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Cross-Cultural Differences in the Influences of Spiritual and Religious Tendencies on Beliefs in Genetic Determinism and Family Health History Communication: A Teleological Approach

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Abstract
Adopting a teleological approach, this study investigates how beliefs in genetic determinism, intentional spirituality, and religious tendencies are associated with family health history (FHH) communication among European American, Chinese, and Korean college students. The results indicate that intentional spirituality was negatively associated with beliefs in genetic determinism and FHH communication, while beliefs in genetic determinism were positively associated with FHH communication. Intrinsic and extrinsic religiosity and paranormal beliefs showed interesting dynamics with beliefs in genetic determinism and FHH communication. An interaction effect regarding cultural identity, beliefs in genetic determinism, and FHH communication was likewise found. The findings have meaningful implications for future studies about religious influences on health behaviors.

Keywords Teleology · Genetic determinism · Intentional spirituality · Religious beliefs · Family health history communication · Genetic information

Introduction

Philosopher Christian Wolff coined the term "teleology" in 1728, defining it as the part of natural philosophy that explains the ends or purposes of things (von Glasersfeld 1990). This term has since been used to describe Western philosophical ideas such as the theological views of Thomas Aquinas (i.e., God as the purpose of being) and Aristotle's metaphysics (i.e., an exploration of the purpose of being) (von Glasersfeld 1990). Today, this purpose-based framework is prevalent in scholarly writings as well as everyday discourse, and it is often prioritized over mechanistic explanations focusing on preceding physical causes (Rottman et al. 2016). The founders of cybernetics intended to mechanize goal-directed behavior in artificial devices and biological organisms and started calling

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these goal-directed behaviors "teleological" (von Glasersfeld 1990). With this in mind, this study explores the teleological perspectives in both metaphysics and cybernetics, focusing on the relationships among beliefs in genetic determinism, intentional spirituality, relevant religious tendencies, and family health history (FHH) communication for Euro-American, Chinese, and South Korean (hereafter Korean) college students.

Genetic determinism considers genes "the sole relevant causal feature of an individual's characteristics and life courses" (Condit et al. 2000. p. 558). Genetic determinism can be understood as the opposite of "teleosemantic" theories, which seek to give a teleological or naturalistic account of intentional information (Griffiths 2001). In the context of cybernetics, these theories attempt to explain representations and their contents with regard to biological function and developmental purposes (Schulte 2015). More specifically, according to teleosemantic theories, a sign represents whatever evolution designed it to represent. Thus, teleosemantic theories are also called the "teleological" or the "biosemantic" approach (Griffiths 2001). Genetic determinism denies the teleological approach in its emphasis on the developmental purposes or intentionality of genetic information, instead focusing on the instructional or causal aspect of genetic information (Griffiths 2001; Smith 2000).

In contrast to genetic determinism, spirituality, which is commonly defined as the experiences individuals have in relation to their existential aspirations about the meaning and purpose of life (Egbert et al. 2004; Kirkwood 1994; Moberg 2002), is well-aligned with a teleological perspective that acknowledges God as the purpose of being. Beliefs in genetic determinism and intentional spirituality are rooted in the opposite tendencies of teleology (i.e., biological causes without developmental purposes vs. metaphysical purposes of life). Given these differing cultural, religious and intellectual traditions, it is possible that genetic beliefs and spiritual and religious beliefs may vary across cultures (Rottman et al. 2016; Heine and Norenzayan 2006). That is, spirituality and beliefs in genetic determinism, which can be understood in the context of teleology, might be influenced by cultural differences.

Knowing about familial disease risk is helpful for accurate risk assessment, the effective prevention of disease, and the reduction of disease risks (Parrott et al. 2015; Yoediono and Snyderman 2008). Family health history (FHH) is reflective of genetic and environmental factors affecting family health, and family members' communication of family health history depends on regulatory barriers such as family culture, cultural beliefs, and norms (e.g., stigma beliefs) (Hong 2018; Parrott and Hong 2014). Both beliefs in genetic determinism and religious and spiritual tendencies, which are related to people's beliefs in genetic control, may function as those regulatory factors. This study thus investigates how these two concepts are associated with FHH communication among Euro-American, Chinese, and Korean college students, explaining cross-cultural differences in these associations. The Euro-American participants were recruited from a basic public-speaking course offered at a particular university, while most of the Chinese and Korean participants were recruited via the international office of this same university.

Literature Review

Exploring Genetic Determinism, Spirituality, and Religious Tendencies in Teleology

Griffiths (2001) divided information into two fundamental categories: (1) causal conceptions of information derived from the mathematical theory of communication (Shannon and Weaver 1949) and (2) intentional or semantic concepts of information (Godfrey-Smith 1999, 2007). Griffiths (2001) argued that the former better captures the essence of genetic determinism. De Jong (2000) similarly argued that within the framework of genetic determinism, genes are viewed as comprising genotypes that give directions for individuals' psychiatric and physical phenotypes. Griffiths (2001) suggested that genetic causation is interpreted deterministically because genes are regarded as a special kind of cause. More specifically, unlike other causal factors, genes are viewed as instructions that provide information directed at the outcomes genes help to produce (Griffiths 2001). However, genetic information can be better understood as a type of semantic or intentional (teleological) information because a causal notion of information or genetic determinism cannot explain or reproduce accidental or unintended outcomes such as pathological development and anomalies (Griffiths 2001). Semantic information can be defined as information contained in thoughts and utterances. Intentionality refers to the relationship between thoughts and the various goals of thought (Griffiths 2001).

According to Dennett (2009), the intentional stance regards things (e.g., genes) as comprising an agent that, like a chess-playing computer, does not only have beliefs and desires but also has sufficient rationality with which it can perform what it ought to do. Teleosemantic theories provide the most promising as well as naturalistic explanation for information conveyed from an intentional stance (Griffiths 2001). Smith (2000) defined teleosemantics as a philosophical program that interprets meanings with regard to the teleology of biological functions and natural selection. Teleosemantic theories can be understood within the context of the cybernetics tradition. Rosenblueth et al. (1943) explained teleological phenomena in organisms by describing these organisms as: (1) seemingly purposeful beings directed toward a goal, and (2) organisms that engage in active behavior. According to Mayr (1974), the goal-directed natural program is the genetic program, and ultimately all natural programs are genetic information. These explanations are in the tradition of cybernetics, and thus goal-directed behavior can be characterized by interactive mechanisms based on goal-seeking as well as error corrections (Mayr 1974). However, genetic determinism only emphasizes the one-way causal effects of genetic information, ignoring its teleological or intentional stance.

Western philosophers and Christian theologians, on the other hand, have long endorsed the idea that natural phenomena can be explained by putative functions (e.g., water exists so that life can survive on Earth) (Rottman et al. 2016). Recently, experimental psychologists have found that belief in a higher power (e.g., God) is the strongest predictor of a belief in life's purpose or teleological thinking (Kelemen et al. 2013; Willard and Norenzayan 2013). Spirituality, which can be understood as a teleological perspective toward life, is commonly defined as the sum of experiences individuals have in relation to God or their existential aspirations about the meaning and purpose of life (Egbert et al. 2004; Kirkwood 1994; Moberg 2002). Therefore, spirituality includes the subjective experience of beliefs as comprising a sacred force with a divine purpose (Zinnbauer et al. 1999). More specifically, people often use their religious beliefs to attempt to understand

life events as having deeper meanings and purposes (see Banerjee and Bloom 2014; Willard and Norenzayan 2013), particularly when material causes can seldom explain those events (Gray and Wegner 2010; Pepitone and Saffiotti 1997). At the same time, people often rely on teleological explanations even when events' material causes are evident (see Legare et al. 2012). Brownell (2010) called this "intentional spirituality," a term he uses to emphasize the teleological aspect of spirituality. Like many experimental psychologists, Brownell (2010) pointed out that intentional spirituality covers the "aboutness" of an experience, its purpose, and its result. While genetic determinism emphasizes unidirectional biological causes, overlooking the purposeful and interactive programs in genetic information, intentional spirituality is concerned with the invisible purposes of an event. Given these opposite directionalities regarding teleological stance, it is possible that intentional spirituality is negatively associated with beliefs in genetic determinism.

Although intentional spirituality is the religious tendency that seems most relevant to teleological tendencies, it is necessary to contemplate other religious tendencies or beliefs as well, recognizing that there may be potential overlaps. Spirituality is related to the discovery of meanings that transcend the material causes of events based on teleological thinking. However, previous research has suggested that much of the variance in beliefs in life's purpose comes from belief in God (Kelemen et al. 2013; Willard and Norenzayan 2013). This may relate to other (quasi-) religious variables such as intrinsic and extrinsic religiosity and paranormal beliefs. Unlike spirituality, religiosity focuses on individuals' religious efforts or religion's influence on individuals' lives. Specifically, intrinsic religiosity refers to individuals' perceptions of religion's impacts on their lives, such as personal religious commitment, while extrinsic religiosity is more closely related to socially visible aspects of religiosity based on a utilitarian motivation for religious involvement (Donahue 1985; Kirkpatrick and Hood 1990). Yet both religiosities are related to individuals' religious behaviors. For example, while intrinsic religiosity involves the religious importance individuals place through personal behaviors (e.g., prayer), extrinsic religiosity includes individuals' participation in religious activities (e.g., church attendance) (Fiala et al. 2002; Nasim et al. 2006). Interestingly, previous research has found that intrinsic religiosity is negatively related to scientific determinism, while extrinsic religiosity is positively associated with it (Carey and Paulhus 2013). These relationships may affect the associations with beliefs in genetic determinism.

Moreover, religious and paranormal beliefs share some common values that affect people's behavior (Wain and Spinella 2007). According to previous studies, paranormal beliefs are beliefs in supernatural phenomena, whether these beliefs be traditionally religious beliefs in life after death or in angels and demons, or quasi-religious beliefs, such as superstitions about UFOs and astrology (Irwin 1993; Mencken et al. 2009). Wain and Spinella (2007) pointed out that although paranormal beliefs are common, they are incompatible with scientific explanation. In this regard, it is possible that paranormal beliefs overlap some with both beliefs in genetic determinism and intentional spirituality. In order to explore the dynamics between beliefs in genetic determinism and these spiritual and religious orientations, the following hypotheses and research question are posited:

H1 Intentional spirituality is negatively associated with beliefs in genetic determinism.

H2 Intrinsic religiosity is negatively associated with beliefs in genetic determinism.

H3 Extrinsic religiosity is positively associated with beliefs in genetic determinism.

RQ1 How are paranormal beliefs associated with beliefs in genetic determinism?

The Roles of Beliefs in Genetic Determinism, Spirituality, and Religious Tendencies in Family Health History Communication

Most diseases are the result of the interaction of various genes and environmental factors (Guttmacher et al. 2004). Knowing one's familial disease risk may be one of the most essential components of proactive health care, since this information is helpful for the accurate assessment of risks, cost-effective prevention, and risk-reducing management strategies (Yoediono and Snyderman 2008). Of course, family-based cooperation is also necessary if accurate family health history and genetic risk information is to be collected and disseminated. Knowing family health history is not only important for the individual, however; it is also crucial for clinicians who guide patients' decisions regarding genetic testing, risk assessment, and treatment (Parrott and Hong 2014).

The communication of family health history, which acknowledges the combined interactions of genomic and environmental factors contributing to the health of the family members across their life spans, can be influenced by regulatory and technological barriers that leave family members resistant to sharing information with one another (Parrott and Hong 2014). The field of public health communications has largely ignored the interactions between these factors, instead emphasizing the roles of genes in individuals' health (Parrott et al. 2004). Parrott et al. (2003) argued that beliefs in genetic determinism may negatively affect individuals' confidence in their abilities to take actions to improve their health. However, public health interventions have strategically used the concept of perceived threats to increase the public's health consciousness and promote healthy behaviors via emotional appeal. For example, previous health interventions have tried to take advantage of an individual's perceived risk of developing breast cancer to increase the likelihood of screening (Condit et al. 2000; Katapodi et al. 2004). In addition, a recent study found that patients' beliefs in genetic determinism were positively associated with their need for genetic risk information (Hong et al. in press). Therefore, it is possible that communicating family history, which includes exchanging (potential) genetic risk information, may be positively associated with beliefs in genetic determinism as well.

On the other hand, given that intentional spirituality focuses on the invisible purposes of events based on experiences with God or existential aspirations (Brownell 2010; Egbert et al. 2004; Kirkwood 1994; Moberg 2002), intentional spirituality may not facilitate individuals' communication about health with their family members. For example, existing literature about African-Americans' religious beliefs and health suggests that African-Americans tend to fatalistically view diseases as punishments from God, and thus believe that diseases can be cured by prayers (see Cohen et al. 1998; Hughes et al. 2003; Landrine and Klonoff 1996). These religious beliefs, which reflect intentional spirituality (i.e., purposeful punishment on the part of God) and intrinsic religiosity (i.e., importance of prayers), influence African-American people's health-related decisions and behaviors (Landrine and Klonoff 1996). Similarly, it is possible that participants with high levels of intentional spirituality believe that FHH communication cannot help prevent disease or are skeptical about it. In addition, as discussed above, much variance of belief in life's purpose comes from belief in God (Kelemen et al. 2013; Willard and Norenzayan 2013), and

religious and paranormal beliefs may overlap, affecting people's behavior (Wain and Spinella 2007). Therefore, intentional spirituality, intrinsic and extrinsic religiosity, and paranormal beliefs may be related to each other and affect FHH communication. Moreover, it is possible that intrinsic religiosity plays a negative role in promoting individuals' FHH communication, while extrinsic religiosity has a positive effect, given each type of religiosity's potential relationship to beliefs in genetic determinism. More specifically, as discussed above, beliefs in genetic determinism, like beliefs in scientific determinism, might be negatively related to intrinsic religiosity and positively related to extrinsic religiosity (see Carey and Paulhus 2013). Given the possibility of a positive relationship between beliefs in genetic determinism and the FHH communication discussed above, the effects of intrinsic and extrinsic religiosities on FHH communication may be in the same direction as their effects on beliefs in genetic determinism. Therefore, the following hypotheses and research question are posited:

H4 Beliefs in genetic determinism are positively associated with FHH communication.

H5 Intentional spirituality is negatively associated with FHH communication.

H6 Intrinsic religiosity is negatively associated with FHH communication.

H7 Extrinsic religiosity is positively associated with FHH communication.

RQ2 How are paranormal beliefs associated with FHH communication?

Cross-cultural Differences in the Dynamics Between Beliefs in Genetic Determinism, Spiritual and Religious Tendencies, and Family Health History Communication

According to a growing body of psychological research, teleological tendencies might be a naturally emerging feature of the universal human mind (Banerjee and Bloom 2014; Kelemen et al. 2013; Rottman et al. 2016). However, a limitation of these prior studies is that they have been conducted almost exclusively in Westernized Judeo-Christian societies (Rottman et al. 2016). Rottman et al. (2016), for example, suggested that believing in a powerful and divine creator may have influenced the teleological interpretations of phenomena pervasive in Western society (see Banerjee and Bloom 2014). As the aforementioned study of African-Americans indicates, although beliefs in God may vary across cultures, compared to other cultures, East Asians' spiritual and religious tendencies have been largely overlooked, especially with regard to health behaviors. Since culturally transmitted information, which functions alongside evolutionary processes, often shapes behavioral patterns, teleological tendencies may be affected by individuals' immersion in societies with discourses invoking teleological explanations (see Heine and Norenzayan 2006; Rottman et al. 2016). Accordingly, spiritual and religious tendencies and beliefs in genetic determinism, both of which depend on an individual's teleological stance (spiritual purpose of life vs. materialistic teleosemantics), may differ across cultures, ultimately affecting FHH communication.

In Western societies, individuals are exposed to narratives of order and design that are tightly linked to inferences about intentional agency from infancy (Ma and Xu 2013;

Newman et al. 2010; Rottman et al. 2016). According to Rottman et al. (2016), China may be the ideal society for comparison with Western societies because, unlike Western societies, China's intellectual inheritance is primarily based on Confucianism, Daoism, Mohism, Buddhism, and communism. Indeed, a recent study revealed that the Chinese culture may attenuate baseline teleological tendencies (Rottman et al. 2016). In particular, the Confucian model of the mind understands the world according to the yin-yang concept embodied in materialism (Chen 1993; Hwang 2012; Yum 1988). According to Confucianism, all materials come into being only after heaven and earth exist; then male and female brought into being and their unification gives birth to a second generation, leading to social relationships between father and son and between sovereign and subordinate (Hwang 2012). As the basis of society, the arrangement of hierarchical social relationships is embodied by the mind of benevolence (Chen 1993; Hwang 2012; Yum 1988). Maiike (2003, 2007) suggested that Confucian teaching reflects an Asia-centric perspective emphasizing the interdependence and interrelatedness of the universe, social relationships, and personal well-being. Korean culture is similar to Chinese culture in many aspects, including cultural traditions and intellectual legacies. In particular, patriarchal and Confucian influences are still pervasive in the Korean culture. However, unlike Chinese culture, (South) Korean culture is generally said to lack communist influences and to have instead the influence of Christianity. According to the Korea National Statistical Office (Statistics Korea 2016), as of November 2015, approximately 28% of the South Korean population identified as either Protestant (19.7%) or Catholic (7.9%).

The traditional inheritance of Chinese and Korean cultures might be better explained using materialism rather than the intentional spirituality of Western societies. In most East Asian countries, including both China and Korea, the intellectual and cultural legacies lack a teleological or purpose-based perspective that is common to theological views as well as Western philosophy. In particular, as the yin-yang concept and the mind of benevolence suggest, Confucian ideas often represent materialist arguments along with idealism (see Hwang 2012; Palais 2015). This intellectual tradition may affect Chinese and Korean people's beliefs in genetic determinism as well as intentional spirituality and other relevant religious tendencies. Of course, it can be assumed that intentional spirituality and intrinsic religiosity are significantly influenced by Western theological views that differ across cultures. The degree as well as the role of paranormal beliefs and beliefs in genetic determinism on individuals' health behaviors may also differ across cultures rooted in these teleological tendencies.

Due to their irrational nature, paranormal beliefs lack a foundation of logical understanding such as causality (Zebb and Moore 2003). In the Western cultures in which Christian theology has a long history, it appears that paranormal beliefs are closely related to spirituality and intrinsic religiosity. For example, a study about Austrians found that intrinsic religiosity was strongly related to paranormal beliefs (Hergovich et al. 2005). A study conducted in the USA likewise found an overall positive relationship between conventional Christian and paranormal beliefs (Mencken et al. 2009). However, paranormal beliefs in the East Asian context may be more closely related to materialist explanations. Although in Western cultures paranormal beliefs can be characterized in the same vein as religious and spiritual beliefs, teleological interpretations, which are quite commonplace in these Western contexts, are generally neglected in East Asian cultures such as those of China and Korea. Both beliefs in genetic determinism and FHH communication may potentially be affected by individuals' spiritual and religious tendencies. For example, a recent cross-cultural study found that while religiosity was positively correlated with distrust in science among Westerners, the opposite held true for religious

Koreans. In addition, whereas paranormal beliefs directly and indirectly influenced distrust in science through religiosity, the East and West went in opposite directions (Clobert and Saroglou 2015). Given that beliefs in genetic determinism can be characterized as overwhelming trust in scientific or biological explanation based on causality, these differences can be applied to the associations among intentional spirituality, religiosity, paranormal belief, and beliefs in genetic determinism, which may ultimately affect FHH communication. As Rottman et al. (2016) suggested, culture may indeed attenuate individuals' inclinations to default to teleological explanations, thereby affecting beliefs in genetic determinism, intentional spirituality, and religious tendencies. Therefore, the following research questions are asked:

RQ3 How do intentional spirituality, intrinsic and extrinsic religiosity, paranormal belief, and beliefs in genetic determinism differ across cultures?

RQ4 How do the associations among intentional spirituality, intrinsic and extrinsic religiosity, paranormal belief, beliefs in genetic determinism, and FHH communication differ across cultures?

Method

Questionnaire

In spring 2014, fifteen South Korean undergraduates (7 males and 8 females) and fifteen Chinese undergraduates (7 males and 8 females) were recruited using convenience sampling in order to determine whether they could understand a questionnaire that had been designed for the study. After the participants read and assessed the questionnaire, the questionnaire was revised based on the participants' levels of comprehension. For example, among the top three leading causes of death in the three countries (Hoyert and Xu 2012; Statistics Korea 2012; National Bureau of Statistics of China 2011), only cancer and heart disease were included in the final questionnaire because several Chinese and Korean students did not know the exact meaning of the word "stroke." Several other items were also revised to aid in Chinese and Korean students' comprehension.

Participants and Procedures

Participants included 260 Euro-Americans, 177 Koreans, and 185 Chinese. About half of the participants indicated that they were female (n = 339, 54.5%), and about half indicated that they were male (n = 283, 44.5%). Participants ranged from 17 to 32 years of age (M = 20.35; SD = 2.23). Additional information about cultural characteristics can be found in Table 1. Participants were recruited in two ways. The study was included in the basic public-speaking course research pool for the spring and summer 2014 semesters. Participants received 2% credit in their course for completing the online study. Most of the undergraduate students attending this particular university are Euro-Americans; therefore, the university's international office was contacted to publicize this study to Korean and Chinese students. While a number of Chinese participants were recruited through this announcement, only half of the necessary Korean participants completed the survey. Therefore, other universities' Korean Student Associations were contacted to recruit more

Table 1 The culture-related features of the sample used in the analyses

Cultural identities		Euro-American *n* (%)	Chinese *n* (%)	Korean *n* (%)
Cultural background	I was born and mostly raised in the US	254 (97.7)	4 (2.2)	10 (5.6)
	I was born and mostly raised in South Korea	0 (0)	1 (0.5)	127 (71.8)
	I was born and mostly raised in China	0 (0)	174 (94.1)	1 (0.6)[d]
	I immigrated from South Korea	0 (0)	0 (0)	20 (11.3)
	I immigrated from China	0 (0)	4 (2.2)	0 (0)
	Other[a]	6 (2.3)	2 (1.1)	19 (10.7)
Years in the US	1–3 years	0	127 (68.6)	60 (33.9)
	4–6 years	1 (0.4)	48 (25.9)	53 (29.9)
	7–10 years	0 (0)	5 (2.7)	43 (24.3)
	10–15 years	3 (1.2)	1 (0.5)	13 (7.3)
	Longer than 15 years	256 (98.5)	4 (2.2)	8 (4.5)
Religious background	Christian	70 (26.9)	24 (13.0)	102 (57.6)
	Catholic	115 (44.2)	2 (1.1)	20 (11.3)
	Buddhist	1 (0.4)	23 (12.4)	4 (2.3)
	No religion	45 (17.3)	129 (69.7)	48 (27.1)
	Other[b]	29 (11.2)	7 (3.8)	3 (1.7)
Language use 1	American English	258 (9.2)	5 (2.7)	8 (4.5)
At home, I mostly speak in	Mandarin Chinese	0 (0)	169 (91.4)	2 (1.1)[d]
	Korean	0 (0)	0 (0)	162 (91.5)
	Other[c]	2 (0.8)	11 (5.9)	5 2.8)
Language use 2	American English	259 (99.6)	24 (13.0)	39 (22.0)
I mostly count numbers in	Mandarin Chinese	0 (0)	154 (83.2)	2 (1.1)[d]
	Korean	0 (0)	0 (0)	127 (71.8)
	Other[c]	1 (0.4)	7 (3.8)	9 (5.1)
Language use 3	American English	259 (99.6)	50 (27.0)	79 (44.6)
I mostly read in	Mandarin Chinese	0 (0)	133 (71.9)	1 (0.6)[d]
	Korean	0 (0)	0 (0)	91 (51.4)
	Other[c]	1 (0.4)	2 (1.1)	6 (3.4)
Total		260 (100)	185 (100)	177 (100)

[a]Most students who chose 'other' described their multi-cultural histories and background in a short answer question

[b]Most Euro-American students who chose 'other' were Jewish, and several Chinese students said they are Taoists

[c]Most Chinese students who chose 'other' said they use multiple languages or Chinese dialects

[d]A few Korean Chinese or Chinese Korean students participated in this study

Korean participants. These participants were paid $7 each for their participation in the online survey. Before beginning the survey, students read an online IRB-approved informed consent form. The survey screen told the participants that the survey was about

family health history communication and that it would take them approximately 30 min to complete. The survey completion rate was 81.3%.

Measures

Intentional Spirituality

To measure intentional spirituality, a single item from Trapnell (2005) was used. Trapnell (2005) created six items with which to measure spirituality. Of the six items, the item that best operationalized Brownell's (2010) concept of intentional spirituality was chosen: "I doubt our universe has any intended purpose by any form of 'higher' force or being." The response options ranged from 1 (strongly disagree) to 7 (strongly agree). For the study's analysis, this item was reverse coded.

Intrinsic Religiosity

Five items based on Allport and Ross (1967) were used to measure intrinsic religiosity. The following items were among the five included: (1) "I try hard to carry my religion over into all my other dealings in life" and (2) "The prayers I say when I am alone carry as much meaning and personal emotion as those said by me during services." The response options ranged from 1 (strongly disagree) to 7 (strongly agree). The internal consistency of the five items was acceptable ($\alpha = 0.91$).

Extrinsic Religiosity

Two items based on Allport and Ross (1967) were used to measure extrinsic religiosity. Specifically, the following items were included: (1) "Although I believe in my religion, I feel there are many more important things in my life" and (2) "Although I am a religious person I refuse to let religious considerations influence my everyday affairs." The response options ranged from 1 (strongly disagree) to 7 (strongly agree). The internal consistency of the ten items was acceptable ($r = 0.56$***).

Paranormal Beliefs

Paranormal beliefs were measured using seven items based on Trapnell (2005). Some of these items were: (1) "I expect there may be some gifted psychics with unusual powers (e.g., communicating with persons who have died)" and (2) "I'm quite receptive to supernatural experiences." The response options ranged from 1 (strongly disagree) to 7 (strongly agree). The internal consistency of the seven items was acceptable ($\alpha = 0.86$).

Beliefs in Genetic Determinism

Five items based on Parrott et al. (2012) were used to measure beliefs in genetic determinism. Two of these items were: (1) "Genes are the most important factor in determining a person's health," and (2) "Genes are more important than one's own behavior in determining one's health." The response options ranged from 1 (strongly disagree) to 7 (strongly agree). The internal consistency of the five items was acceptable ($\alpha = 0.87$).

Current Communication About Family Health History

Twelve items were used to measure the frequency of communication regarding family health history. As described in the survey, among the top three leading causes of death in the three countries (Hoyert and Xu 2012; Statistics Korea 2012; National Bureau of Statistics of China 2011), only cancer and heart disease were fully understood by all participants. For this reason, items pertaining to stroke were eliminated. Two of the items included were: (1) "I have talked with my family members about whether we have a family history of cancer," and (2) "I have talked with my parents about whether we have a family history of cancer." Possible responses ranged from 1 (not at all) to 7 (frequently). Although the questions about stroke were removed from the survey, the internal consistency of the items was more than acceptable ($\alpha = 0.96$).

Analysis

SPSS Version 24 was used for data analysis. A one-way ANOVA test was employed to describe cross-cultural differences in the research variables (RQ3). To investigate Hypotheses 1, 2, 3, 4, 5, 6, and 7, and RQs 1, 2, and 4, the hierarchical multiple regression method was employed. For the hierarchical multiple regression analysis in which beliefs in genetic determinism were used as the dependent variable, gender and cultural identity were entered in block 1; intentional spirituality, intrinsic and extrinsic religiosity, and paranormal beliefs in block 2; and interaction terms in block 3. For the hierarchical multiple regression analysis in which FHH communication was used as the dependent variable, gender and cultural identity were entered in block 1; intentional spirituality, intrinsic and extrinsic religiosity, and paranormal beliefs in block 2; beliefs in genetic determinism in block 3; and interaction terms in block 4. Finally, to further explore RQ4, SPSS Macro for Probing Interactions in OLS and Logistic Regression (MODPROBE; Hayes and Matthes 2009) was employed. This study used a bootstrapping method to check the consistency of a beta coefficient generated by multiple regression analysis by repeatedly sampling cases (5000 times).

Results

Factors Predicting Beliefs in Genetic Determinism

Table 2 reports the results of the hierarchical multiple regression analysis regarding beliefs in genetic determinism, revealing that in all three models, the variables together explained a significant amount of the variance in participants' beliefs in genetic determinism: Model 1: F (3, 618) = 7.04, $p < 0.001$, Adjusted $R^2 = 0.028$; and Model 2: F (7, 614) = 10.12, $p < 0.001$, Adjusted $R^2 = 0.093$.

Model 1 indicates that Chinese and Korean participants were significantly more likely to believe in genetic determinism than Euro-American participants (Chinese: $\beta = 0.18$, $p < 0.001$; Korean: $\beta = 0.15$, $p < 0.01$). In Model 2, as hypothesized, participants' intentional spirituality was negatively associated with their beliefs in genetic determinism (H1: $\beta = -0.19$, $p < 0.001$). However, contrary to Hypothesis 2, participants' intrinsic religiosity was positively associated with their beliefs in genetic determinism (H2: $\beta = 0.22$, $p < 0.001$). In addition, both extrinsic religiosity (H3: $\beta = 0.11$, $p < 0.01$) and

Table 2 Factors predicting beliefs in genetic determinism

	Beliefs in genetic determinism	
	Model 1 β (SE)	Model 2 β (SE)
Gender[a]	− 0.03 (0.10)	− 0.03 (0.09)
Ethnic identity 1–Chinese[b]	0.18 (0.11)***	0.05 (0.12)
Ethnic identity 2–Korean[b]	0.15 (0.11)**	0.08 (0.12)+
Intentional spirituality		− 0.19 (0.03)***
Intrinsic religiosity		0.22 (0.04)***
Extrinsic religiosity		0.11 (0.04)**
Paranormal belief		0.12 (0.04)**
R^2	0.033***	0.103***
ΔR^2		0.070***

[a]Male = 0, female = 1

[b]Comparison group = Euro-American

$+p < 0.10$, $*p < 0.05$, $**p < 0.01$, $***p < 0.001$

paranormal beliefs (RQ1: $\beta = 0.12$, $p < 0.01$) were positively associated with participants' beliefs in genetic determinism.

Factors Predicting Family Health History Communication

Table 3 reports the results of the hierarchical multiple regression analysis regarding FHH communication, revealing that in all four models, the variables together explained a significant amount of the variance in beliefs in current FHH communication: Model 1: F (3, 618) = 10.06, $p < 0.001$, Adjusted $R^2 = 0.042$; Model 2: F (7, 614) = 12.16, $p < 0.001$, Adjusted $R^2 = 0.112$; Model 3: F (8, 613) = 12.57, $p < 0.001$, Adjusted $R^2 = 0.130$; and Model 4: F (10, 611) = 10.78, $p < 0.001$, Adjusted $R^2 = 0.136$.

Model 1 indicates that Korean participants were significantly less likely to communicate with other family members about their family health history than were Euro-American participants ($\beta = -0.18$, $p < 0.001$). In addition, female participants were more likely to communicate their health histories than were males ($\beta = 0.14$, $p < 0.001$). In Model 2, as hypothesized, participants' intentional spirituality was negatively associated with their current FHH communication (H5: $\beta = -0.13$, $p < 0.01$). However, inconsistent with Hypotheses 6 and 7, participants' intrinsic religiosity was positively associated with their communication about family history (H6: $\beta = 0.23$, $p < 0.001$), and there was no effect related to extrinsic religiosity. Moreover, participants' paranormal beliefs were positively associated with their FHH communication (RQ2: $\beta = 0.17$, $p < 0.001$). Lastly, in Model 3, as hypothesized, beliefs in genetic determinism were positively associated with participants' current FHH communication (H4: $\beta = 0.15$, $p < 0.001$).

Table 3 Factors predicting FHH communication

	FHH communication			
	Model 1 β (SE)	Model 2 β (SE)	Model 3 β (SE)	Model 4 β (SE)
Gender[a]	0.14 (0.13)***	0.12 (0.13)**	0.12 (0.13)**	0.12 (0.13)**
Ethnic identity 1–Chinese[b]	− 0.07 (0.15)	− 0.19 (0.17)***	− 0.19 (0.17)***	− 0.53 (0.53)***
Ethnic identity 2–Korean[b]	− 0.18 (0.16)***	− 0.26 (0.16)***	− 0.28 (0.16)***	− 0.31 (0.53)*
Intentional spirituality		− 0.13 (0.04)**	− 0.11 (0.04)*	− 0.10 (0.04)*
Intrinsic religiosity		0.23 (0.05)***	0.20 (0.05)***	0.18 (0.05)***
Extrinsic religiosity		− 0.02 (0.05)	− 0.04 (0.05)	− 0.04 (0.05)
Paranormal belief		0.17 (0.05)***	0.16 (0.05)***	0.15 (0.05)***
Beliefs in genetic determinism			0.15 (0.05)***	0.06 (0.09)
Chinese* Genetic determinism				0.38 (0.13)*
Korean* Genetic determinism				0.06 (0.13)
R^2	0.047***	0.122***	0.141***	0.150***
ΔR^2		0.075***	0.019***	0.009*

[a]Male = 0, female = 1

[b]Comparison group = Euro-American

$+ p < 0.10$, $*p < 0.05$, $**p < 0.01$, $***p < 0.001$

Cross-cultural Differences in Spiritual and Religious Tendencies and Beliefs in Genetic Determinism, and Their Associations with Family Health History Communication

A one-way ANOVA test of these three identity conditions on the dependent variables of intentional spirituality, intrinsic and extrinsic religiosity, paranormal beliefs, and beliefs in genetic determinism (RQ3) was conducted for each variable. Table 4 shows the cross-cultural differences for these variables.

To answer RQ4, hierarchical multiple regression analyses regarding beliefs in genetic determinism and FHH communication were conducted for each culture. Table 5 reports the results of the analyses, revealing that across cultures, different effects of intentional spirituality, intrinsic and extrinsic religiosity, and paranormal beliefs on beliefs in genetic determinism as well as FHH communication were found. According to results, while in the Chinese and Korean cultures, intentional spirituality, intrinsic and extrinsic religiosity, and paranormal beliefs together explained a significant amount of the variance in beliefs in genetic determinism: Chinese culture: F (5, 179) = 9.55, $p < 0.001$, Adjusted $R^2 = 0.189$; and Korean culture: F (5, 171) = 4.15, $p < 0.01$, Adjusted $R^2 = 0.082$, the model was not significant among Euro-American participants: F (5, 254) = 0.42, $p = 0.83$, Adjusted $R^2 = -0.011$. In addition, although intentional spirituality, intrinsic and extrinsic religiosity, paranormal beliefs, and beliefs in genetic determinism together explained a

Table 4 Means, standard deviations, and cultural differences in individual characteristics and bivariate correlations between variables

Variables	Mean (SD)	Euro-American (SD)	Korean (SD)	Chinese (SD)	1	2	3	4	5	6
Intentional spirituality	4.46 (1.79)	4.99 (1.81)[a]	4.43 (1.74)[b]	3.67 (1.48)[c]	1					
Intrinsic religiosity	3.82 (1.45)	3.50 (1.47)[a]	4.28 (1.54)[b]	3.82 (1.22)[c]	0.34***	1				
Extrinsic religiosity	4.55 (1.36)	4.59 (1.18)[a]	4.21 (1.66)[b]	4.81 (1.23)[a]	− 0.17***	− 0.31***	1			
Paranormal belief	3.65 (1.28)	3.32 (1.31)[a]	3.50 (1.18)[a]	4.25 (1.11)[b]	− 0.07	0.07	0.21***	1		
Genetic determinism	3.99 (1.19)	3.74 (1.06)[a]	4.13 (1.25)[b]	4.21 (1.25)[b]	− 0.16***	0.14***	0.10*	0.17***	1	
FHH communication	3.06 (1.64)	3.30 (1.61)[a]	2.59 (1.55)[b]	3.11 (1.67)a	− 0.02	0.15***	− 0.02	0.18***	0.17***	1

Euro-American (n) = 260; Korean (n) = 177; and Chinese (n) = 185

[a,b,c]Fisher's least significance difference (LSD)

*$p < 0.05$; ***$p < 0.001$

Table 5 Factors predicting beliefs in genetic determinism and FHH communication in the three cultures

	Genetic determinism			FHH communication		
	Euro-American β (SE)	Chinese β (SE)	Korean β (SE)	Euro-American β (SE)	Chinese β (SE)	Korean β (SE)
Gender[a]	− 0.01 (0.14)	0.01 (.17)	− 0.07 (0.18)	0.23 (0.20)***	0.10 (0.23)	0.02 (0.24)
Intentional spirituality	− 0.10 (0.05)	− 0.22 (0.06)**	− 0.15 (0.06)+	− 0.12 (0.07)+	− 0.14 (0.08)*	− 0.07 (0.07)
Intrinsic religiosity	0.08 (0.06)	0.40 (0.07)***	0.17 (0.07)+	0.25 (0.08)**	0.23 (0.11)**	0.06 (0.07)
Extrinsic religiosity	0.01 (0.06)	− 0.01 (0.07)	0.20 (0.06)*	0.02 (0.09)	− 0.05 (0.09)	− 0.14 (0.08)
Paranormal belief	0.03 (0.05)	0.13 (0.08)+	0.15 (0.08)+	0.12 (0.08)+	0.17 (0.11)*	0.11 (0.11)
Beliefs in genetic determinism				0.06 (0.09)	0.25 (0.10)**	0.13 (0.10)+
R^2	0.008	0.218***	0.108**	0.118***	0.243***	0.057

[a]Male = 0, female = 1

+$p < 0.10$, *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

significant amount of the variance in current FHH communication: Euro-American culture: F (6, 253) = 5.62, $p < 0.001$, Adjusted R^2 = 0.118; and Chinese culture: F (6, 178) = 9.73, $p < 0.001$, Adjusted R^2 = 0.222, these variables together did not significantly affect Korean participants' current communication: F (6, 170) = 1.79, p = 0.10, Adjusted R^2 = 0.026.

To further investigate RQ4, the interaction terms were entered in the models predicting FHH communication (Table 3). Then, MODPROBE was employed to determine the cross-cultural differences in the associations between beliefs in genetic determinism and FHH communication. The results show that while Chinese participants' beliefs in genetic determinism were significantly and positively associated with FHH communication (conditional effect: b = 0.39, se = 0.09, $p < 0.001$), American participants' beliefs had no relationship to it.

Discussion

The results show the ways in which beliefs in genetic determinism and spiritual and religious tendencies explain individuals' FHH communication and how these associations operate differently in each of the three cultures. In addition, the cross-cultural differences found in this study suggest interesting scholarly questions to be further investigated, including how exposure to Western and Eastern cultures leads to individuals' different teleological stances and how these differences affect the individuals' health-related behaviors.

First, the results of this study show that participants' levels of intentional spirituality were negatively associated with their beliefs in genetic determinism. In this study, the opposite directionalities of genetic determinist beliefs and intentional spirituality were

explained by employing teleological perspectives of genetic information (Griffiths 2001) and Brownell's (2010) concept of intentional spirituality. As hypothesized based on these two perspectives regarding teleological or purpose-based explanations, intentional spirituality played a negative role in participants' beliefs in genetic determinism. This result reveals that participants' beliefs in the causality of genetic information and God's purposes (or existential aspirations) might reflect opposite or differing teleological stances, which then determine the perceived locus of control related to health. Beliefs in genetic determinism, which emphasize the causality of genetic information (de Jong 2000), view genes as genotypes or instructions without desires and purposes related to development. The common definition of spirituality, on the other hand, characterizes individuals' existential aspirations about the meaning and purpose of life (Egbert et al. 2004; Kirkwood 1994; Moberg 2002), and Brownell's (2010) concept of intentional spirituality emphasizes the purpose of events based on a divine being's intentions. The results suggest that these two differing perspectives regarding intentionality may bring about individuals' differing interpretations or understandings of disease and health-related issues.

Second, as hypothesized, while participants' levels of intentional spirituality were negatively associated with their current FHH communication, their beliefs in genetic determinism were positively associated with it. It is possible that these opposite effects on participants' FHH communication reflect teleological stances affecting their health behaviors such as FHH communication. Communicating family history acknowledges the influences of combined interactions between genomic and environmental factors on individuals' health (Parrott and Hong 2014). Although scholars have qualitatively and quantitatively identified the potential problems related to beliefs in genetic determinism given the macro-frameworks used for public communications interventions (see Condit et al. 2009; Nelkin and Lindee 1995), previous studies have revealed that perceiving risks may encourage health-related behaviors such as information-seeking and participation in cancer screenings (Champion et al. 1999; Katapodi et al. 2004). Beliefs in genetic determinism may be no exception (Author et al., n. d.). Although beliefs in genetic determinism may negatively affect individuals' self- and response- efficacy (Parrott et al. 2004), at the same time, the results suggest that increased risks based on beliefs in genes' roles and intentions may positively affect health-related behaviors. On the contrary, as expected, the results suggest that intentional spirituality, which views life events based on the invisible purposes of a divine being such as God (see Brownell 2010; Egbert et al. 2004; Kirkwood 1994; Moberg 2002), is not helpful for individuals' health behaviors such as FHH communication. As hypothesized, it is possible that participants with high levels of intentional spirituality believe that health behaviors are not necessary to improve their health, as they are skeptical about the effects of those behaviors. This finding corroborates the outcomes of previous studies about African-Americans' religious beliefs and their health behaviors (see Cohen et al. 1998; Hughes et al. 2003; Landrine and Klonoff 1996).

Third, participants' intrinsic and extrinsic religiosity showed interesting dynamics with regard to beliefs in genetic determinism and FHH communication. In the present study, several relevant (quasi-) religious tendencies were explored for potential overlaps because beliefs in life's purpose often come from beliefs in God (Kelemen et al. 2013; Willard and Norenzayan 2013). According to the results, however, although there was a negative correlation found in a previous study between intrinsic religiosity and scientific determinism, intrinsic religiosity played a positive role in this study's participants' beliefs in genetic determinism. This was inconsistent with the study's hypothesis. Likewise inconsistent with the hypotheses of this study, participants' levels of intrinsic religiosity were positively associated with FHH communication, and there was no effect related to extrinsic

religiosity. However, as expected, extrinsic religiosity had a positive effect on beliefs in genetic determinism (see Carey and Paulhus 2013). Extrinsic religiosity often reflects selfish or utilitarian motivations for religious involvement, whereas intrinsic religiosity characterizes individuals' perceptions of religion's impacts on their lives (Donahue 1985; Kirkpatrick and Hood 1990). Carey and Paulhus (2013) explained the positive association between extrinsic religiosity and scientific determinism and the negative relationship between intrinsic religiosity and scientific determinism in relation to individuals' beliefs in fatalistic determinism and free will. They explained that since scientific determinism is similar to fatalism, those with fatalistic perspectives seek the social support offered by extrinsic religiosity. On the other hand, individuals with higher levels of intrinsic religiosity are more likely to be independent and value free will and taking responsibility for their behaviors. Therefore, these people's levels of fatalistic determinism as well as scientific determinism tend to be lower than those of others. Given their explanation, it makes sense that extrinsic religiosity was positively associated with beliefs in genetic determinism and that intrinsic religiosity positively influenced participants' communication about their family history. However, it seems that more research is needed to identify the positive effect of intrinsic religiosity on beliefs in genetic determinism.

Fourth, the results suggest potential differences in teleological stances among Euro-American, Chinese, and Korean participants. The results revealed a main effect for the cultural identity condition on intentional spirituality, intrinsic religiosity, extrinsic religiosity, paranormal beliefs, and beliefs in genetic determinism. In particular, intentional spirituality as well as beliefs in genetic determinism, both of which are most relevant to teleological interpretations of events, revealed significant and particularly clear differences among cultures. More specifically, Chinese and Korean participants were significantly more likely to believe in genetic determinism than Euro-American participants. In addition, Euro-American participants' levels of intentional spirituality were the highest among the three cultural groups, and those of Korean participants were also significantly higher than Chinese participants.' These results reinforce arguments made by existing studies in psychology. Although teleological tendencies might be a naturally emerging feature of the universal human mind (Banerjee and Bloom 2014; Kelemen et al. 2013; Rottman et al. 2016), these tendencies might be affected by individuals' exposure to societies with deep-rooted discourses invoking teleological explanations (see Heine and Norenzayan 2006; Rottman et al. 2016). As discussed in the literature, although China and Korea share a wide variety of cultural characteristics and legacies such as Confucianism, Buddhism, and patriarchy, and some of these influences include materialist arguments (Chen 1993; Hwang 2012; Yum 1988), Christianity has exerted a significant influence on Korean society. The results of this study, especially the results about intentional spirituality, reflect these societal as well as historical differences among the cultures.

Lastly, intentional spirituality, intrinsic and extrinsic religiosity, and paranormal beliefs had different effects on beliefs in genetic determinism as well as FHH communication across cultures. In addition to the differing significance of the models, the role of each spiritual and religious tendency differed across ethnicities in relation to beliefs in genetic determinism as well as FHH communication (Table 5). Moreover, the interaction effects showed interesting dynamics among paranormal beliefs, beliefs in genetic determinism, and FHH communication for each culture. More specifically, the positive association between beliefs in genetic determinism and FHH communication among Chinese participants suggests that the role of causal beliefs embedded in genetic determinism may function differently across cultures. Unlike Western cultural discourse, these causal beliefs based on materialism might not be fatalistic to Chinese and Korean individuals. Moreover,

they may be helpful in encouraging individuals' health behaviors in the Chinese culture. Although culture may indeed attenuate the baseline teleological stance (Rottman et al. 2016), meaning that cross-cultural differences may affect these associations among the study variables, more investigation is needed to clarify this relationship.

Limitations

Although this study provides several interesting findings, it is important to acknowledge its limitations. First, since differences exist at the individual level, some Chinese and Korean participants might be similar to Euro-American participants in terms of their spirituality, religiosity, genetic beliefs, and self-efficacy. Second, there is a limitation regarding the use of single-item (intentional spirituality) or two-item (extrinsic religiosity) measures for the key variables. Future studies should examine the relationships among these variables by using more items. Lastly, this study utilized a college-aged sample, meaning that the individuals surveyed were educated and from moderate to high socioeconomic classes. However, given that all undergraduate students attending the particular university are required to take the basic public-speaking course through which the study's American participants were recruited, it can be said that the participants represent a general college-aged population in many respects. In addition, since most Chinese and Korean participants were recruited from the international office of the university, all the Chinese and Korean students had opportunities to participate in this study. Therefore, the students who participated can be considered reflective of the general international students from China and South Korea. Nevertheless, this sample may be different from the composition of the population in the students' home cultures, and there might be differences among these international participants according to their length of stay in the USA. However, as Table 1 shows, most Korean and Chinese participants' length of stay in the USA is much shorter than the American participants who have lived in the USA their whole lives.

Practical Implications

The findings of this study suggest theoretical as well as practical implications that can be applied to future health communication interventions targeting Euro-American, Chinese, and Korean individuals in the USA. East Asian migration to the USA has drastically risen over the past several decades, and most of the immigrants are foreign-born Chinese and Koreans (Migration Policy Institute 2016). Therefore, the findings of this study related to the international students can be successfully adapted to the future health campaigns based on immigrants' native cultures. According to the findings, participants' genetic, spiritual, and religious beliefs together influence their communication of family health history, though the influence differs across cultures. Genetic beliefs and FHH communication are very important health-related predictors for diverse patient populations in this era of genomic or precision medicine. The study's findings suggest that future health interventions need to account for these predictors. Only by considering these predictors can more effective and culturally appropriate communication materials/contents and decision aids related to family health history and genetics be developed.

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