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Explanatory models of illness: A study of within-culture variation ☆

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Abstract

The current studies explore causal models of heart attack and depression generated from American healers whom use distinct explanatory frameworks. Causal chains leading to two illnesses, heart attack and depression, were elicited from participant groups: registered nurses (RNs), energy healers, RN energy healers, and undergraduates. The domain-specificity hypothesis predicted that psychosocial and physical causes would not interact in illness models. Across illnesses, RNs and undergraduates rarely cited interactions between mental and physical causes, consistent with the domain specificity hypothesis. In contrast, energy healers frequently mentioned interactions. Study 2 showed that these differences were not due to salience. These results suggest that domain-specificity theory is supported for groups with extensive exposure to western medicine but does not explain energy models of illness. Implications for other cultural models of illness are discussed.

Keywords: Causal reasoning; Cultural differences; Illness causal beliefs

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1. Introduction

There is considerable evidence from medical anthropology suggesting that illness explanatory frameworks differ profoundly both within and across cultures, yet very little work has investigated if and how causal models of particular illnesses differ across distinct explanatory frameworks. This paper describes two studies that systematically and quantitatively compare causal models of two illnesses, heart attack and depression, among individuals with distinct healing methods and explanatory frameworks—biomedical and alternative medicine practitioners. Explanatory frameworks are sets of assumptions about what types of causes and causal principles are relevant to a particular phenomenon. Explanations that are inconsistent with a preferred explanatory framework: (1) may not be considered, (2) may seem implausible, and (3) may be seen as less satisfactory than those which are consistent with it. An important contribution of the present studies is to analyze how illness explanatory frameworks constrain illness causal models that develop naturally—that is, outside the laboratory.

One salient difference among illness explanatory frameworks which has been discussed at length by anthropologists is between those which attribute illness to physical causes and those which attribute illness to psycho-social causes (Foster, 1976; Kleinman, 1978, 1995; Kleinman, Eisenberg, & Good, 1978; Kleinman & Gale, 1982; Kleinman & Sung, 1979; Murdock, 1980; Shweder, Much, Mahapatra, & Park, 1997). The physical explanatory framework that is discussed most frequently is "biomedicine," though there may be candidate physical causes that either have been rejected by or fall outside the purview of biomedicine. In contrast to physical explanatory frameworks, which attribute illness to a disruption of bodily, physiological process, psycho-social explanatory frameworks attribute illness to thoughts or emotions (one's own or another person's), which usually result from social factors. Drawing on ethnographic evidence from 139 non-industrial societies around the world, Murdock (1980) found that the most prevalent attribution of illness was to psycho-social causes. For example, among the Zande of Central Africa, illness is thought to be caused by jealous or angry neighbors practicing witchcraft (Evans-Pritchard, 1937). In Latin American societies, susto is a common cause of illness in which a shocking emotional situation causes one's soul to leave one's body (Rubel, O'Nell, & Collado-Ardón, 1985). In the United States, and other industrialized societies, many alternative medicine practitioners attribute illness to negative thinking, and other psychological problems (Baer, 2001; Whorton, 2002). This diverse array of explanations has in common the assumption that illness originates from some psychological state which is usually triggered by a change in one's relationship to the social world.

In contrast, biomedical explanatory frameworks focus on physical, bodily processes. In his essay entitled "What is Specific to Biomedicine?" Arthur Kleinman (1995) states that "…in the biomedical definition, nature is physical…knowable independent of perspective…the psychological, social and moral are only superficial layers of epiphenomenal cover that disguise the bedrock of truth…the real stuff." The biomedical model, like scientific models more generally, assumes that the nature of illness is physical and that illness operates according to the causal principles of the physical world.[1]

[1] It is unclear whether the notion of "biomedicine" being discussed by Kleinman and others refers to conceptual models used by individuals or to an idealized professional model that guides practice and research.

The contrast between psycho-social and physical explanatory frameworks suggests that one way in which illness explanatory frameworks might constrain causal models is by determining their content. Illness explanatory frameworks may function as pointers to the kinds of causes that should be recruited in illness explanations. This is the view of domain-specificity theory, which posits that explanatory frameworks for certain kinds of phenomena, including illness, are tied to specific cognitive domains. An abundance of research has addressed the question of whether the phenomenon of illness falls within the cognitive domain of psychology, the mind, or folk-biology, the body (Au, Sidle, & Rollins, 1993; Kalish, 1996, 1997; Keil, 1992; Keil, Levin, Richman, & Gutheil, 1999; Siegal, 1988; Springer & Ruckel, 1992). Many studies use a forced choice methodology in which participants are presented with psycho-social and biological explanations for illness and are asked to select the better explanation. Across studies, most of which are done with middle class American children and adults, participants tend to prefer biological explanations to psycho-social ones, which suggests that illness falls within the domain of folkbiology rather than folk psychology. For some groups, or some illnesses, illness may fall within the domain of folk psychology, rather than folk biology. In general, the domain-specificity hypothesis proposes that illness explanatory frameworks are tied to specific cognitive domains, which facilitate the construction of causal models by specifying which kind of causes and causal principles are relevant to the phenomenon of illness.

An alternative hypothesis, suggested by anecdotal evidence from anthropology, is that illness explanatory frameworks are not tied to particular cognitive domains (physical or psychological) but rather serve as guides or heuristics for how to combine biological and psychological information across domains. For example, Farmer and Good (1991) describe a case in Haiti in which, following a program designed to educate Haitians about the causal relationship between the HIV virus and AIDs, a man exclaims: "I understand that a virus causes AIDs but the question is who sent the virus!" This Haitian man apparently accepted the biological cause of AIDS (the virus) without giving up his prior belief in a psycho-social cause (e.g., the sorcerer). That is, it appears as if the virus explanation did not serve as an alternative to the sorcery explanation, but rather was integrated with it. Comaroff (1978) cites a similar example in which Africans accepted new information that lice caused typhus fever but then demanded to know who sent the lice. Evans-Pritchard (1937) claims that the Zande, who explain illness as the result of witchcraft, did not deny physical causes of illness; they were just more interested in discovering the witch whom initiated the physical causes. In these examples, acquisition of information about physical causes of illness does not appear to trigger a switch in the cognitive domain used to explain illness. Rather, these individuals appear to be integrating both psycho-social and physical causes into a single model. The domain-specificity hypothesis proposes that psycho-social and physical causes function as alternative explanations. In contrast, the cross-domain hypothesis proposes that psycho-social and physical causes can play distinct roles in a single explanation of illness.

The current study examines the role of cognitive domains in illness frameworks by eliciting causal models of two illnesses from RNs, who presumably use a biomedical framework and alternative healers, who seem likely to use a psychosocial explanatory framework. Despite the fact that biomedicine is the dominant medical system in the United States, many alternative healing systems explain illness as the result of psychosocial factors (Baer, 2001; Balshem, 1991; Mansfield, Mitchell, & King, 2002; Whorton, 2002). Alternative medical practices are utilized by as many as one in three Americans (Astin, 1998; Eisenberg et al., 1998; Eisenberg et al., 1993). Alternative healers in the current study practice energy healing. Energy healing is based

on the belief that illness is a disruption in the "energy field" of the body which can be treated by "balancing the energy field." Use of energy healing in particular (e.g., Reiki, Therapeutic Touch, Healing Touch) has increased in the US from just over 3 million people in 1990 to over 10 million in 1997 (Eisenberg et al., 1998; Eisenberg et al., 1993).

An ethnographic study of energy healers was completed by the first author prior to development of the studies described here. During the ethnographic phase, the author read numerous energy healing books (Eden, 1999; Myss, 1996, 1997; Shealy & Myss, 1998) and participated in two weekend-long energy healing workshops sponsored by Healing Touch, an energy healing organization.

According to energy healers, illness results from bad thinking. Myss (1996) says that "the majority of physical illnesses result from an overload of emotional, psychological, and spiritual crises" and "negative attitudes create a negative response in the physical body." According to Myss, people who become ill are engaged in one or more dysfunctional psychological patterns, such as "unresolved or deeply consuming stress" (e.g., feeling neglected as a child or a spouse's death) or "negative belief patterns" (e.g., low self-esteem). These dysfunctional ways of relating to oneself or others result in physical illness and in order to heal, one must correct these dysfunctional patterns. Contrasting biomedicine and energy medicine, Shealy and Myss (1998) claim that biomedicine assumes that "the physical world contains the forces that exert the strongest influence on the body," while energy medicine assumes that psychological stresses lead to the weakening of the body.

There is evidence suggesting that the notion of energy as a causal force is cross-culturally prevalent. First, the concept of energy bears a striking resemblance to what Nemeroff and Rozin (1994) call magical contagion. In magical contagion, moral valence is transferred across the mental/physical boundary via a transmitting substance (like energy). In one of many examples Nemeroff and Rozin (1994) show that Americans are reluctant to wear a sweater said to have been previously worn by Hitler because they believe that the material of the sweater will be "infected" with the negativity of Hitler's social persona. In a review of anthropological literature, Nemeroff and Rozin suggest that the concept of energy is culturally widespread and suggest that it represents a "universal form of thought."

The energy model also shares key principles with the theory of vitalism which was dominant in Western biological thought in the 18th and 19th centuries. The theory of vitalism originated at least as far back as Aristotle, who argued that living and non-living kinds are qualitatively different because the behaviors of living kinds—growth, reproduction, and movement—are generated by an internal force whereas behavior of artifacts is generated by an outward force (Aristotle, 1986). The concept of vital force, which Aristotle defined as the inner causal power of biological organisms, corresponds closely to the concept of energy. During the early part of the 20th century biology witnessed a paradigm shift in which vitalism was supplanted by the mechanistic theories which characterize contemporary biomedicine. This historical shift in the explanatory framework of Western biological thought plays out in individual development as well, at least in industrial societies. Young children prefer vitalistic explanations of biological phenomena to mechanical explanations (Inagaki & Hatano, 1993; Morris, Taplin, & Gelman, 2000). In short, the causal notion of energy is a prevalent and intuitive way of understanding biological processes.

The current studies include people with varying exposure to and training in a biomedical approach to illness. The primary contrast is between registered nurses and energy healers. Undergraduate informants were also employed to assess the effects of exposure to biomedicine independent of formal training in it. In addition, approximately one half of

the energy healers in the current study were registered nurses and half were not. In every case, RN-energy healers were trained in nursing before they were trained in energy healing. Many of the non-RN energy healers ("pure" energy healers) had also been exposed to biomedical concepts (e.g., physical anatomy), for example in massage therapy training, but none had studied or practiced biomedicine. The key question is whether the RN-energy healers construct distinct biomedical and energy models or combine them. The domain-specificity hypothesis predicts that RN-energy healers will construct distinct models—either with physical (specifically, biomedical) causes or with psycho-social causes but not with mixtures of the two. The cross-domain hypothesis predicts that the energy healers will integrate psycho-social and physical causes into a single model.

Inclusion of the RN-energy healer group controls for an expertise confound between the "pure" RNs and the "pure" energy healers. By working in biomedical settings it is likely that RNs have been exposed to a greater number of patients. Thus, differences between RN and energy healer models might be attributable to differences in *expertise* rather than differences in explanatory framework. That is, energy healer models may not include physiological causes because they are unaware of them. "Pure" RNs and RN-energy healers in the current study have equivalent amounts of biomedical experience, and therefore differences between them are likely to be attributable to endorsement of the energy model rather than differences in expertise.

Finally, undergraduates are like "pure" (non-RN) energy healers in their lack of extensive experience with illness (relative to RNs), and their lack of formal training in biomedicine. Nemeroff and Rozin (Nemeroff & Rozin, 2000) report that in certain contexts undergraduates invoke a causal mechanism that is energy-like in its function. If undergraduates invoke this concept in the context of thinking about illness, their models may resemble those of energy healers. Alternatively, their exposure to western medicine may lead them to reject psycho-social factors as candidate causes.

The present multiple group study represents a quasi-experiment and it would be a mistake to treat the three groups as if they were independent variables. Although it is possible to match groups on some variables (e.g., expertise), they no doubt differ in ways besides the factors that motivate their inclusion in these studies. The cost in ambiguity about the underlying basis for any group differences is compensated for by the more robust generalizations permitted by group similarities. In the case of differences the multigroup design permits stronger inferences concerning relevant performance factors than simple, two group contrasts (Medin & Atran, 2004).

Because the focus of the current studies is on examining the patterning of psychosocial and physical causes, we assessed people's causal models of heart attack and depression, prototypical examples of non-contagious physical and mental illness. Heart attack is a phenomenon for which biomedicine provides both a clear physical explanation and a fairly successful mechanical solution. For depression, both biomedical and psychosocial explanations are widely available.

Both heart attack and depression are common and very debilitating. Heart disease is the number one cause of death in this country[2] and at least 18 million Americans suffer from major depression every year[3]. A limitation of previous research on cognitive representations

[2] Statistic cited by the CDC National Center for Health Statistics.

[3] Statistic cited on MedlinePlus, of the National Library of Medicine of the National Institutes of Health (www.nlm.nih.gov/medlineplus).

of cultural models of illness is that each study has focused on a single illness (Blumhagen, 1980; Garro, 1988, 1995). An important question is whether explanatory frameworks vary according to the type of illness being explained.

To understand whether illness explanations cross cognitive domains it is necessary to examine the structure as well as the content of causal models. Study 1 addresses this question by eliciting both lists of causes and causal chains leading from each initial cause to the illness. The key question is how physical and psycho-social causes pattern in the causal chains for different groups. The domain-specificity hypothesis predicts that physical and psycho-social causes will be on distinct causal chains because illness explanations (causal chains) are generated from single cognitive domains. The cross-domain hypothesis predicts that physical and psycho-social causes will be joined on a single causal chain. Because Study 1 is open-ended, it does not completely address the question of whether group differences reflect differences in the underlying models or differences in the salience of alternative causes. Study 2 is a short follow-up to clarify that issue.

A crucial issue is the extent of agreement that is shared across informants within and between groups. The cultural consensus model (CCM) is a quantitative model that provides a statistical method for determining consensus based on small numbers of participants (Romney et al., 1986). The CCM is a principal components analysis in which the participants are the variables. Consensus among participants is assumed if (i) the first eigenvalue is at least three times the value of the second and accounts for most of the variance and (ii) loadings on the first eigenvector are all positive. Under these conditions the first factor can be taken to represent the cultural model. The first factor scores, or "consensus scores," of each informant reflect the degree to which his or her responses reflect the consensual model of the group. In this study, principal components analysis was also used to test for group differences. Tests of group differences were performed by including participants from multiple groups in a combined analysis. Group differences can be detected in a number of ways: (1) failure to achieve an overall consensus in the face of within group consensus (2) an overall consensus along with higher (second or third) factor scores that separate groups, or (3) an overall consensus but reliably greater within group than across group residual agreement (see Medin & Atran, 2004; for examples).

2. Study 1

2.1. Method

2.1.1. Participants

Details about the four groups of participants are summarized in Table 1.[4] Practitioners were contacted via word of mouth. Undergraduates were recruited from the Northwestern

[4] As we noted earlier, the multi-group design should not be construed as a 2×2 factorial experiment where groups take on the role of being independent variables. The four groups of participants differ in a numerous ways (e.g., the undergraduates differ in age, biomedical expertise, and perhaps socio-economic status). The strategy in this sort of quasi-experimental design is to broaden the understanding of two group similarities and differences by adding in third groups, following a "triangulation strategy" (Medin & Atran, 2004). Instead of conceptualizing the design as a 2×2 study it is more useful to think of it as a study that permits a number of three-group comparisons of similarities and differences that allow more powerful inferences about relevant factors. Finally, we make no claims that undergraduates are representative of the American population at large.

Table 1
Participant demographics by group, Study 1

Group	*N*	Age	Years of biomedical experience	Years of energy experience
Registered nurses (RNs)	13	41	13	n/a
RN-energy healers (DUAL)	12	47	20	4
Energy healers	14	48	n/a	8
Undergraduates	23	18	n/a	n/a

Psychology department participant pool. A majority of the participants in all practitioner groups were female (two male RN participants, one male DUAL participant, and four male ENERGY participants). The average level of education across practitioner groups was approximately four years of college. There were no differences between practitioner groups in terms of general level of education ($F(2,39) = 0.44$, $p = .65$). An ANOVA indicated that the RNs were slightly younger overall than the DUAL or ENERGY participants (RN = 41 years, DU = 47 years, EN = 48 years) ($F(2,39) = 3.30$, $p = .05$).

All RNs had either an Associate's degree or a Bachelor's degree in nursing. RN-energy healers had a few years more biomedical experience than regular RNs (RN-energy: 19.6 years, RN: 12.7 years) but the difference was not statistically significant ($t(1,23) = 1.78$, $p = .09$). Six ENERGY participants had some form of exposure to biomedical training—one was a pharmacist, one was in medical school for a year, one worked in a hospital as a medical aide, one ran a pain clinic in a hospital, one was a massage therapist, and one had some post-graduate training in molecular biology. To represent this experience, these six participants were coded as having one year of biomedical experience, while the remaining eight ENERGY participants were coded as having no biomedical experience (as were all undergraduates).

ENERGY participants had slightly fewer years of energy experience than DUAL participants, though the difference was not significant [$t(1,25) = 1.8$, $p = .08$]. It was assumed that participants with an established private practice in energy healing were more experienced than those who worked only with friends and family so estimates of energy experience were increased by 50% for those participants who had a private practice. Group differences on this measure were not significant [$t(1,25) = 1.7$, $p = .10$] (DU = 5.2 years, EN = 11.4 years).[5]

Twenty three Northwestern University undergraduates (UG) also participated in the study. All undergraduates were first-year students, participating for course credit. All had taken biology in high school. None had formal training in illness models. Eighteen undergraduates provided only a single illness model (10 heart attack only and eight depression only) and five undergraduates provided models for both illnesses. No differences were observed between models of undergraduates who provided only one model and those whom provided only a single model.

All participants (aside from two UGs) were born in the US and spoke English as a first language. In terms of SES, most participants were middle or upper middle class.

[5] Four "experience variables" were developed in order to measure the effect of different kinds of experience on causal models: energy experience, biomedical experience, level of general education, and formal psychology training (two ENERGY participants, three DUALs and three RNs had formal training in psychology). All variables were independent except formal psychology training and level of education ($r = .41$). Neither of these factors predicted any of the findings and are not discussed further.

2.1.2. Procedure

The procedure used to elicit causal models was a variation of the laddering methodology based on means-end chain theory in market research (Bagozzi & Dabholkar, 1994; Reynolds, 1985; Reynolds & Gutman, 1984, 1988). The procedure was identical for both probed illnesses. In the first part of the interview, participants were asked "What causes a Heart attack (or Clinical Depression)?" At this point, participants were told that they should give a list of all the causes they could think of and that the experimenter would later probe each cause in more depth.

All participants except undergraduates were asked about heart attack and depression in the same session (the undergraduates usually only gave causes of a single illness). The order of the illnesses was counterbalanced across participants. No order differences were found.

In the second part of the interview, the participant was asked for causal chains linking each elicited cause to the target illness. Causal chains were elicited for causes in the order they were mentioned in the first part of the interview. To elicit the causal chain linking cause X to the illness, the experimenter asked, for example, "How does X cause illness A" (e.g., How does high blood pressure cause a heart attack?). When the participant responded with an intermediary cause, Y, the experimenter repeated the probe with cause Y: "How does Y cause a heart attack?" This process was continued until the participant said the causal chain was complete (e.g., when the participant said "lack of blood to the heart tissue is a heart attack"). All causes were probed for one illness before moving on to the next illness. All interviews were recorded and transcribed.[6]

2.2. Results

2.2.1. Data transformation

Interviews were transcribed and causal factors coded into categories. Causes were first coded into categories describing specific mechanisms and detailed causal factors (e.g., high cholesterol and lack of exercise). Only those causes that were mentioned by at least four people (across groups) were retained. This resulted in 13 specific causal factors for depression and 23 for heart attack. See Appendices A and B for lists of the causes for each illness. Across illnesses, detailed causes fell into four general categories: biological/physical (referred to as physical), psycho-social (referred to as mental), behavioral, and energy-related. Detailed causes were used in consensus analyses and to construct consensual causal models for each group. General causes were used in analyses which explored patterning of causal types within and across individual models.

2.2.2. Causal interaction models

To evaluate the similarity of the models, a cause by effect matrix was created for each informant, for each illness. The cells of the matrix correspond to pairwise interactions among the causes (the illness itself was included in the matrix only as an effect and not as a

[6] Our procedure resembles the mental models approach to risk communication described by Morgan, Fischhoff, Bostrom, and Atman (2002). Specifically, the causal models that are the outcome of our interview protocol resemble the influence diagrams used by Morgan et al. to represent expert knowledge. Influence diagrams are graphs of nodes connected by arrows which indicate the direction of influence between nodes, that is, knowing the value of one node enables one to predict the value of the connected node. While influence diagrams allow both causal and non-causal influences, the models elicited in the current study include causal relations only.

cause). An individual participant matrix was completed by filling in the cells representing all relationships, both direct and indirect, in the causal model of that participant. For example, three cells would be filled for the causal chain high cholesterol → blockage → heart attack: cell (i) cause: high cholesterol/effect: blockage; cell (ii) cause: blockage/effect: heart attack, and cell (iii) cause: high cholesterol/effect: heart attack. The values corresponding to the distance of the causes in the individual participant's model were entered into the cells of the matrix. For example, cell i above would contain a 1, because there is a distance of 1 between high cholesterol and blockage in the causal chain above, cell ii would also contain a 1, and cell iii would contain a 2.[7]

2.2.3. Consensual causal models

The cultural consensus model was run on the participant model–structure matrices within a group to determine within-group consensus and across groups to determine group differences. These analyses were conducted separately for each illness. Consensual causal models were constructed for each group by including any cause–effect relationship that was mentioned by at least four people in the group (approximately 30% of each group). These relationships were used to construct a diagram of the cause–effect relationships mentioned by a plurality of each group. Sometimes there was greater consensus on indirect interactions than on direct ones but direct links that met the criterion (were mentioned by at least four group members) were included. The consensual depression and heart attack models for each group are shown in Figs. 1 and 2, respectively. Each type of analysis is described separately for each illness.

2.2.4. Depression models

Groups generated a similar set of physical and psycho-social causes to explain depression but combined those causes in different ways. Energy healers crossed cognitive domains in their causal chains but RNs and undergraduates did not. This difference can be seen in Fig. 1 by comparing the role of chemical imbalance in the models of each group. In energy healer models psychological states (thoughts and/or emotions) caused a chemical imbalance whereas in RN and undergraduate models, thoughts/emotions and chemical imbalance were on different causal chains. Group differences in the tendency to cross domains in explanations were evident in both group consensual models (Fig. 1) and individual models.

Table 2 provides the mean number of participants per group who mentioned each cause. Participants across groups explained depression using the same basic set of causes. A majority of participants across groups cited *mental states* and *social factors* as causes of depression and over half cited *chemical imbalance* and *genetics*. Participants also agreed on a few highly salient causal relations. *Genes* always caused depression via *chemical imbalance* and *social factors* almost always caused depression by affecting thoughts

[7] In order to provide the cultural consensus model with sufficient data to measure patterns of agreement, a value had to be generated for blank cells, which occurred when a participant did not mention a cause that others mentioned. It was assumed that relations with unmentioned causes were maximally distant psychologically. Therefore, a value of maximal causal distance for each illness was determined by finding the maximal distance between any two causes across all models for that illness and increasing that distance by one. The blank cells in the individual participant matrices of each illness were filled with the value of maximal distance for that illness (the value of maximal distance = 7 for heart attack and 5 for depression).

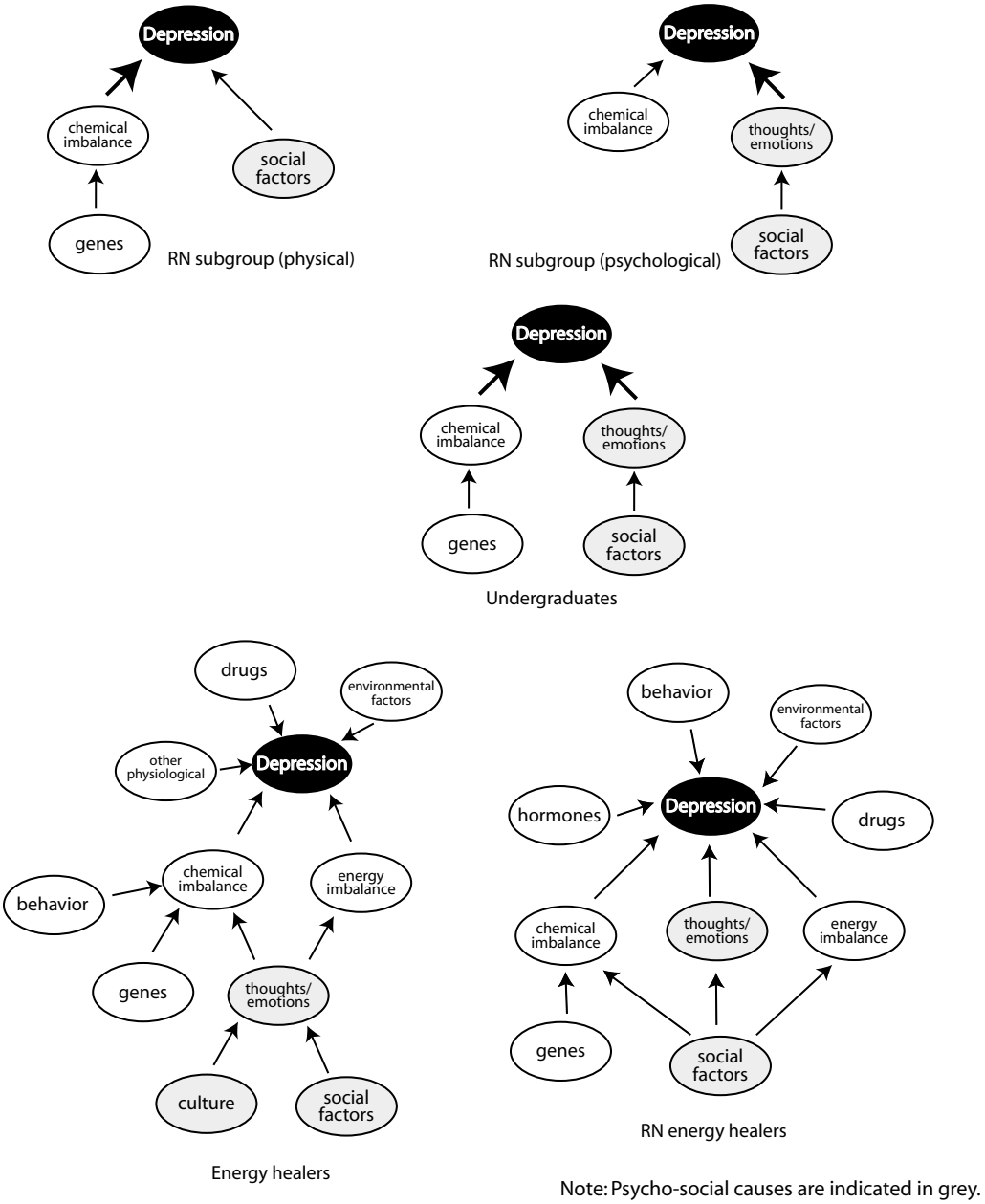

Fig. 1. Consensual depression models by group.

and emotions (e.g., social causes of low self-esteem). The main difference in content of models across groups was that only energy groups mentioned "energy imbalance," which was frequently used to link mental and physical causes. Aside from *energy imbalance*, groups differed more in the way they combined causes than in the content of their models.

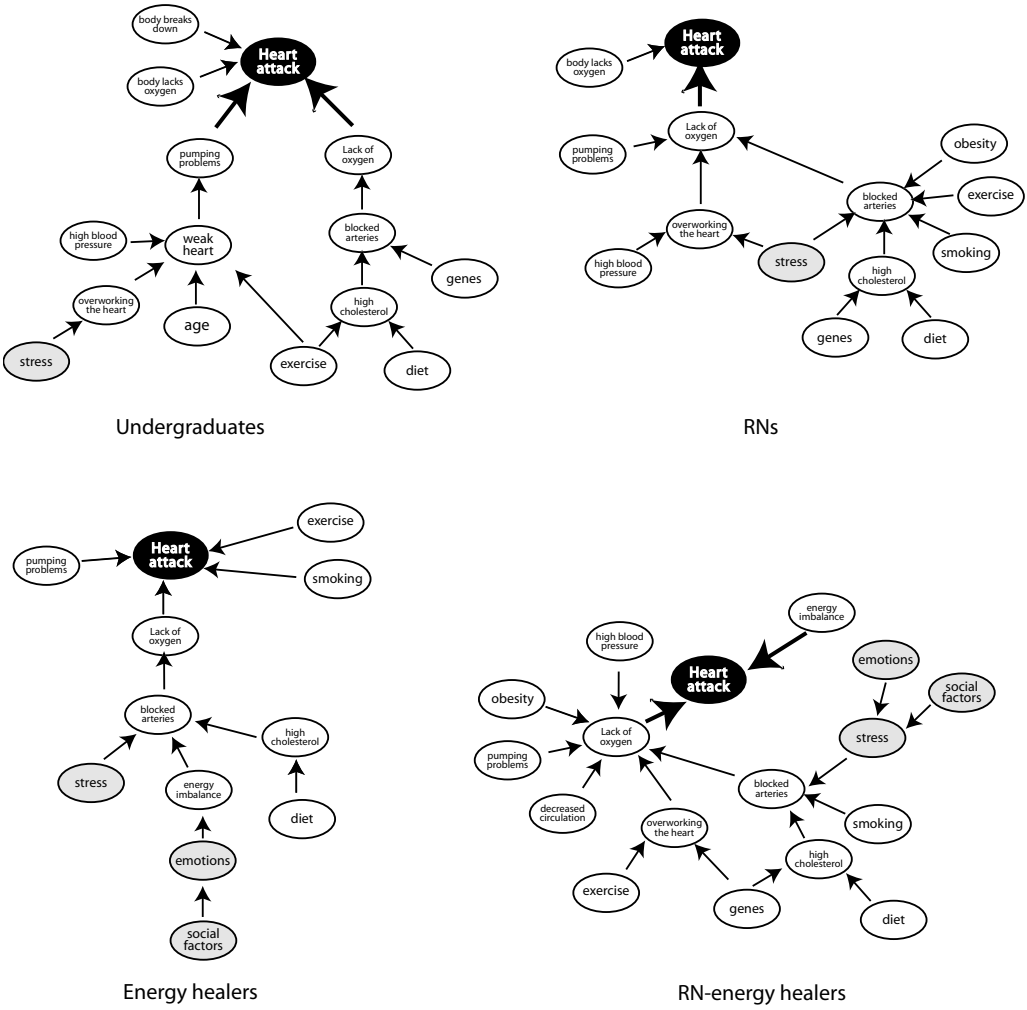

Fig. 2. Consensual heart attack models by group.

Consensus analysis of the structured models indicated that there was moderately good agreement across all participants. The first to second factor ratio was 5:1 (Factor 1: 44% variance, Factor 2: 8.9% variance, Factor 3: 8.5% variance) and first factor scores were positive for all participants. The first factor of the consensus analysis pulls out what is common across participant models and remaining factors may indicate systematic patterns of variation among them. There were two sources of variation among participants, which were represented by the 2nd and 3rd factors. An ANOVA showed that third factor scores on the consensus analysis mapped closely onto group membership ($\mathrm{RN} = -0.15$, $\mathrm{UG} = -0.17$, $\mathrm{DUAL} = 0.07$, $\mathrm{ENERGY} = 0.33$) [$F(3,52) = 17.27$, $p < .0001$]. This factor did NOT distinguish undergraduate models of depression from those of RNs, suggesting that undergraduates and RNs had similar models of

Table 2
Proportion of each group who mentioned each causal factor in depression models

	UG	RN	DU	EN
Physiological				
Chemical imbalance	0.62	0.77	0.92	0.73
Hormones	0.00	0.08	0.58	0.20
Other physiological	0.00	0.23	0.17	0.40
Drugs	0.08	0.08	0.42	0.33
Genetics	0.54	0.54	0.67	0.53
	0.25	**0.34**	**0.55**	**0.44**
Psycho-social				
Thoughts	0.92	0.77	1.00	1.00
Social/family	1.00	0.77	0.83	1.00
Culture	0.31	0.08	0.17	0.33
Bad coping	0.00	0.46	0.33	0.00
	0.74	**0.54**	**0.67**	**0.78**
Behavior	**0.00**	**0.23**	**0.33**	**0.47**
External physical (*environmental*)	**0.08**	**0.08**	**0.33**	**0.33**
Energy	**0.00**	**0.00**	**0.42**	**0.80**

depression. "Pure" energy healer models were distinguished from all other groups. RN-energy healer models were different from undergraduate models and marginally different from RN models ($p = .06$). Consensus analysis confirmed that the biggest differences in depression models were between the RNs and undergraduates on the one hand, contrasted with "pure" energy healers on the other, with RN-energy healers falling in between.

Analysis of individual participant models[8] showed that energy groups were about two times more likely than RNs and undergraduates to include mental and physical causes on the same causal chain.[9] Table 3 shows that out of all relations consisting of physical or mental causes (within domain: physical–physical, mental–mental; cross-domain: physical–mental, and mental–physical)[10], energy healers (DUAL and ENERGY) cited cross-domain relations about 40% of the time while RNs and undergraduates cited cross-domain relations only 25 and 10% of the time, respectively. This difference was confirmed by an ANOVA on proportion of cross-domain relations which included ENERGY experience and BIOMEDICAL experience (coded categorically) as factors. This ANOVA revealed a main effect of ENERGY experience [$F(3,53) = 8.44$, $p = .006$] but no effect of BIOMEDICINE [$F(3,53) = .63$, $p = .43$] and no interaction [$F(3,53) = .94$, $p = .34$]. That is, the two

[8] Depression models of DUAL and ENERGY participants were more complex than those mentioned by RNs and UGs. Energy participants mentioned more causes overall than RNs and UGs (EN = 6.1, DU = 6.2, RN = 4.1, UG = 3.4), ($F(3,52) = 6.19$, $p = .001$), and had longer causal chains (EN = 2.6, DU = 2.7, RN = 2.1, UG = 2.1), ($F(3,52) = 4.25$, $p = .01$).

[9] If two causes are on the same causal chain for an individual, those causes are considered causal relations in this analysis.

[10] A majority of the causal relations within depression models of all groups (RN = 89%, DU = 87%, EN = 75%, UG = 96%) fell into one of these four types.

Table 3
Proportion of psychological and physical causal relations in depression models across groups

	UG	RN	DU	EN
Within-domain relations				
Physical–physical (PP)	0.11	0.28	0.22	0.16
Mental–mental (MM)	0.80	0.47	0.39	0.43
Total	**0.90**	**0.75**	**0.60**	**0.58**
Cross-domain relations				
Physical–mental (PM)	0.03	0.12	0.19	0.02
Mental–physical (MP)	0.07	0.14	0.21	0.40
Total	**0.10**	**0.25**	**0.40**	**0.42**

energy groups cited more cross-domain interactions than did the RNs and Undergraduates.[11]

For RNs, UGs, and RN-energy healers, depression was seen primarily as the result of psychological causal interactions. The most prevalent type of causal relation in models of those participants was between mental causes. The most common mental–mental relation was *social factors → thoughts and emotions* which was included in models of a majority of participants across groups. In contrast to the other groups, models of ENERGY participants included mind–body interactions to the same extent as psychosocial ones.

The content of depression models varied *within* the group of RNs. Some RNs emphasized physical causes of depression whereas others emphasized psychosocial causes. This difference was reflected on the second factor of the cross-group consensus analysis which distinguished between physiological versus psycho-social models of depression. Participants with extreme negative values on the second factor (less than −0.24) emphasized social factors to the exclusion of physical ones and those with extreme positive values on the second factor (greater than 0.20) focused on physical factors (i.e., *genetics*, *chemical imbalance*, and *hormones*) to the exclusion of social ones. Participants at both ends of the physical—psycho-social continuum were RNs. Separate consensus analyses performed on each group indicated that the RN group was the only group that did not show internal consensus.[12] Consensus analysis revealed two distinct models of depression among RNs—eight of the RNs emphasized psycho-social factors (*social factors → thoughts*) and five emphasized physiological ones (*genetics → chemical imbalance*). Schematic diagrams of the

[11] "Pure" energy healers and RN-energy healers were equally likely to cite interactions between physical and mental causes but the direction of these relations varied between energy groups. "Pure" energy healers focused almost exclusively on mind–body interactions whereas RN-energy healers were equally likely to cite body–mind interactions. Body–mind causal relations were mentioned disproportionately by biomedically trained participants. Almost all of them were ones in which a physical factor (e.g., drugs, chemical imbalance, or genetics) caused bad coping.

[12] For DUAL participants the ratio of the first and second factors was 3.8:1 (Factor 1 explained 44% variance) and the mean of the first factor scores was 0.66. For ENERGY participants, the ratio of the first and second factors was 4.4:1 (Factor 1 explained 48% variance) and the mean of the first factor scores was 0.68. For the UGs, the ratio of the first to the second factor was 6.6:1 (Factor 1: 66% variance, Factor 2: 10%) and the mean of the first factor scores was 0.81. For the RNs, lack of consensus was indicated by a first to second factor ratio of only 2.3 (Factor 1: 46% variance, Factor 2: 20%).

consensual models of the two RN subgroups are provided in Fig. 1. This pattern suggests that some RNs construed depression as a physical causal process and others construed it as a psycho-social one.

Energy healers were more likely to mention *energy imbalance* as a cause of depression than were other groups ($X^2(3,n=53)=28.6$, $p<.0001$). Among DUAL and ENERGY participants, greater energy experience increased the likelihood of mentioning *energy imbalance* as a cause of depression ($r(27)=0.47$, $p=.01$). Analysis of the structural role of energy imbalance in depression models suggested that energy imbalance served as a causal link between psycho-social and physical factors. Of the 17 participants who mentioned energy imbalance in their models of depression, 82% said that energy imbalance was a direct cause of depression. Aside from directly causing depression, energy imbalance most frequently led to other physical effects, usually chemical imbalance. Further, energy imbalance resulted from psycho-social rather than physical factors. For every participant who mentioned energy imbalance, social factors caused the energy imbalance, almost always (94%) by way of affecting the thoughts or emotions of the individual.

In sum, RN and undergraduate models were consistent with the edomain-specificity hypothesis and energy models were not. RNs and undergraduates viewed mental and physical causes as distinct, alternative explanations of depression. Consensus analysis showed that RNs who emphasize physical causes tend to de-emphasize psycho-social ones and vice versa. RNs and undergraduates viewed physical explanations of depression as alternatives to psycho-social ones.

Energy models were consistent with the cross-domain hypothesis, in that they viewed physical causes as part of the mechanism by which psycho-social factors led to depression. Analysis of heart attack models permitted an assessment of the extent to which the structural differences discovered in depression models were also reflected in a physical illness.

2.2.5. Heart attack models

Not surprisingly, heart attack models were composed primarily of physical causes. Nonetheless, the structure of heart attack models reflected the same pattern of group differences that was found for depression. Again, RN and undergraduate models treated physical and psycho-social causes as distinct but energy models crossed physical and psychological domains. For example, Fig. 2 shows that all groups explained heart attack as the result of blocked arteries. Energy healers explained blocked arteries as resulting from thoughts and emotions and social factors but RNs and undergraduates did not. RNs and undergraduates did explain some physical causes as resulting from stress which suggested a role for psychosocial factors in their models. Note, however, that the word "stress" is ambiguously physical or psychological in nature.

Table 4 shows that heart attack models across groups contained a common set of physical and behavioral causes such as *blockage*, *lack of blood to the heart*, *high cholesterol*, *lack of exercise*, *diet*, and *stress*. The physical causal chain *diet* → *high cholesterol* → *blocked arteries* → *lack of oxygen* was cited by a large proportion of participants in each group. The likelihood of mentioning psycho-social causes differed by group.[13] Energy healers were

[13] There were slight group differences in the number of causes mentioned by each participant (RN = 9.2, DU = 10.6, EN = 9.1, UG = 7.9) [$F(3,54)=0.29$, $p=.04$]. Tukey HSD post hoc tests showed that the DUAL group cited more causes than the UG group. No other differences were reliable.

Table 4
Proportion of each group who mentioned each causal factor in heart attack models

	UG	RN	DU	EN
Physiological				
Blockage	0.87	1.00	1.00	0.86
No blood to heart	0.50	0.92	0.92	0.71
Hi cholesterol	0.80	0.92	0.67	0.50
Genes	0.40	0.85	0.92	0.21
Pumping probs	0.80	0.54	0.50	0.29
Overworking heart	0.47	0.62	0.50	0.14
HBP	0.33	0.54	0.42	0.21
Weak heart	0.67	0.00	0.08	0.21
Body lacks oxygen	0.27	0.31	0.17	0.21
Body breaks down	0.33	0.15	0.17	0.21
Deer circulation	0.13	0.15	0.33	0.21
Obesity	0.00	0.38	0.33	0.07
Age	0.40	0.15	0.00	0.00
Pressure in h/explod	0.20	0.08	0.00	0.21
Vessel damage	0.00	0.23	0.08	0.07
	0.41	**0.46**	**0.41**	**0.28**
Psycho-social				
Stress	0.60	0.62	0.83	0.36
Emotions/thoughts	0.00	0.00	0.75	1.00
Social factors	0.00	0.23	0.58	0.93
	0.20	**0.28**	**0.72**	**0.76**
Behavioral				
Diet	0.67	0.62	0.67	0.71
Lack of exercise	0.53	0.46	0.67	0.50
Smoking	0.13	0.46	0.50	0.29
Poor breathing	0.00	0.00	0.08	0.21
	0.33	**0.38**	**0.48**	**0.43**
Energy				
Energy imbalance	**0.00**	**0.00**	**0.42**	**0.79**

more likely than RNs and undergraduates to mention psycho-social causes of heart attack. There was no difference across groups in the likelihood of mentioning *stress* ($X^2(3,n=55)=5.24$, $p=.16$), but energy healers were more likely than RNs or undergraduates to mention *thoughts/emotions* ($X^2(3,n=55)=42.16$, $p<.0001$) and *social factors* ($X^2(3,n=55)=29.96$, $p<.0001$).

The CCM analysis indicated a moderately good consensus across participants. The first to second factor ratio was 5:1 (Factor 1: 31% variance, Factor 2: 6.4%), and first factor scores were all positive (mean = 0.54). An ANOVA on second factor scores showed that they differed by group [$F(3,53)=27.07$, $p<.0001$]. Tukey post hoc tests indicated that second factor scores did not distinguish among RN and undergraduate heart attack models (RN = −0.12, UG = −0.18, EN = 0.32, DUAL = 0.07). The model of RNs and UGs was distinguished from the model of "pure" energy healers and models of RN-energy healers (0.07) were in between. The CCM was also performed separately on each group. Each individual group satisfied the criteria for a single cultural

Table 5
Percent of each type of physical-effect relation in heart attack models by group

Type of causal relation	UG	RN	DUAL	Energy
Physical–physical	0.54	0.61	0.43	0.21
Psychological–physical	0.11	0.12	0.23	0.42
Behavioral–physical	0.35	0.27	0.31	0.28
Energy–physical	0	0	0.03	0.09

model (Romney et al., 1986), indicating that participants within each group agreed about their models of heart attack.[14]

Again groups differed in the prevalence of cross-domain (mind–body) causal relations. Table 5 shows the proportion of heart attack causal relations in individual models across groups.[15] Pure energy healers were more likely than other groups to cite mind–body causal relations[16] and they were the most prevalent type of relation in energy healer models. The remaining groups explained heart attack primarily in terms of physical factors. This difference was confirmed by an ANOVA on proportion of mind–body relations by group [$F(3,54) = 14.3$, $p < .0001$]. Post hoc tests showed that the ENERGY group (0.42) cited more of these relations than any of the other groups, who were equivalent (RN = 0.11, DU = 0.23, UG = 0.11). This difference was supported by an ANOVA on the proportion of purely physical causal interactions mentioned by each group [$F(3,54) = 15.5$, $p < .001$]. Post hoc tests showed that the ENERGY group cited fewer purely physical causal interactions (0.21) than any other group, the DUALs (0.43) cited fewer than the RNs (0.61), and neither the DUALs nor the RNs differed from the UGs (0.53).

Behavioral–physical relations made up about 30% of all physical effect relations across groups. There were no differences across groups in the frequency of these relations [$F(3,54) = 0.45$, $p = .70$]. Not surprisingly, energy healers were more likely to cite interactions of energy with physical factors [$F(3,54) = 7.01$, $p < .0001$].

There were only minor differences in the heart attack models of biomedically trained professionals and college undergraduates. RNs and undergraduates were strikingly similar in the kinds of causes they mentioned for heart attack and these focused primarily on

[14] A CCM on RN participants showed a first to second factor ratio of 5.25:1. The first factor explained 49% of the variance, all scores were positive on the first factor and the mean of the first factor scores was 0.69. For RN-energy healers the first to second factor ratio was 4.0:1 (Factor 1: 40% variance), and the mean of first factor scores mean was 0.62. The ENERGY group showed a first to second factor ratio of 3.5:1 (Factor 1: 38% variance), and a first factor score mean of 0.59. The undergraduate CCM showed a first to second factor ratio of 3.6:1 (Factor 1: 36% variance), and the mean of first factor scores was 0.58. All groups satisfy the criterion for a single cultural model (Romney et al., 1986).

[15] In models of all participants, the proximate causes of heart attack were physical in nature. That is, majority of the causal relations in heart attack models had physical effects (RN = 0.98, UG = 0.99, DUAL = 0.88, ENERGY = 0.77). Therefore, analyses of model structure consisted of cross-group comparisons of proportions of physical effect relations with either physical, mental, behavioral, or energy causes. These measures are not independent but the following effects are reliable with a Bonferroni adjustment.

[16] Overall, complexity of heart attack models was roughly consistent across groups. There was no difference in the length of the causal chains across groups (RN = 4.08, DU = 4.25, EN = 4.27, UG = 3.93) [$F(3,54) = 0.67$, $p = .57$]. Structural differences in heart attack models across groups are related to differences in the prevalence of psycho-social factors in the models.

mechanical and behavioral causes. The only causes mentioned by undergraduates that were not mentioned by RNs were *age* (40%) and *weak heart* (53%).[17]

Energy healers (both "pure" energy healers and RN-energy healers) were more likely to mention energy imbalance than were RNs or undergraduates ($X^2(3,n=55)=30.1$, $p<.0001$). Among DUAL and ENERGY participants, greater energy experience increased the likelihood of mentioning *energy imbalance* as a cause of heart attack ($r(25)=0.38$, $p=.048$). E*nergy imbalance* provided a conceptual link between mental and physical causes of heart attack. Energy imbalance was virtually always caused by psycho-social factors (96%) and either led to physical causes (67% ENERGY, 60% DUAL), or was a direct cause of heart attack (33% ENERGY, 40% DUAL). Only one ENERGY participant said energy imbalance had a mental effect, and no one said it had a behavioral effect. Participants also linked psycho-social and physical causes directly without explicit mention of *energy imbalance*. A majority of energy healers who did not mention *energy imbalance* still mentioned *social factors* and linked them to physical causes (76% across groups). Thus, *social factors* were quite common in the heart attack models of energy participants and often, but not always, caused heart attacks through the mechanism of *energy imbalance*.

In sum, group differences in heart attack models mirrored those for depression models. RN and undergraduate models were consistent with the domain-specificity hypothesis while energy models were consistent with the cross-domain hypothesis. Energy healers integrated mental and physical causes in explanations of heart attack, while the RNs and undergraduates cited predominantly physical causes. Undergraduates and RNs cited stress as a cause of heart attack, suggesting a role for psychological factors. However, RNs and undergraduates rarely cited specific psychological states or social causes of heart attack.

Overall, findings from Study 1 suggested that group differences were the result of different assumptions about the role of mental and physical factors in causal models of illness. Study 1 suggested that explanatory frameworks of illness constrained causal models of illness by establishing guidelines for how to combine mental and physical causes (or not

[17] The age → weak heart causal pathway in undergraduate models probably has an analog in the models of the other groups. RN, DUAL, and undergraduate consensual heart attack models (depicted in Fig. 2) all contain two causal paths to a heart attack, one pathway which is characterized by abnormal activity of the heart (overworking the heart among RNs and DUALs and pumping problems, e.g., "heart can't pump/stops pumping" among undergraduates) and the other by blockage (blocked arteries). Although the abnormal heart activity pathway is expressed by different causes in undergraduate models (e.g., UG use of age and weak heart) it is semantically quite similar to the abnormal heart activity pathway of the RNs and DUALs. Another similarity among UG and RN participants is that they rarely mention psycho-social factors aside from stress. The concept of "stress" is unique because, unlike a belief state or an emotional state, the state of being stressed applies equally well to physical and psychological objects. Further, "stress" does not refer to particular mental contents, like "thoughts" or "emotions," but rather to a [content-less] state of the mind as a whole. To refer to a person as "stressed" in the psychological sense construes the mind of the person in physical machine-like terms. That is, a stressed mind (or body) is like a stressed machine, it is under more pressure than it is capable of handling and may break down. Mental contents are irrelevant, as are the conditions that led to the stress in the first place (i.e., the "stressors"). Interestingly, pure energy healers rarely used the concept of stress in their heart attack models. When participants discussed the mechanism of stress in detail they almost always referred to states of physiological arousal (e.g., increased adrenalin). In the case of heart attack then, stress seems to refer to a physical mechanism by which external factors can cause heart attack. However, because it is ambivalent as to whether it is psychological or physical, stress was coded as psycho-social. In models of RNs and UGs, stress was virtually always used as an ultimate cause in heart attack models rather than as a mechanism by which external factors could lead to heart attack. RN-energy healers were more likely to use stress as a mechanism by which emotions and social factors could lead to heart attack. Interestingly, energy imbalance plays the same role in pure energy healer models.

combine them, as the case may be). Importantly, Study 1 was inconsistent with the idea that the role of illness explanatory frameworks is to delimit a single relevant domain of causality.

3. Study 2

The main difference between groups on Study 1 was in the tendency to mention relationships between mental and physical causes in their explanations of illness. We argue that structural differences in models across groups reflected differences in explanatory frameworks, that is, beliefs about the types of causes and causal interactions that lead to illness. However, an alternative explanation for group differences is that they are attributable to differences in the salience or familiarity of mind–body interactions across groups, rather than differences in beliefs about their plausibility. Study 2 was conducted to distinguish between the salience and belief explanations of the group differences found in the first study. In Study 2, participants were asked whether specific mind–body relations are acceptable as possible causes of heart attack and depression. The causal interactions probed were ones that had been frequently cited by energy participants in Study 1.

3.1. Method

3.1.1. Participants

Participants consisted of 23 Northwestern University undergraduates, who participated for course credit, 9 pure energy healers, 10 RN-energy healers, and 12 RNs. All participants except the undergraduates also participated in Study 1.

3.1.2. Procedure

All participants were asked the following questions: (1) "Can heart attack be caused by loneliness causing blocked arteries?" and (2) "Can depression be caused by a traumatic event that leads to a seratonin imbalance in the brain?" If participants answered yes to either of these questions they were asked how they thought this interaction might occur. Undergraduates were given these questions on a paper form and were asked to circle yes or no and then justify their response. Many undergraduates declined to give justifications for their responses. The remaining participants were interviewed over the phone. Most of these participants gave justifications for their responses. The order of questions was counterbalanced across participants.

3.2. Results and discussion

Mean proportions of "yes" responses for each group are displayed in Fig. 3. As Fig. 3 indicates, RNs and undergraduates were less likely than energy healers to accept mind–body interactions as leading to illness. This difference was greater for heart attack than depression. A $2 \times 2 \times 2$ repeated measures ANOVA was performed with ENERGY and BIOMEDICINE as between-subjects factors and illness (depression or heart attack) as a within-subjects factor. This overall ANOVA revealed a main effect of illness [$F(1,50) = 7.6$, $p = .008$] in which the mind–body interaction was accepted more as an explanation for depression than for heart attack (depression = 0.77, heart attack = 0.55). There was also a main effect of ENERGY [$F(1,50) = 20.2$, $p < .0001$] which indicated that energy healer

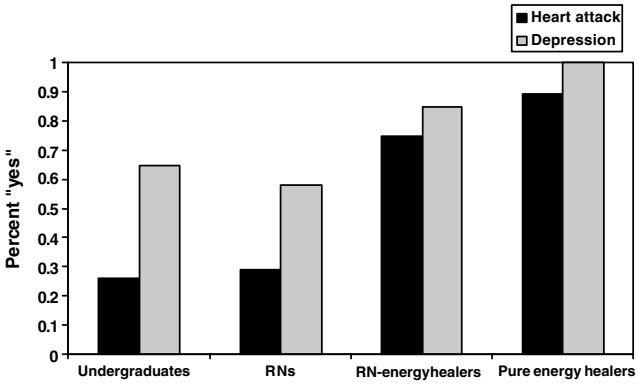

Fig. 3. Percent acceptance of mental-physical causal interactions for each illness by group, Study 2.

participants were more likely than RNs and undergraduates to accept mind–body interactions across illnesses (energy = 0.87, non-energy = 0.45).

These results confirmed that energy healers were more likely than RNs and undergraduates to accept mind–body interactions as causing illness and support the conclusion that group differences in the likelihood of mentioning mind–body causal interactions for heart attack and depression in Study 1 resulted from differences in beliefs rather than differences in salience. Interestingly, RNs and undergraduates were more likely to accept the mind–body interaction for depression than for heart attack. One explanation is that the content of the causes (albeit not their interaction) in the depression causal interaction were familiar to these participants. Traumatic event and chemical imbalance were mentioned by a large proportion of RNs and undergraduates in Study 1 as alternative explanations for depression. In contrast, these participants may not have been exposed to loneliness as a cause of heart attack. [18] It may be that acceptance of the content of the causes increased acceptance of a causal interaction between them. In any case, these participants did not hold a strong belief about mind–body interactions leading to depression. Responses to the heart attack question showed that a majority of RNs and undergraduates rejected the idea that loneliness can cause blocked arteries, while a majority of energy healers accepted it.

4. General discussion

RN and undergraduate illness causal models were consistent with the domain-specificity hypothesis. When both physical and psycho-social causes were mentioned they were located on different causal chains. Moreover, in Study 2 most RNs and undergraduates rejected the possibility that loneliness, a psycho-social factor, could cause blocked arteries.

In contrast, energy healer models were consistent with the cross-domain hypothesis because they included psycho-social and physical causes on a single causal chain. These explanatory frameworks embody different assumptions about the relationship between mental and physical causes—the mind and the body—in illness etiology.

[18] See Cacioppo et al. (2002) for evidence that loneliness may play a role in the evolution of heart disease.

To our knowledge, the current studies are the first to quantitatively and systematically assess detailed causal models of illness across groups with distinct explanatory frameworks. Most prior research on causal models of illness has been limited to a single population and often a single illness. The current findings showed that the pattern of group differences was systematic across two very different kinds of illnesses.

The present studies provide quantitative analyses and modeling that explores and elaborates upon anthropological research in a way relevant to psychology and the larger scientific community. They provide an initial set of evidence that can help to understand the cognitive mechanisms underlying anthropological descriptions of cultural differences in illness models. Because previous studies of illness models have examined lists of causes rather than complete causal models, descriptions of cultural differences have been limited to the *content* of the causes—physical versus psycho-social. By examining the structure of distinct illness models we were able to demonstrate that the key difference between these models is not in the content of causes but in the relationship between mental and physical causes. This suggests that an important element of illness explanatory frameworks is the assumption about whether and how the mind and body interact.

Inagaki and Hatano (1993) consider vitalism to be an alternative construal of biology which differs from a physical or psychological construal. The current study raises the possibility that the energy model (i.e., vitalism) is an integration of the physical and psychological causal realms, rather than an alternative construal that is independent of them.

Kleinman (Arthur Kleinman & Sung, 1979), one of the first medical anthropologists to investigate explanatory models, argues that attribution of illness to psycho-social factors is universal among patients, even in industrialized societies like the US. He argues that all people need to understand their sickness experiences as resulting from their own personal life (Kahneman & Miller, 1986) and do so by constructing psycho-social explanatory models. This predicts that in industrialized societies where a biomedical approach to illness is dominant, patient populations will explain their own illnesses in terms of an interaction of physical and psycho-social factors, as do energy healers in the current study. Kleinman suggests that alternative healers may be popular (and even effective) because their illness concepts and treatment methods are conceptually concordant with the intuitive concepts of sick people (Kleinman & Sung, 1979). An important direction for future research is to investigate structural differences between patient and non-patient models of illness.

Undergraduates share with RNs a bias against mind–body causal interaction in models of illness. Consensus analysis did not distinguish RNs from undergraduates on either illness. Chavez, Hubbell, McMullin, Martinez, and Mishra (1995) also found that relatively high SES (relatively highly educated with a relatively high income) American Caucasian women agreed with physicians about the causes of breast and cervical cancer. The current study shows that young adults in their first year of college have already acquired key features of the biomedical model. This suggests that acquisition of key features of the biomedical explanatory framework does not derive from college education or extensive experience within biomedical settings.

An important question is how these models are distributed across populations and what factors influence their distribution. We suspect that these models are not categorical and that many people have access to and use both, depending on the context. As Nemeroff and Rozin's work shows, in certain contexts (like wearing Hitler's sweater) undergraduates

implicitly assume that a causal force (like energy) links the psycho-social and physical realms. Future research is necessary to understand what makes one or the other framework preferred among certain groups and in certain contexts.

4.1. Implications for treatment-seeking behavior

The nature of illness explanatory frameworks may have important implications for treatment-seeking behavior Notaro, Gelman, and Zimmerman (2002) found that undergraduates believe that physical treatment is ineffective for physical symptoms that are caused by psychological factors and vice versa. For example, undergraduates believed that physical treatments would cure stomach aches caused by physical factors and psychological treatments like relaxation would cure stomach aches caused by psycho-social factors. Heurtin-Roberts and Reisin (1992) showed that hypertensive black women who attributed their high blood pressure to psycho-social causes were less likely to take their blood pressure medication than were those who attributed their high blood pressure to physical causes. The reticence of these individuals to cross mind–body boundaries in treatment decisions may reflect a corollary of their assumption that mind and body do not interact in causing illness.

A dualist assumption in treatment-seeking decisions may also help explain a minor public health crisis that resulted when Magic Johnson was said to have been cured of AIDS by God. In 1997, doctors reported that they could not detect HIV in Magic Johnson's blood. In an interview with Ebony magazine shortly thereafter, Cookie, Magic Johnson's wife, attributed his "cure" to prayers, despite the fact that he had been taking 20 pills per day of medication: "'They think it's the medicine,' Cookie acknowledges. But she and Johnson believe otherwise. They believe it is the miracle each of them has been praying for since the day they learned of the diagnosis." (Randolph, 1997, p. 70). In a Letter to the Editor of Ebony, public health officials warn against this interpretation, stating "As a result of the article, some HIV patients in treatment clinics are claiming that they have stopped taking their HIV medications because prayer is all they need." (Wyatt, Chen, Tucson, & Ivie, 1997, p. 10) Cookie's belief that the will of God cured Magic apparently led her to deny a causal role of the biomedical treatments. Cookie and Magic were not alone in making this inference, as evidenced by the ensuing public health crisis. It may be that God's decision to cure someone is construed as a psycho-social treatment. Because psycho-social and physical treatments are presumed to be distinct (perhaps, to work on different causes), then physical treatments are unnecessary.

For individuals who use a cross-domain illness explanatory framework, biomedical and psycho-social treatments are not necessarily alternatives to one another. In a re-analysis of the ethnographic data used by Murdock (1980) in his study of world theories of illness, Shweder et al. (1997) confirmed that the most common explanations of illness across cultures were moral, psychosocial, and spiritual, rather than physical. However, despite the rarity of physical explanations of illness, they found that biomedical/physical treatments were the most commonly utilized. Shweder et al. (1997) were surprised about the "lack of correspondence" between psycho-social beliefs about causes and use of biomedical treatments among individuals in non-industrialized societies. This behavior seems contradictory from the perspective of domain-specificity theory, where illness beliefs are expected to fall under the rubric of a single cognitive domain. However, it is not contradictory from the

perspective of a model in which interpersonal or moral factors lead to illness by causing physical damage to the body.

The link between causal beliefs and treatment decisions in the above examples is somewhat speculative. It is likely that treatment decisions are closely linked to the structure of illness causal models. Future research should investigate how assumptions about the causal relationship between mind and body relate to one's decisions about treatment.

4.2. Conclusion

The current study provided a comparison of complete causal models of illness among individuals with different illness explanatory frameworks. These studies show that illness explanatory frameworks are not necessarily tied to single cognitive domains and that the notion of cognitive domains is not sufficient to explain how people construct causal models of illness. Embodied within explanatory models are assumptions about the relationship between mental and physical causes—mind and body. Both dualist (domain-specific) and cross-domain explanatory frameworks provide maps for how to combine mental and physical causes. Future research is needed to better understand the origins of these frameworks and their relationship to notions of explanatory sufficiency.

Appendix A. Depression causal code descriptions

Physical/mechanical causes
Chemical imbalance
  Neurotransmitter imbalance (especially seratonin)
Hormones
  Post-partum depression or PMS
Other physiological
  Weak thymus gland
Drugs
  Alcohol or prescription drugs
Heredity
  Genetic predisposition

Psycho-social causes
Thoughts/emotions
  Low self-esteem; excessive grief
Social
  Child abuse; death of spouse
Culture
  Racism; homophobia
Bad coping

Behavioral causes
Behavior
  Lack of exercise; bad diet; lack of sleep

Non-social environmental causes
Non-social environmental
  Lack of sun; magnetic fields

Energy causes
Energy imbalance
  Imbalance of energy (often in particular part of the body)

Appendix B. Heart attack code descriptions

Physical/mechanical causes

Blockage
  Plaque build-up in artery, clot blocks artery, or spasm in artery
Lack of blood to heart
  Heart tissue dies due to lack of oxygen for extended period of time
High cholesterol
Heredity
  Genetic predisposition
Pumping problems
  Heart can not pump due to valve problems or holes in the heart
Overworking heart
High blood pressure (HBP)
Weak heart
  Heart organ is weak (due to old age or congenital defects)
Body lacks Oxygen
  Usually from shallow breathing or lung problems
Body breaks down
  Systemic break down of physiological systems
Decreased circulation
  Circulation is slowed throughout the body
Age
  Usually causes weak heart
Heart explodes
  Due to blocked vessels blood cannot get out of the heart and the heart explodes
Vessel damage
  Damage to inside of artery walls (usually leads to cholesterol build-up)

Psycho-social causes

Stress
  Release of epinephrine; increase in cortical steroids; fight or flight response
Emotions
  Repressed hostility/anger; feelings of rejection; sadness (due to lack of love)
Social
  Culture values hard work or promotes bad eating habits (e.g., processed food); lack of love from others

Behavioral causes

Diet
  Eating fatty foods
Lack of exercise
Smoking
Obesity
Poor breathing
  Shallow breathing

Energy causes

Energy imbalance
  Congestion of energy in the heart area; too little energy in the heart area

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