present with any new problems. Otherwise, if a patient is not in control of (management is not sufficient for) an existing illness, the doctor needs to assess aspects of the patient's CS/SR model that may be contributing to the non-adherence/poor management, in addition to determining if the problem is due to the prescribed medication or worsening biological factors. If a patient is presenting with what he/she thinks is a new symptom that is unrelated to an existing illness, the doctor needs to assess aspects of the patient's CS/SR model that could potentially result in incorrect self-treatment attempts or non-adherence to prescribed treatment. It is not yet known which questions are best for eliciting certain aspects of a patient's CS/SR model, and in order to avoid looking foolish, a patient may report beliefs and/or symptoms to match what he/she believes the doctor wants or expects to hear (a social desirability bias; e.g., Logan, Claar, and Scharff, 2008). The qualitative data that is part of the current study will allow us to identify questions that are effective for eliciting patient models; the doctor-patient interactions will be coded by trained observers to detect the better- and poorer-performing questions and this information will be presented in a separate publication.

After eliciting or inferring important CS/SR beliefs from the patient's actions and/or verbal responses, a doctor must then negotiate the patient's mental model of the illness with the medical model for the condition, the second step of the proposed "Expert Doctor" process. This step is most closely related to the lay conception of doctor "expertise," in that successful execution of the step requires proper medical knowledge and training. It additionally involves an understanding of how patient beliefs translate into behavior and subsequent health outcomes—an understanding that often comes with more experience with patients, and therefore, I hypothesize, is held more by senior doctors than by residents or doctors new to the practice of medicine. Once a physician has a picture of the contradictions between the patient's model, and the medical model and perceives how these disagreements could affect management and health outcomes, s/he needs to communicate these facts to the patient and demonstrate their potential, health consequences. This is the third step of the proposed process of being an Expert Doctor. A similar approach exists in cognitive behavioral therapy, where one technique of a therapist may be to catch the patient at a contradiction and get patient to realize the “truth” rather than just telling the patient “how it is.” Unlike cognitive behavioral therapy, however, the medical practitioner is less often dealing with long standing irrational thoughts, than with implicit models that lead to misinterpretation of symptoms and incorrect ideas of the effects of treatment on the body and the underlying physiology of a chronic disease. Once conflicts between the medical and patient models are removed, the doctor can be more confident that a treatment will be used as prescribed. If there is no conflict because the patient does not have a model formulated, e.g. if the patient came in with a novel symptom and no ideas about cause, timeline, or expected treatment, then the doctor should communicate the probable causes and requisite treatment so that the medical model becomes the patient model (i.e., so that it “makes sense” to the patient and is therefore adopted as his/her own model of the illness).

Method Overview

This paper was a first attempt at validating a measure of Doctor Expertise, a construct that is captured by the three stages of patient and medical model assimilation detailed above. To construct-validate the DES as a measure of the Doctor Expertise construct in a primary care setting, the following types of evidence were sought in this project: content-related validity evidence, criterion-related validity evidence, convergent validity evidence, and discriminant validity evidence (Whitley, 1996; DeVellis, 2003). While convergent and discriminant validity have traditionally been seen as the two types of construct-related validity, it is now generally recognized that all of the above types of validity can be considered under the umbrella of construct validity (Whitley, 1996). The essence of construct validation of a scale lies in demonstrating that the scale accurately measures the effects of the construct (latent variable) on the outcomes of interest (i.e. the scale should uphold the relationships theorized in the nomological network). Briefly, to be construct-valid the scale must be composed of items that are all relevant to and representative of the construct (content-related validity), the scale must yield scores that are related to measures of other, related constructs (criterion-related validity evidence through prediction or concurrent covariation), and the scale must yield results similarly to other scales of the same construct (convergent validity) and differently from measures of unrelated constructs (discriminant validity). That is, the DES must contain items that tap the whole construct and only the construct of Doctor Expertise, it must predict prospectively and/or concur simultaneously with measures of related constructs, it must agree with other measurements of Doctor Expertise, and it must *not* measure constructs that are distinct from Doctor Expertise.

The nomological network of Doctor Expertise is first presented along with a description of the general data collection method and the method of measurement used for each construct in the nomological network. The construction of the Doctor Expertise

Scale and content-related validity evidence is then given, followed by the scale's psychometric properties, criterion-related validity evidence, and finally, evidence of the scale's convergent and discriminant validity.

Doctor Expertise Nomological Network

Improvement of patient adherence is clearly an area of primary importance, where doctors have the potential to use the processes of Doctor Expertise to improve patient health outcomes. There are other constructs that are theorized to relate to Doctor Expertise and to patient adherence; some occupy an intermediary step between Doctor Expertise and patient adherence in the nomological network of Doctor Expertise, and some occupy more proximal a position to patient adherence in the network. Here I detail such a nomological network for the construct of Doctor Expertise that will be important for the construct-validation of the DES. Figure 1 illustrates the nomological network for the construct of Doctor Expertise. I expect Doctor Expertise to be strongly related to a measure of how much the patient's and the doctor's illness models are in agreement—the construct I call "Shared Models." The greater the match between a patient's model and the doctor's model, the greater the likelihood the patient will intend to adhere and actually adhere to the prescribed treatment. I hypothesize that the patient is more likely to report high agreement in his/her beliefs with the doctor's, and subsequently more adherence to the prescribed treatment if implementation of the Doctor Expertise process is successful. Another construct related to both Doctor Expertise and patient adherence is belief change. If a physician infers that the patient's CS/SR model conflicts with the medical model and communicates the contradiction to the patient, then the patient's beliefs are more likely to change than if the doctor was not able to successfully implement the steps in the Doctor Expertise process. Furthermore, if the patient's beliefs do change to align more with the medical model, then the patient will likely score highly in a measure of Shared Models. Finally, through patient adherence, Doctor Expertise should be related to health outcomes, such as the resolution of the presenting problem and changes in the patient's physical and or mental functioning, depending on which were affected by the illness/presenting problem in the first place. Figure 2 illustrates the nomological network of the latent Doctor Expertise construct that was used for validation of the DES in the current study (simplified from the complete nomological network in Figure 1).

The current study was conducted from the summer of 2007 to the summer of 2008 in an internal medicine, primary care practice at a University Medical Center. All patients were approached for recruitment, regardless of their reasons for seeing the doctor. Patients who consented were given a one-page questionnaire to fill out while waiting for their appointment; they were asked about the reason for their doctor visit along with questions about general health and patients' expectations for the doctor visit. The patients separately consented to have their interaction with the doctor audio recoded; patients who did not consent to the audio recording were still included in the study. Patients were contacted by phone 24-48 hours after the visit by research personnel for a 1.5 to 2 hour interview regarding the doctor visit and any prescribed treatment plans. Measures of physical and mental functioning were taken as well as general health and patient CS/SR model beliefs. The respondents completed the Doctor Expertise Scale to assess whether they perceived the visit as leading to "Belief Change," "Shared Models," "Patient Satisfaction," and evaluated their view of the doctor's "Psychosocial Skills" (these measures are described in detail below and listed in the Appendix). One month after the doctor's visit, patients were contacted by phone by research personnel for a thirty-minute interview about the presenting problem resolution, physical and mental functioning, general health, and adherence to the presenting problem treatment.

Shared Models

To measure the construct of “Shared Models,” or the degree to which the patient perceived the doctor’s beliefs, thoughts, and actions to match his/her own model of the illness, the patient was asked a number of questions directly about his/her perception of shared models. Patients were asked to rate their level of agreement on a 5-point scale, “Not at all” to “Very much,” with 5 items, such as “Overall, the doctor and I share a common understanding of the illness.” An average of the items was calculated for the “Shared Models” variable. The scale created from the above 5 items had a Cronbach’s alpha of .791, based on standardized versions of the items. Item-total correlations were all above .65, except for item number 4 above, which had an item-total correlation of .194. However, since the Cronbach’s alpha was well over .7, the item was kept in the scale. It is important to note that several of the measures we are using to validate the DES are new and have therefore not been previously validated. Each scale is theoretically linked to the construct of Doctor Expertise, but results that do not support the theorized relationships could be due to either a problem with the DES, with the measures of the other constructs, or with the nomological network. Interpretation of all results below is therefore made with caution and with acknowledgement of these issues.

Patient Adherence

Patient adherence was measured using a scale adapted only slightly from the Medication Adherence Scale (MARS; Horne and Weinman, 2002) to fit the specific circumstances of the study and theory of Doctor Expertise. For example, a more specific adherence question related to a common primary care occurrence was added: “I followed this treatment for as long as the doctor prescibed: Not at all, A little, Somewhat, Quite a bit, Very much,” and a more general question was added to assess if patients did something “different from” what was prescribed rather than “more” or “less” than prescribed; it is possible that the patient’s CS/SR model is in sufficient conflict with the medical model to lead the patient to choose a treatment completely different from that prescribed . An average of the standardized items was calculated for the "Patient Adherence" variable. The items of the scale had a Cronbach's alpha of .72 based on standardized items. The item-total correlations were all moderate, with the lowest equal to .260 and the highest equal to .601.

Belief Change

The construct of "Belief Change" was measured by 5 items assessing the perceived degree to which the patient's beliefs changed from before to after seeing the doctor. 2 items asked directly about perceived belief change (e.g., "How much have your thoughts changed about the cause of your symptoms?"), and 3 items assessed change by subtracting the score from an item before the doctor visit from the same item after the doctor visit (e.g., the absolute difference between a patient's pre- and post-doctor visit responses on the question, "How likely do you think this is a very serious problem?"). The above variables were standardized and then assessed for internal consistency to determine if Belief Change could be a composite measure of the items. Cronbach's alpha was .271 for the 5 items, indicating a composite measure should *not* be created. Further, the only significant correlation between any two of the five items was .357 for the items assessing worry/concern about and seriousness of the presenting problem. Even this correlation was not sufficiently high enough to warrant a composite measure for those two items, so the items were retained for separate analyses.

Presenting Problem Resolution

Presenting problem resolution was assessed with two different items, one of which gauged relative resolution ("Is the problem better") and the other which gauged absolute resolution ("Is the problem completely gone"). The former is more relevant for longer term acute problems and for chronic problems, and the latter is more relevant for acute problems that can be resolved in one month or less. The two items correlated at .468 and were not combined into a composite measure of problem resolution because of the low correlation and the distinction in applicability to varying presenting problems. Despite the fact that the relative resolution item seems to be applicable to more cases than the absolute resolution item, the response scale elicited a number of non-interpretable answers from patients, as seen by the comments they gave with their answer to the relative resolution item. The original response options (“Yes,” “No, problem is unchanged,” “No, problem is worse,” “No, problem is unchanged and under control,” and “Not Applicable”) were altered so that only a Yes or No response was possible in the analyses. All original “No” options were assigned the same value, and the “Not Applicable” value was assigned a missing value status. The original response options for the absolute problem resolution item were “Yes” and “No,” and were therefore not altered for analyses.

Patient Satisfaction

The same question was asked at the beginning and at the end of the 24-hour follow-up interview and was stated only slightly differently each time, asking about the patient’s overall level of satisfaction with the doctor visit. The two items correlated .692 with each other and were consequently averaged into one composite measure after the variables were standardized.

Psychosocial Skills

Items assessing the construct of “Psychosocial Skills” are those that are meant to measure what people call in lay terms, the “bedside manner” of the doctor—for example, whether or not the doctor shows concern about the patient’s happiness and family life and other topics usually considered small talk and not usually relevant to the patient’s illness, the tone of the doctor’s voice, eye contact, and touch (Weissmann et al, 2006). This construct will be explored more fully when the discriminant validity of the DES is assessed. The five items relevant to the construct are listed in the Appendix and had a

Cronbach's alpha of .848 on the standardized items. An average of the five items was created for the composite measure (unstandardized).

Doctor Expertise Scale Construction and Content-Related Validity

To demonstrate content-related validity of the scale, one must show that the content, or items, of a scale are both *relevant* to the construct and *representative* of the construct. The stages of the Doctor Expertise process are *general* processes and include behaviors that "Expert" doctors engage in, but the specific behaviors involved in each stage are dependent upon the medical setting, the patient's particular characteristics and the doctor's particular characteristics. Because scale validation is conducted for a specific purpose and not all potential uses at one time, the validation of the DES was conducted in the current study specifically for use in a primary care setting, and therefore the items were designed to assess specific Doctor Expertise-related behaviors that occur in the primary care setting. Regardless of the specific items of the DES and the specific context in which it is used, the doctor who completed the three stages of the patient- and medical-model assimilation process should be seen and rated by patients as having higher levels of Doctor Expertise. In this section, the choice of primary care setting is first explained, and then the construction of the DES items is described and justified.

The primary care setting was chosen for the construction and validation of the DES for several reasons: it allows for a more general look at Doctor Expertise, it allows for the study of chronic and acute illnesses simultaneously, and it allows for access to a greater variety of patients, who may differ in socioeconomic status, age, education, gender, religion, ethnicity, and culture, than may be found in a specialty clinic. The primary care setting was also chosen for initial validation purposes, because the timeline for measuring the constructs related to Doctor Expertise in the nomological network is much shorter than in a chronic illness specialty clinic. The effect of Doctor Expertise on patient adherence to a treatment for a presenting problem can therefore be assessed over an acute time period. That is, the primary care setting provides a window of assessment that is short enough to capture the effects of a doctor's Expertise *in one visit* and with a one-month follow-up, rather than a 6-month to 1-year or longer follow-up. The focus of the validation procedures is therefore on fairly short-term outcomes: change in CS/SR beliefs, patient adherence, and problem resolution within one month of the doctor visit.

In a primary care setting, where *all* types of illnesses and individuals are treated or at least encountered by doctors, Doctor Expertise can only be assessed for a wide range of presenting complaints seen in a primary care setting using items that are sufficiently general to be both *relevant* and *representative* for both acute and chronic illnesses and overall health. The DES items are necessarily about the causes, identity, control, consequences, timeline, and treatment for a presenting problem, therefore the patient sample was limited for the validation analyses to only those patients who had a presenting problem to discuss with the doctor *and* for whom every item of the eight Doctor Expertise items were applicable; the composite Doctor Expertise score is a sum of eight dichotomous items. The number of patients excluded from the analysis was 109, leaving 115 patients in the sample.

The construction of all of the questions in the study was supervised by a health-sociologist, three health-psychologists, and two medical experts. The items chosen for the DES were therefore assessed for relevance to and representativeness of the Doctor Expertise construct. Each item in the DES is a question about whether or not the doctor did a particular behavior, and the answer response options were: “Yes,” “No,” “Previously,” and “Not Applicable.” The “previously” option was included, because some patients were seeing their regular doctor, whom they may have seen for many years previous to the particular visit under study. Therefore, some of the topics assessed by the items may have been discussed by the doctor at a previous visit; because these behaviors are considered part of Expert Doctoring, the “Previously” response option was given the same value as a “Yes” response for the current analyses. The option of “Not Applicable” option was required for respondents who did not have a presenting problem or a prescribed treatment. Therefore, the “Not Applicable” response option was assigned a missing value status. Since the Doctor Expertise Scale is a single composite measure of all of the Doctor Expertise items, if any of the items were answered “Not Applicable,” then that patient was excluded from the analyses of the DES due to a missing composite measure of the DES.

The DES items assess the doctors’ behaviors with regard to all the domains of a CS/SR model, but not every *stage* of the Doctor Expertise assimilation process are directly assessed with the items. The first and second stages, or elicitation of the patient’s CS/SR model and negotiation of the patient model with the medical model, respectively, can be captured indirectly by assessing how well the third stage of the assimilation process occurs, which is the communication to and discussion with the patient about the medical model juxtaposed to the patient’s model. The Doctor Expertise Scale explicitly assesses only the third stage described in the assimilation process. It can be assumed, for the time being, that stages 1 and 2 must occur (albeit to varying degrees of success) before stage 3 occurs. Therefore our assessment of stage 3 will reflect the success of doctor implementation of stages 1 and 2. The second stage occurs mainly in the thoughts of the physician and is therefore not amenable to patient-report measures. The first stage could potentially be measured by items assessing what questions the doctor asked the patient about the patient’s CS/SR beliefs and behaviors. These types of questions were excluded from the current study for reasons of brevity, but the recorded interactions can provide this information. Because of the importance of treatment-related CS/SR beliefs for outcomes such as patient adherence and problem resolution, the focus of the DES items is primarily on communicating proper treatment to the patients. Specific items for the Doctor Expertise Scale are in the Appendix. Also listed in the Appendix are a number of Doctor Expertise-related items in the current study that were eliminated from the Doctor Expertise Scale for their conditional-nature or other reasons explained in the Appendix.

The DES is purely based on patients' self-reports of the doctors' behaviors. This design decision was made for practical reasons—interviewing patients about their experiences is much easier than (1) relying on audio recordings of the doctor-patient interaction and then having at least two trained raters code for Doctor Expertise or (2) recruiting doctors for interviews to assess their level of Doctor Expertise, which is likely not a perfectly stable trait within an individual and would be therefore more difficult and less reliable a technique than a patient-specific assessment. Patients are easier to recruit than are doctors, and getting patient reports on quantitative measures is much more time and cost economical than having trained observers code hours of doctor-patient interactions. Along the same lines, it is easier to get patients to participate in an interview than to agree to have their doctor interactions recoded due to privacy violation factors. The downside of relying on patient reports is that it leaves the researcher vulnerable to confounds, such as patient attention and memory effects on the results as well as social desirability biases (King & Bruner, 2000). However, to lessen the probability of social desirability bias effect on the measure, the Doctor Expertise Scale items were designed to ask the patient only about the doctor's overt and observable behaviors and not to ask about the patients' *perceptions* of Doctor Expertise. How the behaviors relate to the Doctor Expertise construct is therefore up to the theoretical determination of the researcher and not the potentially biased perceptions of the patient. Also, relying on patient reports of doctor behavior affords us one potentially important advantage: patient reports are more likely to be related to the patient's subsequent behavior than are observer-rated reports, even if the observer-rated reports better represent the Doctor Expertise construct due to less than perfect patient attention to and memory of doctor behaviors.

Psychometric properties and Reliability of the DES

The psychometric properties of the scale are important for scale construction and for the theoretical interpretation of the underlying construct or latent variable. All scale items should assess the construct of interest, even if they assess different construct facets. Also, one can test to see if truly only one latent factor determines scores on all of the scale's items or if the scale assesses two or more latent factors. One common factor would indicate a unified, singular construct, whereas two or more latent factors would indicate possible sub-factors of the construct (i.e. that the theory/nomological network should be modified or further specified) or that the scale is assessing more constructs than are desired theoretically (i.e. that the scale should be modified).

Factor Analysis

A one-factor solution was expected based on our theory and construction of the Doctor Expertise Scale. Confirmatory factor analysis with weighted least squares estimation was conducted in MPlus (Muthén & Muthén, 1998-2007) to test the fit of a one-factor solution of the dichotomous variables that make up the Doctor Expertise Scale. The Chi-Square test of model fit was marginally significant (statistic = 24.847, df = 16, p = .073). Exploratory factor analysis was then conducted to see how many factors (between 1 and 3) were optimal with weighted least squares estimation and oblique quartimin rotation (recommended method; Muthén & Christoffersson, 1981). Since the theory of Doctor Expertise does not dictate which of the eight items in the scale would make up one factor and which items would make up a second or third factor, confirmatory factor analysis was not used to test a two-factor model against the one-factor model. The exploratory factor analysis had no convergence for the two-factor solution. The one-factor solution Chi-Square test of model fit was significant at $p = .05$ (statistic = 31.058, df=20), and the three-factor solution was not significant (Chi-Square statistic = 6.715, df = 7, $p = .4592$). While the one-factor model might not fit the data perfectly, both the CFA and the EFA indicate a one-factor solution is most likely the best fit to data, indicating the Doctor Expertise Scale taps into one latent factor reasonably well.

Reliability Analysis

The reliability of the DES was assessed using the Kuder-Richardson alpha, a measure of the internal consistency of the items in the scale. Internal consistency analyses can only be done with listwise deletion and the results therefore do not include the patients for whom only some of the items were applicable. The Kuder-Richardson Alpha was .749, indicating good internal consistency of the scale.

Intra-Class Correlation and Design Effect Analysis

Intra-class correlations (ICC) are used most often as measures of inter-rater reliability. They can be used with clustered data, such as the current study is using (patients clustered or nested within doctors) in order to determine if patients of the same doctor answer study questions in similar ways; the higher is the ICC, the greater is the amount of variation in the dependent variable accounted for by which group/doctor the patients belong to. The ICC indicates both how stable a trait Doctor Expertise is for a doctor and if multilevel analysis is necessary when testing the relationship between a predictor variable, such as Doctor Expertise, and any outcome. Although environmental effects on a doctor's performance from day to day could affect his/her performance level of "Expertise," I theorize that the average level of Doctor Expertise for a particular doctor is a fairly stable; therefore, the ICC for Doctor Expertise is hypothesized to be significantly greater than zero. If the daily context influences scores on the DES substantially, however, then the assessment of Doctor Expertise for each doctor may vary greatly. Also, if patients respond very differently to each other on the performance for the same doctor due to their particular illnesses and individual differences, then variation in Doctor Expertise might not be significantly accounted for by the doctor variable. I.e., it is possible that variation in Doctor Expertise may be greater within the doctor than between doctors due to both differences within doctor over time and to patient-specific differences in doctor ratings.

Following the guidelines of Shrout and Fleiss (1979), ICC (1) was used for the current analyses, which is typically calculated using the one-way ANOVA in SPSS. ICCs were calculated by hand and for only the five senior practitioners who saw 20 or more patients, because the number of patients seen by each doctor was unequal, meaning simple calculations by ANOVA were not as accurate as hand calculations. The other doctors were excluded from the ICC analyses due to the very small number of patients seen by each of them. If the number of observations is too few for a substantial number of groups (more than one can have a great effect; see Swigar et al, 1964), then the average number of observations per group is significantly lower than if the groups with too few observations were eliminated from the analyses, which causes the ICCs to underestimate the effect of group membership on the outcome. The average level and standard deviation of Doctor Expertise for each of the five senior doctors and all of the residents grouped together are presented below in Table 1 for descriptive purposes (the DES has a minimum of 0 and a maximum of 8, each point reflecting if the patient reported the doctor did the behavior asked about in each item). The ICCs and their significance values (for the differences between the ICCs and zero) are provided in Table 2, along with the design effect associated with each ICC. The design effect provides a clearer picture of the ramifications of the ICC in that it represents the amount by which a researcher must multiply (increase) the original sample size in order to get the same statistical power as if the observations were completely independent of each other (see Rowe et al, 2002).

Variance in the following variables was not significantly accounted for by differences between doctors: Doctor Expertise, patient adherence, cause-related belief change, change in overall understanding of the illness, and worry-related belief change. Variance in the following variables was significantly accounted for by differences between doctors: shared-ness of models, patient satisfaction, psychosocial skills of the doctor, problem resolution (both "completely gone" and "better" versions), and belief change regarding the relatedness of the presenting problem to a chronic condition. For the criterion-related validation analyses presented below, Doctor Expertise will be tested for its relationships to these variables using either ordinary least squares regression if the outcome variable was not affected by the doctor-level variable, or using multilevel modeling if the outcome variable was affected by the doctor-level variable.

Criterion-Related Validity

To demonstrate criterion-related validity of the DES, analyses were conducted to assess both concurrent and prospective/predictive relationships between Doctor Expertise and the constructs in its nomological network, illustrated in Figure 2. As mentioned above, ordinary least squares regression was used for those outcome variables that were not influenced by the doctor-level variable, and multilevel modeling (in SPSS: Statistical Package for the Social Sciences, SPSS Inc, Chicago, IL; and SAS software: SAS Institute Inc., 2000-2004) was used for those outcome variables that were influenced by the doctor-level variable. It is important to note here that all seventeen doctors in the study were included in the multilevel analyses below, even though only five of the doctors and their patients were used in the ICC analyses above. Multilevel analyses can handle group-variable levels (i.e. doctors) that have only a few or even just one observation, as long as not too many doctors have only one or two patients (for guidelines, see Guo & Cai, 2007). Using multilevel analysis with a group-level sample size of under 50 can lead to biased estimates of the standard errors of the group-level variables (Maas and Hox, 2005), therefore standard errors should be interpreted with caution in the analyses below, due to the limited doctor sample size of 17.

All analyses of continuous/quantitative outcome variables were conducted in SPSS using random intercepts modeling in the mixed model procedure. The analyses of presenting problem resolution (resolved or not resolved; better or not better) were conducted using the SAS software "glimmix" procedure for hierarchical logistic regression. The average relationship within doctors (i.e. after controlling for the effect of the doctor-level variable) of Doctor Expertise to each outcome variable is reported below.

Doctor Expertise (DE) and Shared Models

The MLM analysis showed that Doctor Expertise did significantly and positively predicted the degree to which patients perceive their own models to be shared with their doctor's model (Shared Models) within doctor. The average relationship/slope (over all doctors) between Doctor Expertise score and Shared Models is .157, which is interpreted just as would be a regression coefficient; with every unit increase in Doctor Expertise, the amount by which Shared Models increases is 15.7% ($t = 4.975$, $df = 95.128$, $p < .001$). An effect size estimate for this effect of Doctor Expertise on Shared Models *within* doctor (i.e., taking into account doctor differences in Doctor Expertise and Shared Models) was found by subtracting the amount of unexplained variance in the model with Doctor Expertise as a covariate from the amount of unexplained variance in the null model. This value is .0925 (9.25%), which equals the amount of variance in Shared Models accounted for by Doctor Expertise, within doctor, and can be interpreted just as would be R-squared change (Garson, n.d.).

DE and Patient Adherence

The linear regression analysis showed that Doctor Expertise does not significantly predict patient adherence (unstandardized regression coefficient = .039, t = 1.025, p = .309).

DE and Presenting Problem Resolution

Random intercepts hierarchical logistic regression was conducted using SAS software and showed that the intercept variability between doctors in both absolute and relative problem resolution was not significant. This indicates that the effect of the doctor-level variable on problem resolution was uniform for all doctors when Doctor Expertise was at its mean level. The analyses indicated that there was a significant effect of doctor on both absolute and relative problem resolution after level of Doctor Expertise was taken into account; for absolute problem resolution, the estimate (unstandardized regression coefficient) was = .7092, t=2.32, df=15, p=.035, indicating that, on average, 71 percent of a doctor's patients reported that their problem had *not* completely gone away (n=80 patients). For relative problem resolution, the estimate was = -.7868, t=-2.27, df=15, p=.038, indicating that, on average, 79 percent of a doctor's patients reported that their problem had gotten *better* (n=79 patients). The estimate for relative problem resolution is negative, because SAS software estimates the probability of a "0" event rather than a "1" event, and in the case of presenting problem resolution this means that SAS software estimated the probability of patients *not* getting better and the probability that patients' problems would *not* be completely gone; i.e., for absolute problem resolution the estimate was positive because there was a higher probability of the problem not being gone, and for relative problem resolution, the estimate was negative because there was a higher probability of the problem being better.

After the effect of the doctor was controlled for, Doctor Expertise was not a significant predictor of absolute problem resolution (estimate = -.1794, t = -1.46, df = 63, p =.149) but was a marginally significant predictor of relative problem resolution (estimate = -.2137, t = -1.73, df = 62, p = .089). Note that the negative estimates indicate that Doctor Expertise was negatively associated with *not* getting better and therefore positively associated with getting better and with the problem being completely gone (this was the trend in both cases).

DE and Belief Change—Overall understanding

The linear regression analysis showed that Doctor Expertise does significantly and positively predict better understanding of the presenting problem from before to after the doctor visit (unstandardized Beta=.157, t= 3.985, p<.001). The effect size of this relationship is R-square equal to .128, which means Doctor Expertise explains 12.8% of the variance in change in overall understanding of the presenting problem.

DE and Belief Change—Relatedness of presenting problem to chronic condition

The MLM random intercepts analysis showed that the effect of Doctor Expertise on belief change regarding how related a presenting problem is to a chronic illness was not significantly different from zero (regression estimate = -.014, t = -.350, p = .728).

DE and Belief Change—Causal beliefs

The linear regression analysis showed that Doctor Expertise significantly and positively predicts change in patients' CS/SR model causal beliefs regarding their presenting problem (standardized Beta = .238, t = 2.276, p = .025). The effect size, R-square, was .057, indicating 5.7% of the variance in causal belief change is explained by Doctor Expertise.

Construct-Related Validity

Evidence for the construct validity of the Doctor Expertise Scale is provided in part by the criterion-related validity evidence presented above—if the measure of Doctor Expertise is related to other constructs that are theorized to relate to the construct of Doctor Expertise, then this supports the construct validity of the measure (Whitley, 1996). However, there are two other necessary ways to assess the construct validity of a measure, which will now be provided: convergent validity and discriminant validity. The former validity is demonstrated when differing measures of the same construct are shown to be highly related to each other. The latter is demonstrated when measures of a theoretically distinct construct are shown to *not* be related to a measure of the construct of interest.

Convergent Validity

To assess the convergent validity of the Doctor Expertise Scale, an observer-rated measure of Doctor Expertise was calculated from a sub-sample of the available audio recordings of the doctor-patient interactions in order to compare the patient-reported Doctor Expertise with an observer-rated Doctor Expertise, which is allows a more theoretically driven assessment of the doctor's Expert performance than is possible with patient/lay person assessments of doctor behavior. Audio recordings were available for only 42 of the patients who also had a complete Doctor Expertise score (36.5% of the 115 who had scores on the DES). 23 of these were chosen to be coded such that the distribution of Doctor Expertise scores in the patient sample was represented proportionally in the 23 audio recordings.

Doctor Expertise was coded in two different ways: the first to assess the accuracy of the patient reports and the second to assess a more theoretical/direct definition of Doctor Expertise. If the first measure correlates highly with the Doctor Expertise Scale, then this will support the claim that patients' attention to and memory for doctors' behaviors is reliable. If the second, more theoretically thorough measure correlates highly with the Doctor Expertise Scale, then this will provide strong evidence for the construct validity of the Doctor Expertise Scale. The lead researcher coded all of the interactions after listening to each recording two times.

The first, patient-report matched measure of observer-rated Doctor Expertise correlated .274 with the Doctor Expertise Scale scores. The two scores are therefore positively related, and despite the fact that a stronger relationship was predicted between the two scores, correlations of performance (behavior-related) scores by different raters in other areas of research have found correlations of comparable strength (Conway & Huffcutt, 1997). The weaker-than-predicted correlation can be partially explained by person-related differences in the patients who are rating each doctor that do not exist in the single-observer ratings of the performances of each doctor. That is, the variability in patient-reports of Doctor Expertise is greater than is the variability in the observer-rated scores of Doctor Expertise. The second, more theoretically embellished measure of observer-rated Doctor Expertise correlated .146 with the Doctor Expertise Scale scores, indicating a less than optimal convergent validity of the Doctor Expertise Scale. However, because the observer-rated measure of Doctor Expertise is a new measure itself, the lack of convergence between the two measures may not reflect entirely upon the validity of either measure in assessing Doctor Expertise but may instead reflect more measurement, or reliability, issues.

Discriminant Validity

To assess the discriminant validity of the Doctor Expertise Scale, scores on the DES were compared with scores on a measure of “psychosocial skills,” or bedside manner of the doctor—from the patient’s perspective. There has been a large push in the medical education field to train new doctors’ psychosocial skills in order to improve patient care (Weissmann et al, 2006). However, it is not clear how “being nicer” to a patient or getting to know a patient’s personal life will improve his/her treatment adherence, even if it improves patient satisfaction.

In fact, since psychosocial skills do not inherently involve addressing patient CS/SR models, it was hypothesized that they would not lead to “shared models,” better adherence, and improved problem resolution, regardless of how they related to patient satisfaction. The Doctor Expertise Scale should therefore measure something different than does our measure of psychosocial skills. Whether or not this is true was assessed with a correlational approach to show that, even if Doctor Expertise and the degree of psychosocial skills correlated with each other and both correlated with patient satisfaction, only Doctor Expertise explains partial variance in shared models, adherence, and problem resolution. Given the nature of Psychosocial skills, however, it was hypothesized that scores on the Psychosocial Skills variable would predict a change in overall worry or concern of the patient about his/her illness.

DE and Psychosocial Skills. The MLM analysis (valid n = 101) of the relationship between Doctor Expertise and Psychosocial Skills showed that Doctor Expertise has a positive and significant relationship to Psychosocial Skills with the unstandardized estimate (regression coefficient) equal to .071, standard deviation = .027, t = 2.607, df = 95.875, p = .011.

DE vs Psychosocial Skills and Patient Satisfaction. MLM analysis (valid n = 100) was conducted with Doctor Expertise and Psychosocial Skills as covariates and patient satisfaction as the outcome variable, but despite reaching convergence, the model did not result in a positive definite Hessian matrix, so the validity of the results is not guaranteed. Both Doctor Expertise and Psychosocial Skills were significantly and positively related to patient satisfaction (standardized Doctor Expertise: estimate = .290, sd = .049, t = 5.864, df = 97, p <.001, and standardized Psychosocial Skills: estimate = .387, sd = .043, t = 9.07, df = 97, p <.001).

DE vs Psychosocial Skills and Shared Models. Both Doctor Expertise and Psychosocial Skills were centered and standardized before being entered into the multilevel model with Shared Models as the dependent variable. Both covariates were significant predictors of Shared Models with nearly identical estimates (Doctor Expertise estimate = .2585, standard error = .067, df = 82.93, t = 3.846, p < .001; Psychosocial Skills estimate = .2597, standard error = .054, df = 79. 782, t = 4.776, p < .001). By subtracting the amount of residual variance left unexplained in the model with both covariates from the residual variances of the models with each covariate alone, it was determined that Psychosocial Skills uniquely explains more variance in Shared Models than does Doctor Expertise (10.98% versus 7.98%, respectively). This is contrary to the theoretical predictions of the relationships between the constructs of Doctor Expertise, Psychosocial Skills, and Shared Models. The unique variance in Shared Models explained by each covariate does support the discriminant validity of the DES, however.

DE vs Psychosocial Skills and Problem Resolution. 69 patients were included in the analysis for absolute problem resolution. A random intercepts model was used in a hierarchical logistic regression using the GLIMMIX procedure in SAS software (SAS Institute Inc., 2000-2004.), which is recommended when the number of groups (in this case doctors) is relatively small (less than 50; Maas & Hox, 2005). Psychosocial skills and Doctor Expertise were both entered into the model as fixed effects, and the results indicated that, while neither were statistically significant predictors of absolute problem resolution, the estimates (regression coefficients) for Doctor Expertise and for Psychosocial Skills were trending in opposite directions, with Doctor Expertise being positively related to absolute problem resolution (unstandardized estimate = -.1354, t=-1.02, df = 52, p=.311) and Psychosocial skills being negatively related to absolute problem resolution (although not significantly different from zero effect on problem resolution; unstandardized estimate = .0316, t = .08, df = 52, p = .939). The same non-significant trends were found for relative problem solution; Doctor Expertise had an estimate of -.2097, t = -1.58, df = 52, p = .119, and Psychosocial Skills had an estimate of .1436, t = .36, df = 52, p = .720. Both analyses of problem resolution indicate Doctor Expertise and Psychosocial skills do indeed measure different constructs *and* that higher levels of Doctor Expertise are associated with better problem resolution whereas higher levels of Psychosocial skills are not. However, a larger sample is needed to see if the sample trends are significant relationships in the population.

DE vs Psychosocial Skills and Belief Change—overall understanding. Simultaneous linear regression demonstrated that Doctor Expertise is more predictive of positive change in patient overall understanding of their illness than is a doctor's psychosocial skills. Hierarchical linear regressions showed that the unique variance in belief change accounted for by Doctor Expertise after controlling for psychosocial skills was R-squared change = 8.2% (F-change = 9.698, df=1, 93, p=.002), which was greater than the unique variance in belief change accounted for by Psychosocial Skills after controlling for Doctor Expertise—R-squared change = 7.7% (F-change = 9.147, df = 1, 93, p = .003). These results indicate that Doctor Expertise is more important than Psychosocial Skills in predicting overall understanding/belief change, which supports the theory that Doctor Expertise behaviors are more important for illness-relevant belief change and behaviors than are psychosocial skills. More importantly for discriminant-validity, however, is the fact that Doctor Expertise has incremental validity to Psychosocial skills, indicating the scales are not tapping the same construct.

DE vs Psychosocial Skills and Belief Change—worry/concern. The simultaneous linear regression showed that neither Doctor Expertise nor Psychosocial Skills predicted change in worry or concern about an illness from before the doctor's visit to after the doctor's visit.

Psychosocial Skills and Patient Satisfaction, Patient Adherence, and Problem Resolution. Unrelated to the discriminant validity of the DES, yet primary to our theoretical interests in Doctor Expertise compared Psychosocial Skills in predicting actual health outcomes, is the relationship of psychosocial skills and patient satisfaction to patient adherence and to problem resolution. Both Doctor Expertise and Psychosocial Skills were related to patient satisfaction, but it was expected theoretically that only Doctor Expertise and not Psychosocial Skills would be related to patient adherence and to problem resolution. It has already been demonstrated that Doctor Expertise does not predict patient adherence and only marginally significantly predicts relative problem resolution. Even though psychosocial skills were not significantly related to problem resolution, they were significantly related to patient adherence when entered into a MLM as the only covariate (estimate = .258, $t = 2.148$, $df = 84.98$, $p < .05$). When patient satisfaction was added as a covariate along with Psychosocial Skills, then Psychosocial Skills became non-significant (estimate = .087, $t = .578$, $df = 83.992$, $p = .565$) but patient satisfaction was marginally significant (estimate = .231, $t = 1.815$, $df = 83.699$, $p = .073$).

Discussion

The first aim of this study was to present a new construct, Doctor Expertise, and its nomological network, including its important applications to patient health care. The second aim was to assess the construct validity of a scale to measure the construct of Doctor Expertise—the Doctor Expertise Scale (DES). The psychometric properties and factor structure of the DES were found to be reasonably solid and as expected, with good internal consistency of the scale items, which assess only one latent factor. Content-related validity evidence was provided with a thorough description of the Doctor Expertise construct and how the items in the DES were constructed to be relevant to and representative of the Doctor Expertise construct in a primary care setting. Statistical analyses, including multilevel linear and logistic regression as well as ordinary least squares regression were used to assess the criterion-related, convergent, and discriminant validity of the DES.

Criterion-related validity evidence was provided in the analyses of the degree to which patients perceive their own models to be shared with the doctor's model ("Shared Models"), the degree of belief change about the causes of the presenting problem, and the degree of change in overall understanding of the presenting problem/illness belief. The higher was the rating of Doctor Expertise, the greater was the degree of sharedness of patient-doctor models, the greater was the increase in the patients' overall understanding of the presenting problem/illness, and the greater was the increase in belief change regarding the causes of the presenting problem/illness. These relationships are all important for patient health, because if a patient sees eye-to-eye with the physician about his/her health and illness and if he/she is better able to understand the illness' cause and the illness overall, then the patient will be more likely to adhere to the prescribed treatment and to have better health outcomes. Indeed, despite the small sample size of patients and doctors, Doctor Expertise was marginally significantly and positively related to relative problem resolution, supporting the fact that Doctor Expertise may indeed be important for actual medical outcomes and not just patient satisfaction. There was a similar and promising trend between Doctor Expertise and absolute problem resolution, which makes sense given that absolute problem resolution is harder for patients and physicians to attain than relative problem resolution.

Evidence was not found for criterion-related validity in the analyses of patient adherence or belief change regarding the relatedness of the presenting problem to a chronic illness. The lack of a significant relationship between Doctor Expertise and patient adherence in the current sample may have been due to too small a sample size, or it could also have been due to an insufficient measure of patient adherence. There are many documented reasons for non-adherence, discussed previously, which were not assessed sufficiently in the current study. With an assessment of these factors, they could be controlled for in analyses, and the relationship of Doctor Expertise to its theorized effects on patient adherence could then be tested with more statistical power.

Contrary to our hypotheses, Psychosocial Skills and patient satisfaction *were* related to patient adherence, although when both were in the model simultaneously, only patient satisfaction was marginally significantly related to patient adherence. The reason for this is unclear, especially since patient satisfaction was calculated from two very general statements regarding overall satisfaction with the doctor’s office visit. Despite being confusing theoretically, these analyses did support the discriminant validity of the DES, by demonstrating that Psychosocial Skills is a construct distinct from the construct measured by the Doctor Expertise Scale. Also, as was pointed out in the section on discriminant validity, psychosocial skills were not at all related to problem resolution and were even trending towards having a negative effect on problem resolution. Perhaps the superior predictive utility of Psychosocial Skills to Doctor Expertise in predicting patient adherence can be explained by the stronger relationship to patient satisfaction in this sample, which is likely due to the juxtaposition of the psychosocial skills items to the patient satisfaction items in the PRIM study. That is, patient satisfaction seems to be the best predictor of patient adherence in this sample, and the superior predictive utility of Psychosocial Skills to Doctor Expertise may be an artifact of the item order in the PRIM study. Indeed, Doctor Expertise was highly related to patient satisfaction, and this relationship was not likely due to an artifact, since the DES items were about behaviors, not perceptions like the patient satisfaction and Psychosocial Skills items, and the DES were dichotomous response items unlike the 5-point scale items of patient satisfaction and Psychosocial Skills, which were asked one right after the other in the current study.

Patient reports of Doctor Expertise are easier and quicker to obtain than are observer-rated measures based on coding of audio-recorded doctor-patient interactions. They are also more highly predictive of the patients' beliefs and behaviors (specifically, "Shared Models" and patient adherence) in this study sample than are the observer-rated measures, both the patient-report equivalent measure and the longer, more theoretically embellished measure. Therefore, the patient-report Doctor Expertise Scale should be used when the purpose of a measure is to predict patient behavior. The patient-reported measure is also more highly correlated with absolute problem resolution than is the observer-rated measure and they are comparably correlated with relative problem resolution. Therefore, the patient-report measure may also be better for purposes of training medical students. It is important to note that the patient-report measure was more highly correlated with patient satisfaction and ratings of psychosocial skills of the doctors than was the observer-rated measure. This would be expected, since the variance is partly shared between patient-report measures of Doctor Expertise and patient-report measures of Psychosocial Skills and patient satisfaction, and not shared between observer-rated measures of Doctor Expertise and patient-report measures of Psychosocial Skills and patient satisfaction.

On one hand, the DES is a patient- and illness-*specific* measure: different domains of the patient's CS/SR model may be more or less important for the management of one illness compared to another illness. For example, the causal beliefs of a patient may be more important for management of hypertension than his/her identity beliefs about hypertension, whereas the patient's identity beliefs may be more important for his/her management of CHF than are the patient's causal beliefs of CHF. It may also be the case that the important domain for management of a particular illness is different for one patient than another patient. For example, control beliefs about diabetes may be most important (i.e. driving their non-adherence) for a patient who thinks diet and exercise are not helping their condition but consequence beliefs may be most important for a patient who thinks their diabetes is "not that bad" or that he/she has "only a little bit"—actual comments made by patients during the course of this study's interviews. The theoretical groundwork provided by this paper will be important for the extension of the Doctor Expertise Scale to other medical settings, such as specialty asthma, cardiovascular disease, or diabetes clinics.

On the other hand, the DES may be an illness- and patient-*generalized* measure: a question remains whether a doctor *need* elicit each patient's particular CS/SR model (or beliefs from *every* domain) if most patients with the same particular illness have similarly erroneous CS/SR models. If patient model/medical model contradictions do tend to cluster by illness or by some other identifiable characteristic, then perhaps a single question may become sufficient for an Expert Doctor to "elicit" an entire mental model of a patient, if that single question identifies the key characteristic of a well-known type of mental model. What I am suggesting, is that the processes of patient- and medical-model assimilation required for high levels of Doctor Expertise may not need to take extended amounts of time and effort for each patient, an important consideration given the limited time a doctor has with each patient. It is possible that future research using the Doctor Expertise Scale could identify and categorize within a health psychological framework the prototypical cases of patient- and medical-model conflict (i.e. prototypical erroneous patient beliefs that lead to non-adherence).

Overall, the Doctor Expertise Scale has reasonable content-related, criterion-related, and discriminant validity; more convergent validity evidence is needed but difficult to acquire given the fact that no other measures of Doctor Expertise exist in the literature. However, its utility in understanding and predicting patient adherence is not known from the current study. In general, the fact that so much data was missing due to the inapplicability of the DES items to particular patient situations means that the scale will require even more cases to be tested and validated further in the primary care setting. More cases were missing than should have been if the DES items were as representative as they were meant to be. Item choice should be re-visited with general applicability in mind. Many more items could be added to the scale without increasing the patient burden incurred with administering it. Adding more specific questions regarding patient satisfaction would also allow for the effects of patient satisfaction on patient adherence to be teased apart from the effects of Doctor Expertise and Psychosocial Skills. With more valid cases due to a better DES construction, better patient satisfaction measure construction, and to a larger sample size, the relationships between Doctor Expertise and the constructs in its nomological network will become clearer.

Given the ease of administration of the DES, its use could be implemented to improve doctors' performance in patient health care through medical education and through clinical interventions. However, further construct validation of the DES should be conducted before these steps can be taken with solid confidence in their likely outcomes. The validation of a scale is a continuous process and a scale is never truly perfected (Sireci, 2007).

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Table 1. Average level and standard deviation of Doctor Expertise for each of the five senior doctors with more than 20 patients and for the residents grouped, together with over 20 patients. Note: due to missing data in the DES items for some patients, the n patients for each doctor is less than 20 and displayed in parentheses next to the averages.

Doctor ID#	Average level of Doctor Expertise (n patients)	Standard deviation of Doctor Expertise
1	4.47 (19)	2.63
2	5.08 (12)	1.98
9	3.38 (13)	1.85
12	4.46 (13)	2.57
14	4.38 (21)	2.58
residents	5.5 (20)	1.73

Table 2. Intraclass correlations (ICCs) for each of the listed variables of interest by doctor (only the 5 senior doctors with more than 20 patients in the dataset). Note: a design effect equal to or greater than 2 indicates that effects of the doctor-level variable should be taken into account in future analyses involving the specific outcome variable or covariate of interest in order to obtain unbiased estimates (Muthen & Satorra, 1995). Note: The ICC is equal to the amount of variance between the group level variable (doctor) divided by the total amount of variance (between plus within groups variance) and was calculated by hand due to the unequal number of patients for each of the five doctors in the analyses. Swiger et al (1964) provide the equations necessary for the calculations involving quantitative/continuous variables, and Mak (1988) provides the equations necessary for the calculations involving dichotomous outcome variables (the two problem resolution variables).

Construct/Variable	**ICC**	**p-value** (difference from zero)	**Design Effect**
Doctor Expertise/DES	-.2030 (approx. = 0)	>.05	0
Shared Models	.0891	0.028	2.622*
Patient Adherence	.0364	0.218	1.444
Patient Satisfaction	.1277	0.001	4.627*
Psychosocial Skills	.1937	<.001	5.649*
Problem Resolution “completely gone”	.0723	0.05	2.301*
Problem Resolution “better now”	.1434	0.007	3.353*
Belief Change: cause	.0223	0.223	1.423
Belief Change: relatedness of problem to chronic condition	.1366	0.007	3.322*
Belief Change: overall understanding	.0373	0.107	1.88
Belief Change: worry/concern	.0319	0.178	1.618

Figure 1. Simplified nomological network of the Doctor Expertise construct, which will be tested for validation purposes of the Doctor Expertise Scale.

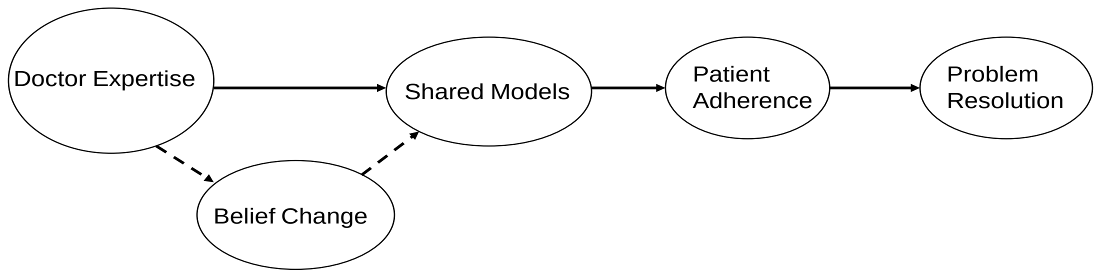
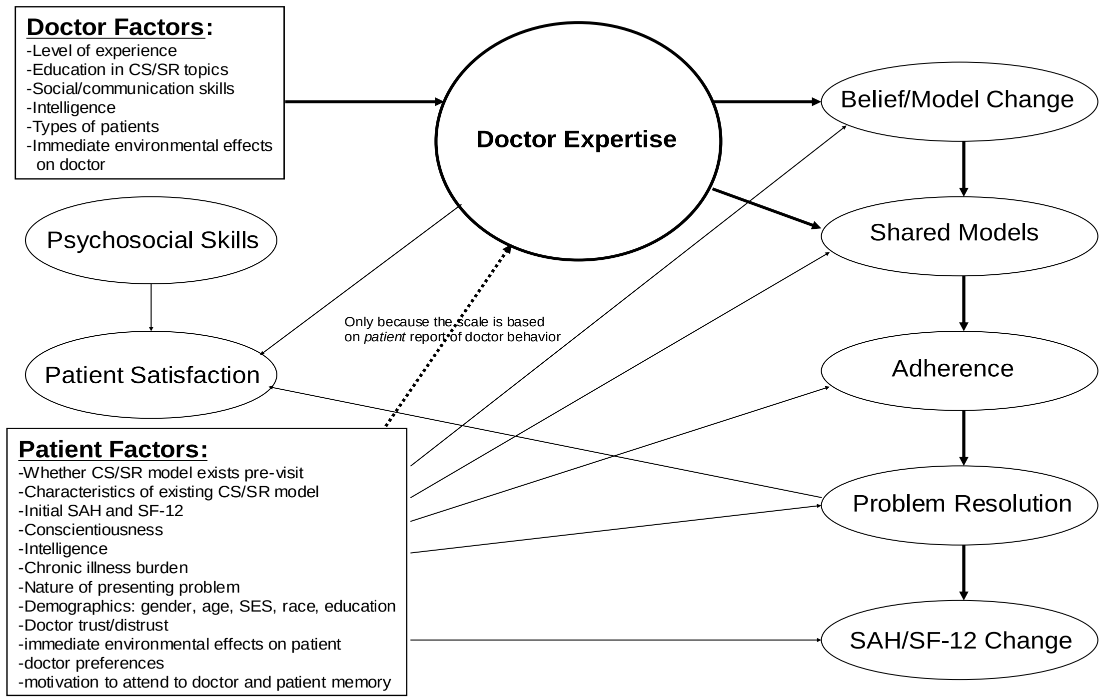


Figure 2. A more complex illustration of the nomological network of Doctor Expertise for all medical settings.



Appendix

The Doctor Expertise Scale:

1. The doctor told me what s/he was looking for during the physical exam. (Identity domain)
2. The doctor discussed with me what might be the cause. (Cause domain)
3. The doctor told me how long I could expect to have this problem. (Timeline domain)
4. The doctor gave me clear instructions about my treatment: what to do, when, how often, and for how long. (Control and Timeline domains)
5. The doctor told me what I might expect when taking my medication/treatment. (Consequences and Identity domains)
6. The doctor gave me some tips to help me work my treatment into my daily routine. (Control and Consequences domain)
7. The doctor told me how to monitor my problem to see if the treatment is working. (Identity domain)
8. Did you and the doctor discuss whether this problem is related to any of your other medical conditions? (despite the fact that this item is conditional, it was included in the DES because it was relevant for two-thirds of the sample and it is of primary importance in the theory of Doctor Expertise and patient health beliefs and behaviors in chronic illness management).

Excluded items from the Doctor Expertise Scale:

1. The doctor gave me a diagnosis for my problem. (excluded because giving a diagnosis is not always feasible; more tests or time may be needed, regardless of the Expertise of the doctor).
2. The doctor used a model or a poster or drew a picture to explain it to me. (excluded because not *necessary* for Doctor Expertise—verbal description can be sufficient, if a description is even needed).

3. If the doctor ordered tests, s/he explained to me what they were for. (excluded because conditional item—not relevant to any patient for whom no tests were ordered).
4. The doctor gave me some written instructions about the treatment to help me remember what to do. (excluded because not necessary for Doctor Expertise—verbal instructions would suffice in many cases when instructions are needed).

Shared Models:

1. The doctor and I agreed on the causes of the problem: Not at all, A little bit, Somewhat, Quite a bit, Very much.
2. Overall, the doctor and I share a common understanding of the illness: Not at all, A little bit, Somewhat, Quite a bit, Very much.
3. I understood the doctor's explanations of the treatment plan: Not at all to Very much.
4. I am going to do something different for this problem than what the doctor recommended: Very much, Quite a bit, Somewhat, A little bit, Not at all (reversal of responses was done after data collected).
5. Overall, the doctor and I share a common understanding of the treatment: Not at all, A little bit, Somewhat, Quite a bit, Very much.

Patient Adherence:

1. I followed this treatment for as long as the doctor prescibed: Not at all, A little, Somewhat, Quite a bit, Very much.
2. Did you ever accidentally forget to use one of your treatments (meds, diet, exercise, or other): Always, Often, Sometimes, Rarely, Never?
3. Did you ever decide to skip one of your treatments (meds, diet, exercise, or other): Always, Often, Sometimes, Rarely, Never?
4. Did you ever take more than prescribed: Always, Often, Sometimes, Rarely, Never?
5. Did you ever take less than was prescribed: Yes, No?

6. Did you ever do something else that is different than what the doctor said to do with any of your treatments: Always, Often, Sometimes, Rarely, Never?

Self-Assessed Health (SAH) Change:

1. In general, would you say your health is: Poor, Fair, Good, Very Good, Excellent?
2. Compared to other people your age, how would you rate your current health: Poor, Fair, Good, Very Good, Excellent?
3. Do you think your doctor would say your current health in general is: Poor, Fair, Good, Very Good, Excellent?

Presenting Problem Resolution:

1. Is the problem any better now? No, Yes
2. Has the problem gone away completely? No, Yes

Patient Satisfaction:

1. After you left the doctor's office, how satisfied were you with the care you received: Not at all, A little bit, Somewhat, Quite a bit, Very much?
2. All in all, how satisfied were you with the care you received at your doctor visit: Not at all, A little bit, Somewhat, Quite a bit, Very much?

Psychosocial Skills:

1. My doctor understood my feelings about this problem: Not at all, A little bit, Somewhat, Quite a bit, Very much.
2. My doctor was sympathetic about my problem: Not at all, A little bit, Somewhat, Quite a bit, Very much.
3. My doctor is a good person: Not at all, A little bit, Somewhat, Quite a bit, Very much.
4. My doctor is like a friend or family member to me: Not at all, A little bit, Somewhat, Quite a bit, Very much.
5. My doctor is concerned about my feelings: Not at all, A little bit, Somewhat, Quite a bit, Very much.

Belief Change:

1. Since speaking with the doctor, have your thoughts changed about what may have caused the problem/symptoms: Not at all, A little bit, Somewhat, Quite a bit, Very Much?
2. Change from Pre- to Post-Visit: Is your current problem related to a chronic condition of yours: Not at all, A little bit, Somewhat, Quite a bit, Very much?
3. Change from Pre- to Post-Visit: How concerned or worried are you about this problem: Not at all, A little bit, Somewhat, Quite a bit, Very much?
4. Change from Pre- to Post-Visit: I think this problem is likely to be a very serious one: Not at all, A little bit, Somewhat, Quite a bit, Very much.
5. I understand my problem better now than I did before the visit: Not at all, A little bit, Somewhat, Quite a bit, Very much.

Observer-Rated Measures of Doctor Expertise:

<u>Doctor Expertise Checklist: Score will come from *average* of applicable "Yes" responses.</u>

**means item should be reverse scored

<u>►</u>means item is part of patient-report measure of Doctor Expertise

<u>></u> means item is part of patient-report measure of Doctor Expertise but a duplicate of a <u>►</u> item. It either item (for Problem 1 or for Problem 2) is marked with a "Yes," then 1 point is awarded for that pair of items. If either is marked with a "No" and the other is "Not applicable," then a 0 is awarded for that pair. If both are marked with "Not applicable," then the item is not counted in the total score (i.e., the score will be out of less than 8 of the items in the DES).

1. <u>►Identity:</u> Did the doctor tell the patient what he/she was looking for during the physical exam?

Yes	No	Not Applicable	Previously

2. Identity: Did the doctor ask the patient if he/she has ever had the symptoms from Problem 1 before?

Yes	No	Not Applicable

Which problem?/Notes:

3. Identity: Did the doctor ask the patient if he/she has ever had the symptoms from Problem 2 before?

Yes	No	Not Applicable

Which problem?/Notes:

4. Control: Did the doctor ask the patient if he/she had tried anything else to treat the Problem 1 on his/her own?

Yes	No	Not Applicable

Which problem?/Notes:

5. Control: If Yes to the above question, did the doctor comment on why the patient's self-treating might be bad or good for the symptom(s)? (Problem 1)

Yes	No	Not Applicable

6. Control: Did the doctor ask the patient if he/she had tried anything else to treat the Problem 2 on his/her own?

Yes	No	Not Applicable

Which problem?/Notes:

7. Control: If Yes to the above question, did the doctor comment on why the patient's self-treating might be bad or good for the symptom(s)? (Problem 2)

Yes	No	Not Applicable

8. Identity: If more than one symptom/problem presented, did the doctor discuss which symptoms are related to each other and which are due to different problems?

Yes	No	Not Applicable

9. ►Identity: Did the doctor discuss with the patient if/how any of the presenting problems were related to any other medical conditions of the patient? Or how conditions that were discussed are related to each other?

Yes	No	Not Applicable	Previously

10. ►Cause: Did the doctor discuss with the patient what might be the cause of his/her Problem 1?

Yes	No	Not Applicable	Previously

Which problem?/Notes:

11. >Cause: Did the doctor discuss with the patient what might be the cause of his/her Problem 2?

Yes	No	Not Applicable

Which problem?/Notes:

12. Cause: Did the doctor explain how the cause would be determined through tests or monitoring (Problem 1)?

Yes	No	Not Applicable

Which problem?/Notes:

13. Cause: Did the doctor explain how the cause would be determined through tests or monitoring (Problem 2)?

Yes	No	Not Applicable

Which problem?/Notes:

14. Cause: Did the doctor address any alternative explanations/causes the patient might believe (Problem 1)?

Yes	No	Not Applicable

Which problem?/Notes:

15. Cause: Did the doctor address any alternative explanations/causes the patient might believe (Problem 2)?

Yes	No	Not Applicable

Which problem?/Notes:

16. ►<u>Control:</u> Did the doctor give the patient instructions on the treatment(s): what, when, how often, and/or for how long? (Problem 1)

Yes	No	Not Applicable	Previously

Which problem?/Notes:

17. ><u>Control:</u> Did the doctor give the patient instructions on the treatment(s): what, when, how often, and/or for how long? (Problem 2)

Yes	No	Not Applicable	Previously

Which problem?/Notes:

18. <u>Control:</u> Did the doctor explain how the prescribed treatment would work to fix the Problem 1?

Yes	No	Not Applicable

Which problem?/Notes:

19. <u>Control:</u> Did the doctor explain how the prescribed treatment would work to fix the Problem 2?

Yes	No	Not Applicable

Which problem?/Notes:

20. ►<u>Timeline/Consequences:</u> Did the doctor tell the patient what to expect on the medicines/treatment(s) for Problem 1?

Yes	No	Not Applicable	Previously

Which problem?/Notes:

21. ><u>Timeline/Consequences:</u> Did the doctor tell the patient what to expect on the medicines/treatment(s) for Problem 2?

Yes	No	Not Applicable	Previously

Which problem?/Notes:

22. <u>Consequences:</u> Did the doctor discuss any possible side effects of the treatment(s) for Problem 1?

Yes	No	Not Applicable

Which problem?/Notes:

23. Consequences: Did the doctor discuss any possible side effects of the treatment(s) for Problem 2?

Yes	No	Not Applicable

Which problem?/Notes:

24. Consequences: Did the doctor tell the patient what to do if the treatment(s) did not seem to work or if the treatment(s) became too bothersome for the patient to continue with it (e.g., side effects or difficulty implementing)? (Problem 1)

Yes	No	Not Applicable

Which problem?/Notes:

25. Consequences: Did the doctor tell the patient what to do if the treatment(s) did not seem to work or if the treatment(s) became too bothersome for the patient to continue with it (e.g., side effects or difficulty implementing)? (Problem 2)

Yes	No	Not Applicable

Which problem?/Notes:

26. ►Control: Did the doctor tell the patient how to monitor the Problem 1 to see if the treatment was working?

Yes	No	Not Applicable	Previously

Which problem?/Notes:

27. >Control: Did the doctor tell the patient how to monitor the Problem 2 to see if the treatment was working?

Yes	No	Not Applicable	Previously

Which problem?/Notes:

28. ►Consequences: Did the doctor give the patient any tips on working the treatment(s) into his/her routine? (Problem 1)

Yes	No	Not Applicable	Previously

Which problem?/Notes:

29. >Consequences: Did the doctor give the patient any tips on working the treatment(s) into his/her routine? (Problem 2)

Yes	No	Not Applicable	Previously

Which problem?/Notes:

30. Timeline: Did the doctor tell the patient how long it would take to notice improvement in the Problem 1 from treatment?

Yes	No	Not Applicable

Which problem?/Notes:

31. Timeline: Did the doctor tell the patient how long it would take to notice improvement in the Problem 2 from treatment?

Yes	No	Not Applicable

Which problem?/Notes:

32. ►Timeline: Did the doctor tell the patient how long he/she could expect to have the Problem 1?

Yes	No	Not Applicable	Previously

Which problem?/Notes:

33. ≥Timeline: Did the doctor tell the patient how long he/she could expect to have the Problem 2?

Yes	No	Not Applicable	Previously

Which problem?/Notes:

34. **Overall: Did the doctor leave any patient concerns unaddressed (not discussed at all or not resolved with no plan for resolution)?

Yes	No	Not Applicable

What was unaddressed?:

35. Did the doctor ask the patient if s/he has skipped or forgotten any treatment(s)?

Yes	No	Not Applicable

36. Overall: In general, how well did the doctor seem to understand where the patient was coming from (all of the patient's illness beliefs and health behaviors)?

Not at all	A little bit	Somewhat	Quite a bit	Very much
0	1	2	3	4

5 = everything was understood by doctor

4 = partially understood, almost everything

3 = half understood, half not

2 = partially understood, almost nothing

1 = nothing understood

37. Overall: In general, how well did the doctor successfully “adjust” the patient’s model to work with the biomedical model?

Not at all	A little bit	Somewhat	Quite a bit	Very much
0	1	2	3	4

5 = everything was adjusted by doctor

4 = partially adjusted, almost everything

3 = half adjusted, half not

2 = partially adjusted, almost nothing

1 = nothing adjusted

38. **Did doctor say one thing and then take it back or change the emphasis so that the patient may have been confused?

Yes	No	Not Applicable