Published in final edited form as:

Am J Health Behav. 2011 May ; 35(3): 318–333.

Older Adults' Common Sense Models of Diabetes

Joseph G. Grzywacz,

Department of Family and Community Medicine, Wake Forest University School of Medicine

Thomas A. Arcury,

Department of Family and Community Medicine, Wake Forest University School of Medicine

Edward H. Ip,

Department of Biostatistical Sciences, Division of Public Health Sciences, Wake Forest University School of Medicine

Christine Chapman,

Department of Epidemiology and Prevention, Division of Public Health Sciences, Wake Forest University School of Medicine

Julienne K. Kirk,

Department of Family and Community Medicine, Wake Forest University School of Medicine

Ronny A. Bell, and

Department of Epidemiology and Prevention, Division of Public Health Sciences, Wake Forest University School of Medicine

Sara A. Quandt

Department of Epidemiology and Prevention, Division of Public Health Sciences, Wake Forest University School of Medicine

Abstract

Objective—Investigate the importance of viewing belief systems about health maintenance holistically.

Methods—Qualitative (N=74) and quantitative data (N=95) were obtained from multi-ethnic rural-dwelling older adults with diabetes to characterize their Common Sense Models (CSMs) of diabetes.

Results—There is a discrete number of CSMs held by older adults, each characterized by unique clusters of diabetes-related knowledge and beliefs. Individuals whose CSM was shaped by biomedical knowledge were better able to achieve glycemic control.

Conclusions—Viewing individuals' health beliefs incrementally or in a piece-meal strategy may be less effective for health behavior change than focusing on beliefs holistically.

Keywords

Diabetes; common sense model; health beliefs; glycemic control; health behavior change

Introduction

The Self Regulatory Model^{1;2} is a useful theoretical tool for understanding adults' health self-management behavior, particularly in the context of chronic disease. The Self-Regulatory Model argues that individuals are active problem-solvers in managing their health; individuals self monitor health-related experiences and symptoms, and they evaluate available alternatives for responding to perceived deviations in health status. Individuals are posited to create a "common sense model" (CSM) of their health by integrating knowledge and beliefs across several discrete domains or illness representations.¹ In the context of chronic diseases, such as diabetes or asthma, an individuals' CSM of the disease is comprised of the identity assigned to the disease, its presumed cause, beliefs about controllability, anticipated consequences of the disease, and awareness of alternatives for medical management.³ Individuals are believed to integrate their knowledge and beliefs across these illness representations into a more or less coherent model of the disease (i.e., their CSM), and variation in individuals' CSMs contributes to differences in observed behaviors for disease management.

Although the Self Regulatory Model has proven to be useful in several studies,^{4–7} there are areas where additional development is needed. In particular, the theory provides little direction about how discrete domains of beliefs or illness representations are combined to create a CSM of a specific disease (e.g., diabetes) or health experience (e.g., dizziness). Researchers frequently use established instruments like the Illness Perception Questionnaire (IPQ)^{8;9} to measure illness representations, but there is substantial ambiguity in how to use obtained data. For example, researchers interested in understanding CSMs of diabetes frequently use scores obtained from the diabetes-specific IPQ¹⁰ for specific belief domains (i.e., control, cause, consequences, etc) as independent outcomes.^{11–13} Research such as this informs understanding of specific belief domains, but it cannot advance understanding of CSMs of diabetes because investigators are considering components of the CSM rather than the whole. Similarly, when considering the consequences of variation in CSMs of diabetes, researchers frequently use scores obtained from subscales of the Illness Perception Questionnaire as independent predictors of diabetes self-management outcomes (e.g., A1C, frequency of physical activity).^{14–16} This analytic approach misses the essential conceptual point that the CSM of the disease, not the individual components of the CSM, is the most proximal determinant of the outcome.

The inability to develop integrative or holistic characterizations of CSMs is both theoretically and practically problematic. The inability to operationalize the CSM concept is theoretically problematic because it precludes falsification of a core concept, and it undermines robust testing of the Self Regulatory Model's proposition that differences in CSMs contribute to variation in health behavior and disease management. The inability to measure and estimate individuals' CSM also poses practical problems because it forces health behavior practitioners to focus on subunits of the CSM, such as beliefs about controllability or the benefits of available management strategies. Although there is value in such an incremental approach, it is also a bit like trying to describe an elephant by feeling its trunk, legs, and tusks; a characterization of the animal based on individual descriptions, or even the sum of the descriptions, is incomplete or compromised. Likewise, practitioners' ability to affect behavior change to support health promotion or disease management is also likely compromised if the focus lies on one or an incomplete combination of belief domains held by individuals.

Of course the tendency to reduce complex ideas to a few discernable ideas is not limited to the Self Regulatory Model. Dominant theories of health behavior focus on a discrete number of concepts representing distinct knowledge and belief domains. The Health Belief Model,

one of the most commonly used theories in health behavior,¹⁷ highlights the salience of perceived susceptibility and severity of illness or disease, as well as perceptions of treatment efficacy. The Theories of Reasoned Action and Planned Behavior, emphasize subjective norms and beliefs about control and efficacy.^{18–20} Like the Self Regulatory Model, these and other theories lack the ability to characterize holistic belief systems, including sometimes inconsistent knowledge and beliefs,²¹ that shape how individuals interpret and react to their health. Although they have long recognized the fact that health belief systems are complex, health behavior practitioners' ability to design consistently effective interventions for health promotion or chronic disease management has likely been hampered by the inability to summarize knowledge and beliefs into a complete and meaningful whole.

The goal of this study is to investigate the importance of viewing belief systems holistically. This overall goal will be achieved by focusing on beliefs about diabetes management held by an ethnically diverse sample of rural-dwelling older adults with diabetes. Diabetes self-management provides a good model for viewing belief systems holistically because diabetes is a common chronic condition with defined behavior strategies advocated for self-managing blood glucose levels to minimize complications from the disease.²² Yet, despite the existence of defined clinical recommendations, one-third of older adults with diabetes²³ are unable to effectively self-manage their diabetes and achieve optimal glycemic control. Although several challenges impede effective glycemic control among older adults, it is possible that interventions focusing on older adults' holistic CSM of diabetes may be more effective than those focused on one or more discrete domains of diabetes knowledge and belief relevant to glycemic control. Guided by the Self Regulatory Model, we use qualitative and quantitative data designed to characterize older adults' CSMs of diabetes and diabetes management to: 1) document consistencies and inconsistencies across domains of diabetes knowledge and belief; 2) identify discrete CSMs of diabetes management; and 3) describe variation in glycemic control across CSMs.

Method

The data for this paper are from the ELDER2 (AG17587), a project designed to document and measure the CSMs of diabetes management held by rural-dwelling older adults. The data used in this paper are from two interconnected elements completed during the first of two planned phases in the ELDER2 project. The first element is a qualitative study, which included in-depth interviews conducted with 74 individuals aged 60 years or older who had diabetes. The second element is a quantitative pilot study of the Common Sense Model Inventory (CSMI), a beta version of an instrument that was developed based on knowledge learned in the first element. The design and method of each of these elements are presented separately.

Element #1: Qualitative In-Depth Interviews

Sample—A total of 74 African American, American Indian, and white men and women aged 60 and older who had had diabetes for at least two years were recruited from three south-central rural counties in North Carolina. These counties were chosen because they contain large minority populations and because a high proportion of the population is below the federal poverty line. They represent a variation on the urban-rural continuum (<http://www.ers.usda.gov/Data/RuralUrbanContinuumCodes/>) such that one is a county in a metropolitan area with an urban population of 250,000 – 1 million, one is a nonmetropolitan county with urban population of 20,000 or more adjacent to a metropolitan areas, and one is a nonmetropolitan county with urban population of 2,500–19,999.

A site-based sampling method was used to accrue a sample representative of the older adults within the target communities.²⁴ Sites are places, organizations or services used by members

of the population of interest. Recruitment sites included a total of 6 government offices or programs, 5 community organizations, 3 senior recreation centers, 1 non-subsidized senior apartment complex, 5 subsidized senior buildings, 3 local businesses, 13 congregate meal sites, 5 civic organizations, 5 community leaders, and 2 churches. Formal and informal community leaders were contacted and enlisted to help with study recruitment.

The goal of the sampling plan was to recruit 15 participants for each ethnic/gender cell, with each cell having participants spread across educational attainment categories (less than high school, high school, more than high school). Interviews were stopped at minimum of 11 per cell because ongoing analysis showed that saturation^{25;26} had been reached.

Data Collection—Data collection was completed from May through November 2007. The data were collected using in-depth interviews that ranged in length from 1 to 3 hours. Interviews were scheduled with study eligible individuals who expressed willingness to participate. Most interviews were conducted in the homes of the respondents. Interviewers described the purpose and domain of material covered in the in-depth interview and obtained informed consent and permission to record the interviews from each participant. An incentive (\$10) was offered for completing the interview. All procedures were approved by the Wake Forest University School of Medicine Institutional Review Board.

The interview guide was semi-structured and was focused on questions about diabetes beliefs, diabetes knowledge, consequences of diabetes, and self-management of symptoms. The guide was reviewed and revised throughout the interview process in order to include insights that emerged through the data collection phase.

Data Analysis—Data analysis was based on a systematic, computer-assisted approach. Each interview was transcribed verbatim and edited for accuracy. A preliminary codebook was developed based on the interview guide. The transcribed interviews were distributed among the research team for primary and secondary coding. Coding discrepancies were discussed during regular project meetings and resolved via consensus, including the possibility of subsequent refinement of identified codes or the creation of new codes. The final codes fell into nine domains representing different aspects of diabetes self-management. The domains included: causes of diabetes, consequences of diabetes, symptoms related to diabetes, knowledge of how to control symptoms, attitudes towards diabetes treatment, knowledge of diabetes physiology, cure and control, attitudes towards diabetes, and sources/access to diabetes information. Analyses of these data were used to generate a substantive knowledge of older adults' common sense models of diabetes. Further, these analyses were used to generate a list of items using common vernacular to measure older adults' common sense models of diabetes. These items were used to develop the beta-version of the Common Sense Model Inventory (CSMI).

Element #2: Quantitative Pilot Study of the CSMI

Sample—A total of 95 African American, American Indian, and white men and women were recruited from three North Carolina counties. Inclusion criteria were age 60 or older, having a diabetes diagnosis for at least two years, and residing in one of the three rural study counties described in Element #1 above.

The goal of the sampling plan was to recruit 15 participants for each ethnic/gender cell, with each cell having participants spread across educational attainment categories (less than high school, high school, more than high school). A mixed method recruitment style was used to provide a representative sample from the study communities. We recruited 38 participants from various community based organizations through site-based sampling,²⁴ 23 participants from individual community members through word-of-mouth referral and 34 participants

from an existing participant database compiled from previous rural aging studies. Interviews were stopped at a minimum of 15 per cell.

Recruited participants were, on average, 73 years of age ($SD=7.9$) and a majority were female (53.2%). The median self-reported age of diabetes diagnosis was 60 (range 20 – 85), and fully 75% reported being 50 or older at the time of diagnosis. The racial composition of the sample was 35%, 34% and 31% being white, African American, and American Indian, respectively. Approximately one-third (32.6%) of participants were currently married or living in a marriage-like relationship, nearly one-half (47.9%) were widowed, and the remainder were either divorced or never married. Over one-third of the sample (38%) reported having an eighth grade education or less, 28% reported having a ninth to twelfth grade education or a general equivalency degree, and 25% reported having some advanced training. Only 7% of participants reported having earned an associate's or college degree.

Data Collection—Data collection was completed from July 2008 through September 2008, and consisted of an interviewer-administered, fixed response questionnaire and a fingerstick blood draw for glycosylated hemoglobin (A1C). An appointment for data collection was scheduled with study eligible individuals who expressed willingness to participate. Data collection was conducted at the home of the participant, unless they requested to meet elsewhere. Interviewers described the goal and objectives of the study and obtained written informed consent. An incentive (\$10) was offered for completing the interview. All procedures were approved by the Wake Forest University School of Medicine Institutional Review Board.

Measures—*CSMI*: Participants responded to 94 statements pertaining to their beliefs about the causes and consequences of diabetes, their self-management strategies and their diabetes knowledge. The response options for each item were “agree”, “disagree”, or “don't know.”

The CSMI was constructed based on information obtained in Element #1. The process of item development followed a multistage procedure. First, the investigators reviewed interview transcripts to identify statements focusing on self-management, beliefs, attitudes and causes relating to diabetes. Selected statements along with items from established instruments including the Illness Perception Questionnaire^{8,9} were compiled into one list and sorted based on the similarity of the ideas they represented. For each group of like statements, a representative statement was selected. Each investigator then independently grouped the representative statements into categories.

Investigators then compared the categorized statements and domain names they had individually developed. Through negotiation the team agreed that 7 domains sufficiently represented the wide range of information collected in the qualitative interviews. The domains were: *Symptoms*, *Cause*, *Consequence*, *Information Seeking*, *Management*, *Medical Management*, and *State of Mind*. Symptoms, Cause, Consequences, and Information Seeking are self-explanatory. Management refers to participant's actions related to self-management of their disease. Medical management refers to interactions with the medical profession in relation to managing their diabetes. State of Mind refers to the statements that illustrate how participants think about their disease on a daily basis and how it is integrated into their everyday activities.

Glycemic control (A1C) was assessed by collecting a finger stick blood sample and using the procedures for the handheld Bayer A1cNow+ device. The Bayer A1cNow+ is a fully integrated, single use disposable device which delivers A1C results in less than five minutes, using a single fingerstick and 5 μ L of blood. The device has been revised and enhanced recently for greater accuracy. The correlation with National Glycohemoglobin

Standardization Program (NGSP) laboratory analysis is high (0.988). Its NGSP precision estimate is $\leq 4\%$ the coefficient of variation.²⁷ Results were available in 5 minutes and were recorded and given to the respondent after all questionnaire data had been collected.

Data Analysis—CSMs of diabetes involve both factual knowledge about the disease as well as beliefs about the disease and the value of advocated strategies. Because many of the items contained in the CSMI do not contain a positive (right) or negative (wrong) answer, individuals' CSMs of diabetes could not be summarized through principal components analysis or summation scales. As a result, the psychometric properties of the CSMI had to be evaluated using methods that are not traditionally used in scale validation, such as latent class analysis (LCA). The LCA attempts to identify clusters of participants that have similar beliefs. Although all items in the CSMI could (theoretically) be incorporated in a single LCA analysis, there are several problems with such an approach. First, the approach often produces a solution that has a large number of classes, which makes interpretation of the classes difficult. Second, because items can belong to multiple domains, items within a domain are not necessarily “locally independent,” potentially violating a fundamental assumption in LCA. Finally, the size of some classes in a complex latent class model containing many classes may be too small for any meaningful and valid inference.

In this project we used an alternative approach to circumvent these problems. The alternative strategy takes a “divide-conquer-integrate” approach, which is summarized in four steps. First, we applied LCA to items within each illness representation domain (e.g., diabetes “cause” or “symptoms”) in order to generate within-domain latent classes. The Akaike's Information Criterion (AIC) statistic was used to guide selection of the most appropriate cluster solution. Second, we used results from LCA in step 1 together with input from an expert panel, to set the number of classes, interpret each class, and provide each class with a label (this step effectively creates a “super-item” for each domain). Third, we pooled the super-items together to form a “new” inventory, in which each domain represented an individual item. Finally, we analyzed the new inventory using a categorical version of the LCA. The latent classes obtained at this step are referred to as latent super-classes. At this stage we also used the AIC statistic to guide selection of the most appropriate cluster solution. We call such an approach a two-stage latent class analysis (2S-LCA). The first stage refers to the domain-level LCA, and the second stage refers to the LCA at the inventory (CSMI) level. Accordingly, the 2S-LCA is an approach that conceptualizes an individual's CSM of diabetes as a hierarchy of clusters of illness representations characterized by the grouping of discrete belief items by belief domains. The 2S-LCA approach is related to the domain-based LCA²⁸ and the multilevel LCA.²⁹ We delimit the quantitative analysis to four key illness representations of diabetes (i.e., causes, symptoms, consequences, and management) because of the developmental nature of the analytic method, the large number of items across all seven domains of diabetes knowledge and belief, and the small sample size. The 2-S LCA procedure was implemented using the program Latent Gold (Statistical Innovation, MA).

Results

CSMs of Diabetes: Qualitative Results

Case summaries from Element #1 illustrate that some individuals have a clear and coherent biomedical model of diabetes management, characterized by a biomedically endorsed explanation of the causes of diabetes and exacerbations of glucose variation, understanding of the medical consequences of diabetes, and strategies for reducing the likelihood of these consequences that are consistent with biomedicine. For example, *ELDER002* holds a clear biomedical model of diabetes and diabetes management. This 73 year-old white woman is

able to differentiate type 1 from type 2 diabetes, she subscribes to *Diabetes Forecast* magazine, and reports trying to stay abreast of recent advances in diabetes treatment. She also has an account of diabetes physiology in terms of sugar absorption and the role insulin plays which is consistent with the biomedical model. For example, she states

Well, exercise – it keeps your body – our – sugar has to go into the cells. Insulin – and what has happened with us the sugar does not go into the cells and make energy. So, just the exercise keeps our cells accepting this sugar, and then it doesn't go into the blood stream. If it goes into the blood stream, of course, it's going to make your sugar go up. It has to be used, you know, accepted by the cells. In our case what happens is the cells, you know, of course I don't make any insulin. That's a difference in a type 1 and a type 2. A type 1 does not have – produce any insulin.

ELDER002 recognizes that diabetes is a serious health condition with serious consequences, but she also believes firmly that diabetes is controllable. She closely adheres to strategies advocated for effective diabetes management, clearly describing the importance of being active and how she walks 30 minutes per day. With the help of printed materials that she keeps for handy reference, she can speak cogently of how diet affects her blood sugar, and she has a concrete understanding of how much various foods translate into specific units for blood sugar. For example, she states that

If I think it's [my blood sugar] low, I'll check to see, and if it is, I will eat something or drink orange juice or half a Coke....it's part of your education. ... I have a cup of orange juice or a half of a regular soda, uh, three graham crackers, and I don't mean three long ones. Three small graham crackers is my 15 grams of carbohydrates, and that's what it takes to bring it up.

Similarly *ELDER068*, an African American man, has a biomedical model of diabetes. He differentiates between type 1 and type 2 diabetes, mainly in terms of the advocated medical treatments (i.e., insulin versus pills). He recognizes that the insulin he takes every day "goes directly into the bloodstream" to help control his symptoms, and he is keenly aware of the value of adhering to dietary practices advocated for diabetes management. He reports that his sister died of diabetes-related complications, in part because "she wouldn't take the medications" and kept "snitching" sugar and sweets, suggesting that he partially attributed his sister's death to poor adherence to biomedical recommendations for glucose control.

In stark contrast, other adults have an integrated *non*-biomedical model of diabetes, a CSM that could be characterized as a folk model. *ELDER069*, an African American man, reports that diet affects diabetes, but his notion of a proper diet is one that avoids certain kinds of meat. While he says that he does not eat meat, he goes on to say that he eats "chicken gizzards, chicken livers, beef tripes" and seafood. *ELDER069* believes that stress is an important contributor to diabetes, and he reports only taking his insulin when he is upset because he feels that the stress will raise his blood sugar. Although *ELDER069* does see a doctor and occasionally takes his prescribed insulin, he is generally dismissive of doctors: "A lot of people pay attention to what the doctor tells them but I pay attention to the way I feel, the way the [Holy] Spirit works with me." He is distrustful of doctors and concerned about being "programmed" to believe that he is sick. Rather than listen to the doctor, *ELDER069*'s diabetes self management behavior follows somatic experiences, stating, "if I have a feeling my sugar is up I'll take insulin, if my sugar's not up I don't take no insulin." By biomedical standards, this management plan has proven less than effective: the participant reported a recent blood glucose reading of 555 mg/dL.

Between the biomedical and non-biomedical models of diabetes are those with more fragmented CSMs of diabetes. *ELDER064*, a Native American man, has a biomedical

understanding of his type 2 diabetes. He is well aware that medication, diet and physical activity are needed for effective glucose control, he understands that the neuropathy in his fingers and feet is due to his diabetes, and that poorly controlled diabetes can result in kidney and heart problems that are severe.

I also have kidney problems and I, well, it does have something to do with diabetes They [local health care provider] was always keeping an eye on my kidneys too because they say diabetes can affect your kidneys, hypertension can affect your kidneys and all that.

Yet, despite having a reasonable biomedical understanding of diabetes, *ELDER064* purposefully avoids taking his diabetes medication, and he reports eating whatever he likes, being particularly fond of “soda-pop”. Similarly, although he accepts the notion that his neuropathy is a consequence of diabetes, he questions whether he still has diabetes because his A1C is consistently below “...that magic number of 7,” referring to the recommended target level of A1C 7.0% established by the American Diabetes Association. Further, despite recognizing the severe consequences of diabetes, he seems unconcerned about his own diabetes, saying, “I worry about other people in the family more than I do myself.”

Similarly, *ELDER062* has a fragmented view of diabetes and diabetes self management. *ELDER062*, a Native American man, has an incomplete understanding of diabetes in that he has little knowledge of basic diabetes physiology and limited ability to talk about advocated strategies for diabetes management. Nevertheless, he is aware that he needs to limit sugars in his diet and engage in regular physical activity. Staying physically active is not challenging because it is something he has always liked to do, but diet modification is reported to be more of a burden. Nevertheless, *ELDER062* reports regularly checking product labels to determine the suitability of different items. So *ELDER062* appears to follow a biomedically advocated strategy for diabetes management, despite having little understanding of the disease. Indeed, *ELDER062* flatly rejects the approach used by many of his friends, who will “take a pill and eat what [they] want”.

CSMs of Diabetes: Quantitative Results

Quantitative data from element #2 reinforce both the consistencies and inconsistencies in beliefs about different aspects of diabetes observed in the case summaries, as well as the more general CSMs of the disease. LCA of items within discrete belief domains illustrate points of convergence and divergence in diabetes beliefs.

In the “cause” domain of diabetes, latent class analysis yielded a four-cluster solution (Table 1). In some cases, there was practical convergence in older adults’ beliefs about the causes of diabetes. Across all four clusters the majority of participants agreed with the statement that “people get diabetes when their body stops producing insulin,” an item designed to capture a basic understanding of the pathophysiology of diabetes. Similarly, there was 100% agreement across three of the four clusters with the item intended to capture a genetic disposition for diabetes (i.e., “diabetes runs in families”). However, there is also evidence of inconsistency of beliefs. For example, the majority of individuals in clusters 1 and 4 agree with the statement that “some people get diabetes because they ate too many sweets when they were young”, yet a substantial proportion of individuals in cluster 2 and the majority of those in cluster 3 disagreed with this statement. Similarly, whereas the vast majority of individuals in clusters 1 and 4 agree with the statement that “being overweight makes people get diabetes”, the majority of individuals in clusters 2 and 3 disagreed.

Each cluster of responses to items reflecting diabetes “causes” has a distinctive characteristic. The pattern of responses in Cluster 1 reflects a popular view of diabetes causes. Individuals in this cluster consistently agreed with widely held yet empirically

unsubstantiated beliefs about diabetes, such as “diabetes is caused by stress,” “diabetes is caused by poor circulation,” and “some people get diabetes because they ate too many sweets when they were young.” The pattern of responses in Cluster 2, by contrast, reflects a more biomedical view of diabetes causes. Individuals in Cluster 2, for example universally agree that “diabetes runs in families,” it occurs “when the body stops producing insulin,” and they generally reject the belief that “diabetes can’t be hereditary because not everyone in a family gets it” or “diabetes is caused by clogged arteries.” There is not a clear pattern of responses by individuals in Cluster 3, apart from a general tendency to disagree with most statements. Finally, the pattern of responses in Cluster 4 is best characterized by ambivalence in that a high proportion of individuals in this cluster answered “don’t know” to items with controversial points of view, such as “diabetes is caused by eating too many processed foods” or “diabetes is caused by chemicals or additives put in food.”

Participant responses to items reflecting other domains of diabetes knowledge and beliefs had distinct characteristics. Analyses of items in the diabetes “symptoms” domain yielded a three-cluster solution (Table 2). Individuals represented in Cluster 1 of symptoms had *indiscriminant* views of diabetes symptoms; they generally agreed with each symptom showing little ability to differentiate legitimate from false symptoms of poor glycemic control. By contrast, those represented in Cluster 2 held few popular beliefs about diabetes; they were able to differentiate legitimate symptoms of poor glycemic control (e.g., “feeling weak or rundown is a symptom of low blood sugar) from likely false symptoms (e.g., “falling down is a sign of diabetes”). Individuals in Cluster 3 were *ambivalent* about symptoms of poor diabetes control, with a substantial proportion, in two cases the clear majority, of individuals responding “Don’t Know” to CSMI items.

A three-cluster solution also emerged in the “consequences” of diabetes domain (Table 3). The first cluster of “consequences” items emphasizes *general internal* consequences of diabetes in terms of circulation, blood pressure, and internal organs. Everyone in Cluster 2 agrees that “diabetes is the silent killer” and over four-fifths agree that “diabetes makes it difficult for your body to fight infection”, suggesting that diabetes is an *insidious disease* that quietly weakens the body. The defining characteristic of individuals in Cluster 3 is agreement that “diabetes has serious financial consequences” and a tendency to disagree with statements linking diabetes to cardiovascular disease suggesting that the primary consequence of diabetes is *hardship*.

Finally, a four-cluster solution emerged for the “management” domain of diabetes (Table 4). Individuals in Cluster 1 hold a *general lifestyle* view of management; their responses emphasize lifestyle-related factors such as stress management, and diet and exercise, although they may misunderstand the meaning of some lifestyle behaviors. For example, almost one-quarter of individuals in Cluster 1 agree with the statement “doing household chores is enough exercise for someone who has diabetes,” or “the body processes sugar in fruits and vegetables differently than sugar in sweets and starches.” Individuals in Cluster 2 have a more *discerning lifestyle* view of diabetes management, in that there was nearly complete disagreement with statements that reduce diabetes management down to a few simple activities. For example 94% of individuals in Cluster 2 disagreed with the statement “doing household chores is enough exercise for someone who has diabetes” and 93% disagreed with the statement “that the only thing people with diabetes need to know is to stay away from sweets”. Individuals in Cluster 2 also disagreed with the statement “the body processes sugar in fruits and vegetables differently than sugar in sweets and starches,” apparently recognizing that successful management does not involve limiting only one type of food such as sweets or starches. Individuals in Cluster 3 have a *false lifestyle* view of diabetes management. Like those in Cluster 1, virtually everyone in Cluster 3 agreed with statements like “some people only need to watch their diet and exercise to manage their

diabetes” and “stress makes your blood sugar go up and down” suggesting that effective stress management, exercise and diet are essential for diabetes management. However, unlike individuals in Cluster 1, virtually everyone in Cluster 3 also agreed with statements like “blood sugar often goes up and down for no reason,” suggesting that blood glucose is erratic and beyond individual control, and nearly everyone in Cluster 3 believed that meat consumption was of primary importance for effective glucose control. Finally, individuals in Cluster 4 are characterized as being *reactive and uninformed* as there was virtual agreement that “people only take diabetes seriously after they have had complications.” Yet, individuals in Cluster 4 also believe that it was beyond them to effectively control their diabetes because nearly everyone agreed that “stress makes your blood sugar go up” and “blood sugar often goes up and down for no reason.” Further, nearly all individuals in Cluster 4 responded “Don’t Know” about items about appropriate physical activity and whether “the body processes sugar in fruits and vegetables than sugar in sweets and starches.”

Coherent CSMs of diabetes management emerged from second-order latent class analyses. The AIC statistics for the 2-, 3-, 4- and 5- class models were 727.9, 703.4, 701.1, and 704.7, respectively. The four-class solution (Table 5), which was deemed most appropriate based on both interpretability and the AIC statistic, closely resembled the models described in qualitative portion of this study reported in the Element #1 results. The first cluster of the four-class solution represents a “Popular Beliefs” CSM of diabetes (Super-class 1). In this CSM, individuals are virtually unanimous in agreeing with items reflecting popular notions of the causes of diabetes (e.g., eating too much sugar as a child); they indiscriminately attribute most symptoms to diabetes, regardless of symptom etiology; beliefs about the consequences of diabetes emphasize general internal problems, yet there is no dominant approach to management. Then there appears to be a “Biomedical Belief” CSM (Super-class 2). Individuals with this CSM endorse biomedically-based causes of diabetes and have low agreement with popular symptoms of diabetes (e.g., “diabetes makes you feel drunk in the head” or “diabetes causes frequent urination”); they have less discrete beliefs about the primary consequences of diabetes; and their management beliefs emphasize general lifestyle behaviors.

The third Super-class appears to be a “Hyper-vigilant” CSM of diabetes. Individuals with this CSM lack clear beliefs about the causes of diabetes, as well as symptoms of diabetes and poor glycemic control; their beliefs about the consequences of diabetes emphasize general internal problems, and they endorse a lifestyle pattern that includes several false beliefs such as “limiting how much meat you eat is important for controlling diabetes”. The fourth Super-class, which we called the “Defeated” CSM is small (4% of the population) and has some commonality with the Hyper-vigilant (they are joined when a 3-cluster solution is used). Individuals with the “defeated” CSM have a biomedical knowledge about the causes of diabetes and low agreement with popular symptoms of diabetes. However, individuals with a “defeated” CSM are unclear about the consequences of diabetes (i.e., a high percentage of Don’t Know responses) and they are generally reactive and uninformed in their approach to management.

Variation in glycemic control, as indicated by hemoglobin A1C, by super-class classification was observed. Individuals in super-class 2, the “biomedical beliefs” model, had the lowest average A1C ($M = 6.8\%$, $SD = 1.2$, $n = 33$). Individuals assigned to super-class 1, the “popular beliefs” model, had intermediate average A1C ($M = 7.3\%$, $SD = 1.2$, $n = 44$), whereas those in the last two classes had comparably higher A1C values. Individuals with a “hyper-vigilant” model of diabetes, super-class 3, had an average A1C percentile of 7.5 ($SD = 1.1$, $n = 11$) and those with a “defeated” model had an average A1C percentile of 7.6 ($SD = 1.0$, $n = 3$). A one-way analysis of variance indicated no statistically significant differences in A1C among super-class classifications indicative of CSMs of diabetes ($F = 1.28$, $df = 3$; p

= 0.2847) It is noteworthy, though, that only individuals with a biomedical model of diabetes were observed to have an average A1C percentile below the advocated clinical target of 7.0.

Discussion

Health behavior practitioners have a wide assortment of theories to draw on to inform their health interventions. Although the richness of available theories has improved understanding of health behavior and informed the creation of worthwhile interventions, an important limitation remains. That is, most theories argue that multiple domains of knowledge and belief collectively shape behavior, yet tests of these theories rarely consider how discrete domains of knowledge and belief combine holistically. This gap is problematic because interventions that focus on one or more theoretical concepts miss the important theoretical point that it is the integration of knowledge and beliefs (along with social and structural barriers) that shape behavior relevant to health. The Self Regulatory Model,^{1,3} for example, elegantly illustrates that individuals use knowledge and beliefs across several domains of representations of the illness (e.g., causes, consequences, management alternatives) to create self-care strategies for managing existing disease or responding to illness. Unfortunately, tests of the theory typically focus on the independent effects of discrete domains rather than the synergistic effects of beliefs across multiple domains.^{4,6} Additionally, the theory remains underdeveloped in explaining how beliefs and knowledge combine in integrative and meaningful ways, and how this can be used to inform more effective behavioral interventions. In this study we used a multi-method approach, including a novel extension of LCA, to define and characterize older adults CSMs of diabetes.

Before discussing the results, it is important to acknowledge the developmental nature of this research, and the corresponding limitations. The sample for the quantitative portion of this study was small and non-representative. The implication of this feature is that it may have constrained the number of identifiable CSMs of diabetes. The small sample, for example, likely could not have supported a full analysis of all seven domains of diabetes knowledge identified in the qualitative component of the study. Inclusion of additional knowledge domains in the second-order LCA may have resulted in a different set of identified CSMs. Further, the identified CSMs of diabetes may not generalize to other populations of older adults with diabetes. Obtained results, therefore, cannot be viewed as definitive CSMs of diabetes; rather, they must be viewed as tentative and preliminary. A second limitation of this study is the exclusive focus on diabetes. It is unknown if CSMs similar to those illustrated for diabetes in this study exist for other diseases such as hypertension or cancer; consequently, readers should use caution in applying the observed CSMs to other diseases. Research focused on specific diseases and other population groups is needed.

Limitations notwithstanding, the results of this study make theoretical and practical contributions to the health behavior literature. The results support two key propositions of the Self Regulatory Model.¹ First, the identification of a discrete number of CSMs of diabetes in both the qualitative and quantitative components of the study is consistent with the basic premise of the Self Regulatory Model; that is, individuals develop a schema or working model of a health condition. Despite the different methods used in each component of the study, results yielded similar CSMs of diabetes, including those that were clearly informed by a biomedical understanding of the disease, others that were informed by popular or folk understandings of diabetes, and those informed by a mixture of beliefs. Second, as suggested by the Self Regulatory Model, individuals' CSMs of an illness emerged from multiple more discrete domains of knowledge and belief such as causes of the illness and alternatives for medical management. Importantly, each CSM was not

characterized by a single belief domain, as evidence by the fact that several CSMs were characterized by at least some endorsement of a biomedical view of diabetes causation, symptoms, consequences, and medical management. Rather, it was the clustering and relative contribution of several discrete belief domains that typically characterized a CSM of diabetes. This finding reinforces the posited complex structure of individuals' health beliefs and the importance of creating holistic understandings of individuals knowledge and beliefs when developing behavior interventions. Finally, our analytic work highlights the non-judgmental treatment of responses to belief items. In contrast to factor analysis or principal component analysis, which require item responses to acquire a directional scale (ordinal or binary), the latent class approach treats responses as nominal. This approach opens a new avenue for analysis of inventory of belief items under the CSM.

The results also highlight needed refinements to the Self Regulatory Model. In both the qualitative and quantitative results there was clear evidence that several older adults have CSMs of their diabetes that are characterized by inconsistent knowledge and beliefs. Other studies have reported similar inconsistencies in descriptions of immigrant Latinos' working model of diabetes.²¹ Collectively, these results suggest that inconsistent beliefs about diabetes and diabetes management are not restricted to distinct groups of adults as they have now been observed in each of several major racial and ethnic groups. This suggests that inconsistent beliefs may be more common than typically thought under the assumption held by the Self Regulatory Model that individuals are motivated to avoid cognitive dissonance. Further theoretical and empirical work is needed to understand how individuals structure and accommodate their inconsistent knowledge and beliefs. As was evidenced in our qualitative results by *ELDER064*, an ethnic minority male, individuals can have a coherent biomedical understanding of the disease yet lack a coherent regimen of glucose self-management. Therefore, understanding how individuals hold apparently inconsistent notions across discrete domains of belief may prove pivotal for shaping health promotive behavior.

The quantitative results comparing AIC values across the discrete CSMs of diabetes are also a contribution. Although the sample was too small to allow statistical testing, it is noteworthy that the only group of individuals whose average AIC values were below the targeted guidelines established by the American Diabetes Association was the group classified as having a coherent biomedical CSM of diabetes. This finding is consistent with previous studies suggesting that discrete domains of diabetes knowledge and belief predict better self-management behavior,¹⁶ but it extends those studies by demonstrating the salience of considering individuals' CSM of diabetes holistically. Although several other CSMs incorporated aspects of biomedicine, they were further augmented by other domains of belief that apparently undermined attainment of glycemic control. This finding is compelling because it highlights the salience of viewing individuals' beliefs holistically and integratively. It suggests that CSMs of health that are *partially informed* by biomedical knowledge and belief may not differ clinically from those that are *uninformed* by biomedicine. If future research confirms these findings, it suggests a paradigm shift is needed to understand health behavior change. New models of health behavior articulating the relative composition of distinct knowledge and beliefs, including counterproductive knowledge and beliefs, need elaboration and testing.

The results of this study also offer important insights for practice, both with regard to those engaging with individuals who have diabetes and those focused on health behavior change more broadly. For both groups of practitioners, the results of this study suggest that incremental approaches to behavior change are not likely to be successful. By incremental, we mean approaches that focus on one or few domains of knowledge and belief (e.g., educational programs about the value of a health program, or motivational campaigns). Based on our results suggesting that those with a coherent biomedical CSM of diabetes were

the only group to meet glycemic control, we believe that effective interventions require tactics that operate on multiple domains of knowledge and belief concurrently. This idea is consistent with the general notion that effective health promotion interventions are multidimensional and integrated.³⁰ In the context of diabetes care, it suggests that targeting individual domains of knowledge or belief, such as knowledge of how diabetes works or cooking classes teaching ways to reduce sugar in common recipes will meet with little success. Rather, effective diabetes care education needs to focus on changing knowledge and belief in multiple domains in an integrated and synchronous fashion. Likewise, more generalized health behavior interventions, such as those targeting physical activity, cannot focus on specific beliefs such as the perceived value of physical activity or individuals' beliefs about their ability to sustain a physical activity program. Rather, effective interventions require incorporating elements targeting several belief domains in an integrated and holistic way.

In summary, the results of this study highlight the importance of viewing individuals' belief systems about health holistically. Both qualitative and quantitative data indicated that there are a discrete number of CSMs of diabetes held by older adults with diabetes. On average, effective glycemic control was observed for individuals whose CSM of diabetes was shaped by a coherent biomedical view of the disease. Individuals whose CSM of the disease was partially informed or completely uninformed by biomedical views of diabetes did not evidence glycemic control. These results indicate that the tendency to view individuals' beliefs incrementally or in a piece-meal strategy may be an inefficient way of healthy behavior change. The challenge for health behavior scientists and practitioners is to develop a better understanding of the basic construction of individuals' CSMs of health and how they develop and change. Such knowledge will provide the foundation for creating effective behavioral interventions to minimize the burden of disease and realize the goal of good health for all.

Acknowledgments

This research was supported by a grant from the National Institute of Aging (R01 AG17587).

References

1. Leventhal, H.; Brissette, I.; Leventhal, EA. The common sense model of self-regulation of health and illness. In: Cameron, LD.; Leventhal, H., editors. *The self-regulation of health and illness behavior*. London: Routledge; 2003. p. 42-65.
2. Leventhal EA, Leventhal H, Schaefer P, Easterling D. Conservation of energy, uncertainty reduction, and swift utilization of medical care among the elderly. *J Gerontol B Psychol Sci Soc Sci*. 1993; 48:P78-86.
3. Leventhal, H.; Meyer, D.; Nerenz, DR. The common sense representation of illness danger. In: Rachmand, S., editor. *Contributions to medical psychology*. New York: Pergamon; 1980. p. 17-30.
4. Clark NM, Gong M, Kaciroti N. A model of self-regulation for control of chronic disease. *Health Educ Behav*. 2001; 28:769-82. [PubMed: 11720277]
5. Harvey JN, Lawson VL. The importance of health belief models in determining self-care behaviour in diabetes. *Diab Med*. 2009; 26:5-13.
6. O'Connor SM, Jardine AG, Millar K. The prediction of self-care behaviors in end-stage renal disease patients using Leventhal's Self-Regulatory Model. *J Psychosom Res*. 2008; 65:191-200. [PubMed: 18655865]
7. Walsh JC, Lynch M, Murphy AW, Daly K. Factors influencing the decision to seek treatment for symptoms of acute myocardial infarction: An evaluation of the Self-Regulatory Model of illness behaviour. *J Psychosom Res*. 2004; 56:67-73. [PubMed: 14987966]
8. Weinman J, Petrie KJ, Moss-Morris R, Horne R. The Illness Perception Questionnaire: A new method for assessing the cognitive representation of illness. *Psychol Health*. 1996; 11:431-45.

9. Moss-Morris R, Weinman J, Petrie KJ, Horne R, Cameron LD, Buick D. The revised Illness Perception Questionnaire (IPQ-R). *Psychol Health*. 2002; 17:1–16.
10. Skinner TC, Howells L, Greene S, Edgar K, McEvilly A, Johansson A. Development, reliability and validity of the Diabetes Illness Representations Questionnaire: four studies with adolescents. *Diab Med*. 2003; 20:283–9.
11. George JT, Valdovinos AP, Russell I, et al. Clinical effectiveness of a brief educational intervention in Type 1 diabetes: Results from the BITES (Brief Intervention in Type 1 diabetes, Education for Self-efficacy) trial. *Diab Med*. 2008; 25:1447–53.
12. Lawson VL, Bundy C, Harvey JN. The influence of health threat communication and personality traits on personal models of diabetes in newly diagnosed diabetic patients. *Diab Med*. 2007; 24:883–91.
13. Lawson VL, Bundy C, Harvey JN. The development of personal models of diabetes in the first 2 years after diagnosis: A prospective longitudinal study. *Diab Med*. 2008; 25:482–90.
14. Broadbent E, Petrie KJ, Main J, Weinman J. The brief illness perception questionnaire. *J Psychosom Res*. 2006; 60:631–7. [PubMed: 16731240]
15. Lawson VL, Bundy C, Lyne PA, Harvey JN. Using the IPQ and PMDI to predict regular diabetes care-seeking among patients with Type 1 diabetes. *Br J Health Psychol*. 2004; 9:241–52. [PubMed: 15125807]
16. Searle A, Norman P, Thompson R, Vedhara K. Illness representations among patients with type 2 diabetes and their partners: relationships with self-management behaviors. *J Psychosom Res*. 2007; 63:175–84. [PubMed: 17662754]
17. Glanz, K.; Lewis, FM.; Rimer, BK. Linking theory, research and practice. In: Glanz, K.; Lewis, FM.; Rimer, BK., editors. *Health behavior and health education: Theory, research and practice*. San Francisco, CA: Jossey-Bass; 1997. p. 19-35.
18. Ajzen I. The theory of planned behavior. *Organ Behav Hum Decis Process*. 1991; 13:179–211.
19. Ajzen I, Madden TJ. Prediction of goal-directed behavior: Attitudes, intentions, and perceived behavioral control. *J Exp Soc Psychol*. 1986; 22:453–74.
20. Ajzen, I.; Fishbein, M. *Understanding attitudes and predicting social behavior*. Englewood Cliffs, NJ: Prentice Hall; 1980.
21. Arcury TA, Skelly AH, Gesler WM, Dougherty MC. Diabetes meanings among those without diabetes: Explanatory models of immigrant Latinos in rural North Carolina. *Soc Sci Med*. 2004; 59:2183–2193. [PubMed: 15450696]
22. American Diabetes Association. Standards of medical care in diabetes, 2009. *Diabetes Care*. 2009; 32 (Suppl 1):S13–61. [PubMed: 19118286]
23. Quandt SA, Bell RA, Snively BM, et al. Ethnic disparities in glycemic control among rural older adults with type 2 diabetes. *Ethn Dis*. 2005; 15:656–63. [PubMed: 16259490]
24. Arcury TA, Quandt SA. Participant recruitment for qualitative research: A site-based approach to community research in complex societies. *Hum Organ*. 1999; 58:128–33.
25. Guest G, Bunce A, Johnson L. How many interviews are enough? An experiment with data saturation and variability. *Field Methods*. 2006; 18:59–82.
26. Patton, MQ. *Qualitative research and evaluation methods*. Thousand Oaks, CA: Sage; 2002.
27. Bode BW, Irvin BR, Pierce JA, Allen M, Clark AL. Advances in hemoglobin A1C point of care technology. *J Diabetes Sci Technol*. 2007; 1:405–11. [PubMed: 19885097]
28. Reboussin B, Ip EH, Wolfson M. Locally dependent latent class models with covariates: An application to underage drinking in the United States. *J R Stat Soc Ser A Stat Soc*. 2008; 171:877–97.
29. Vermunt J. Multilevel latent class models. *Sociol Methodol*. 2003; 33:213–39.
30. Stokols D. Translating social ecological theory into guidelines for community health promotion. *Am J Health Promot*. 1996; 10:282–98. [PubMed: 10159709]

Table 1

4-cluster solution from latent class analysis for the “cause” domain of diabetes beliefs (N = 95).

	Cluster Size	Cluster 1 0.48	Cluster 2 0.32	Cluster 3 0.14	Cluster 4 0.06
Diabetes can't be hereditary because not everyone in a family gets it.	Agree	0.41	0.20	0.75	0.25
	Disagree	0.59	0.77	0.25	0.75
	DK	0.00	0.03	0.00	0.01
Some people get diabetes because they ate too many sweets when they were young.	Agree	0.69	0.19	0.36	0.77
	Disagree	0.31	0.67	0.64	0.23
	DK	0.00	0.13	0.00	0.00
Everyone is born with diabetes, but it develops at different times for different people.	Agree	0.45	0.27	0.26	0.24
	Disagree	0.55	0.62	0.62	0.60
	DK	0.00	0.11	0.12	0.16
Diabetes is caused by eating too many processed foods.	Agree	0.41	0.32	0.41	0.11
	Disagree	0.58	0.61	0.58	0.32
	DK	0.01	0.07	0.01	0.57
People get diabetes when their body stops producing insulin.	Agree	0.83	0.90	0.62	0.97
	Disagree	0.09	0.08	0.09	0.03
	DK	0.08	0.02	0.29	0.00
Being overweight makes people get diabetes.	Agree	0.93	0.63	0.03	0.79
	Disagree	0.07	0.37	0.66	0.21
	DK	0.00	0.00	0.31	0.00
Diabetes is caused by poor circulation.	Agree	0.97	0.19	0.13	0.07
	Disagree	0.03	0.80	0.79	0.61
	DK	0.00	0.01	0.08	0.32
Diabetes is caused by clogged arteries.	Agree	0.89	0.10	0.04	0.00
	Disagree	0.11	0.89	0.73	0.08
	DK	0.00	0.01	0.22	0.92
Diabetes is caused by chemicals or additives put in food.	Agree	0.44	0.20	0.49	0.15
	Disagree	0.56	0.60	0.51	0.51
	DK	0.00	0.20	0.00	0.33
Diabetes is caused by chemicals or additives put in food.	Agree	0.44	0.20	0.49	0.15

	Cluster 1	Cluster 2	Cluster 3	Cluster 4
Cluster Size	0.48	0.32	0.14	0.06
Disagree	0.56	0.60	0.51	0.51
DK	0.00	0.20	0.00	0.33
Agree	1.00	1.00	0.16	0.99
Diabetes runs in families.				
Disagree	0.00	0.00	0.84	0.01
Agree	1.00	0.31	0.25	0.76
Diabetes is caused by stress.				
Disagree	0.00	0.62	0.59	0.24
DK	0.00	0.07	0.15	0.00
Cluster Label	Popular	Biomedical	Disagreeable	Ambivalent

Table 2

3-cluster solution from latent class analysis for the “symptoms” domain of diabetes beliefs (N = 95)

		Cluster 1	Cluster 2	Cluster 3
		0.57	0.35	0.08
Cluster Size				
Feeling weak or rundown is a symptom of low blood sugar	Agree	0.95	0.74	0.11
	Disagree	0.05	0.23	0.08
	DK	0.00	0.02	0.81
Blurry vision is sometimes a symptom of high blood sugar.	Agree	0.88	0.58	0.76
	Disagree	0.12	0.26	0.23
	DK	0.00	0.15	0.01
Feeling nervous is a sign of low blood sugar.	Agree	0.96	0.72	0.10
	Disagree	0.04	0.28	0.25
	DK	0.00	0.00	0.65
People with diabetes have tingling in their feet due to high blood sugar.	Agree	0.99	0.57	0.42
	Disagree	0.01	0.22	0.18
	DK	0.00	0.21	0.40
Falling down is a sign of diabetes.	Agree	0.72	0.09	0.07
	Disagree	0.28	0.79	0.69
	DK	0.00	0.13	0.25
Having to go to the bathroom often at night is caused by diabetes.	Agree	0.77	0.72	0.42
	Disagree	0.22	0.24	0.20
	DK	0.01	0.04	0.38
High blood sugar makes you feel drunk in the head.	Agree	0.90	0.64	0.37
	Disagree	0.10	0.30	0.25
	DK	0.00	0.06	0.38
Diabetes makes people feel thirsty all the time.	Agree	0.90	0.43	0.31
	Disagree	0.10	0.54	0.53
	DK	0.00	0.03	0.15
Cluster Label		Indiscriminant	Low Popular	Ambivalent

Table 3

3-cluster solution from latent class analysis for the “consequences” domain of diabetes beliefs (N = 95).

		Cluster 1	Cluster 2	Cluster 3
		0.71	0.18	0.11
Cluster Size				
People with diabetes have problems with circulation.	Agree	0.97	0.99	0.10
	Disagree	0.03	0.01	0.71
	DK	0.00	0.00	0.19
Diabetes affects all of the organs.	Agree	0.98	0.41	0.45
	Disagree	0.02	0.42	0.44
	DK	0.00	0.16	0.12
Diabetes causes high blood pressure.	Agree	0.91	0.15	0.29
	Disagree	0.09	0.61	0.70
	DK	0.00	0.23	0.01
Diabetes is a silent killer.	Agree	0.85	1.00	0.47
	Disagree	0.15	0.01	0.43
	DK	0.00	0.00	0.09
Diabetes has serious financial consequences.	Agree	0.62	0.65	0.99
	Disagree	0.38	0.35	0.01
Diabetes makes it difficult for your body to fight infection.	Agree	0.58	0.82	0.52
	Disagree	0.36	0.18	0.36
	DK	0.06	0.00	0.12
Cluster Label		General Internal	Insidious	Hardship

Table 4

4-cluster solution from latent class analysis for the “management” domain of diabetes beliefs (N = 95).

	Cluster 1 0.34	Cluster 2 0.31	Cluster 3 0.31	Cluster 4 0.05
Cluster Size				
Drinking lots of water helps to flush extra sugar out of the body.	Agree 0.60	Agree 0.50	Agree 0.71	Agree 0.48
	Disagree 0.34	Disagree 0.33	Disagree 0.29	Disagree 0.33
	DK 0.07	DK 0.16	DK 0.01	DK 0.19
Stress makes your blood sugar go up.	Agree 0.96	Agree 0.64	Agree 0.96	Agree 0.97
	Disagree 0.04	Disagree 0.18	Disagree 0.04	Disagree 0.03
	DK 0.00	DK 0.17	DK 0.00	DK 0.00
People only take diabetes seriously after they have had complications.	Agree 0.75	Agree 0.54	Agree 0.83	Agree 0.98
	Disagree 0.25	Disagree 0.46	Disagree 0.17	Disagree 0.02
It takes a long time for a cut or sore to heal because of diabetes.	Agree 0.79	Agree 0.84	Agree 0.98	Agree 0.30
	Disagree 0.21	Disagree 0.16	Disagree 0.02	Disagree 0.47
	DK 0.00	DK 0.00	DK 0.00	DK 0.23
Limiting how much meat you eat is important for controlling diabetes.	Agree 0.32	Agree 0.66	Agree 0.94	Agree 0.55
	Disagree 0.43	Disagree 0.34	Disagree 0.06	Disagree 0.44
	DK 0.25	DK 0.00	DK 0.00	DK 0.01
The only thing people with diabetes need to know is to stay away from sweets.	Agree 0.31	Agree 0.07	Agree 0.55	Agree 0.49
	Disagree 0.69	Disagree 0.93	Disagree 0.45	Disagree 0.51
Doing household chores is enough exercise for someone who has diabetes.	Agree 0.26	Agree 0.06	Agree 0.56	Agree 0.00
	Disagree 0.74	Disagree 0.94	Disagree 0.44	Disagree 0.07
	DK 0.00	DK 0.00	DK 0.00	DK 0.92
The body processes sugar in fruits and vegetables differently than sugar in sweets and starches.	Agree 0.26	Agree 0.06	Agree 0.56	Agree 0.00
	Disagree 0.74	Disagree 0.94	Disagree 0.44	Disagree 0.07
	DK 0.00	DK 0.00	DK 0.00	DK 0.92
Blood sugar often goes up and down for no reason.	Agree 0.54	Agree 0.69	Agree 0.96	Agree 0.75
	Disagree 0.40	Disagree 0.30	Disagree 0.04	Disagree 0.25
	DK 0.06	DK 0.00	DK 0.00	DK 0.00
Some people only need to watch their diet and exercise to manage their diabetes.	Agree 0.92	Agree 0.62	Agree 1.00	Agree 0.48
	Disagree 0.08	Disagree 0.31	Disagree 0.00	Disagree 0.29
	DK 0.00	DK 0.07	DK 0.00	DK 0.23

	Cluster 1	Cluster 2	Cluster 3	Cluster 4
Cluster Size	0.34	0.31	0.31	0.05
Cluster Label	General Lifestyle	Discerning Lifestyle	False Lifestyle	Reactive/Uninformed

Table 5
CSMs of diabetes management emerged from second-order latent class analyses (N = 95)

	Cluster1	Cluster2	Cluster3	Cluster4
Cluster Size	0.48	0.37	0.11	0.04
Domains of Diabetes Beliefs Cause				
Popular	0.97	0.02	0.01	0.03
Biomedical	0.03	0.69	0.42	0.72
Disagreeable	0.00	0.22	0.34	0.20
Ambivalent	0.00	0.06	0.24	0.05
Symptoms				
Indiscriminant	0.87	0.22	0.49	0.41
Low Popular	0.12	0.60	0.46	0.52
Ambivalent	0.00	0.18	0.05	0.07
Consequences				
General Internal	0.83	0.35	0.99	0.19
Insidious	0.15	0.42	0.01	0.41
Hardship	0.01	0.23	0.00	0.40
Management				
General Lifestyle	0.30	0.96	0.01	0.00
Discerning Lifestyle	0.42	0.04	0.14	0.00
False Lifestyle	0.28	0.00	0.82	0.21
Reactive & Uninformed	0.00	0.00	0.03	0.79
Cluster Label	Popular	Biomedical	Hyper-vigilant	Defeated