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Supernatural explanatory models of health and illness and healthcare use in China among men who have sex with men

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Abstract

People's beliefs in supernatural explanatory models of health and illness—beliefs in divine and/or supernatural forces to inform how they perceive, interpret, and respond to health and illness—may have important implications for their use of healthcare services, especially among individuals with lower socioeconomic status (SES). However, the relevance of such research for contexts with strong Confucian and Buddhist traditions and sexual minority subpopulations remains unclear. We conducted a nation-wide survey in China of 503 men who have sex with men (MSM) to test hypotheses examining how supernatural beliefs impact commitment to a primary healthcare provider and testing history for HIV and syphilis. We also tested hypotheses regarding how SES may moderate such effects. Results indicate that strength of supernatural beliefs is associated with less commitment to a primary care provider and lower likelihood of HIV testing, particularly

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among men with lower educational attainment. However, among men with low income, supernatural belief was associated with higher likelihood of testing for HIV and syphilis. Belief in supernatural explanatory models of health and illness may have substantial influence on healthcare use among MSM in China. As religion and spirituality evolves within China, additional research concerning supernatural beliefs and healthcare use is warranted.

Keywords

Religion; Spirituality; Fatalism; Gay men; Fundamental cause theory

Introduction

Belief in supernatural explanatory models of health and illness—that is, people’s use of culturally-specific beliefs in divine and/or supernatural forces to inform how they perceive, interpret, and respond to health and illness—can influence optimal and appropriate uptake of biomedical healthcare services (Kleinman, Eisenberg, & Good, 1978). Numerous studies have demonstrated that possessing supernatural beliefs is associated with lower engagement in preventive health seeking behaviors (Kremer, Ironson, & Porr, 2009; Straughan & Seow, 1998; Vyas, Limneos, Qin, & Mathews, 2014), potentially because supernatural beliefs facilitate weaker perceived self-efficacy due to fatalistic attitudes toward life. Moreover, conviction in supernatural interventions within everyday life appears to decline as socioeconomic status (SES) rises (Schieman, 2010), with higher SES also having well-documented associations with higher likelihood of health care access and use (Carpiano, Link, & Phelan, 2008).

These findings have particularly important implications for men who have sex with men (MSM), a marginalized subpopulation that faces stigma, discrimination, and associated health-related risks because of heteronormative attitudes largely based on their local community and larger society’s moral beliefs and laws, which are often rooted in religious traditions that condemn or do not affirm homosexuality. Higher levels of internalized heterosexism among MSM—i.e. heterosexist conceptions that MSM may have of their own personal self-image—have been observed among those who are exposed to religious environments that are not accepting of homosexuality (Barnes & Meyer, 2012). Such negative self-conceptions have been linked to a wide range of deleterious outcomes, including poorer access to healthcare services, higher sexual risk, and (among HIV+ MSM) lower adherence to anti-retroviral treatment (Garrett-Walker & Pérez, 2017; Huebner, Davis, Nemeroff, & Aiken, 2002). Nevertheless, supernatural beliefs may also be a personal resource for MSM. Kubicek et al. (2009) found that belief in a higher power provided comfort and support for some of the young MSM in their study sample, and helped in forming their identity.

However, the overwhelming majority of such research on general populations and MSM specifically comes from settings with prominent Judeo-Christian traditions. Hence, it remains unclear how applicable such findings are in contexts with strong Buddhist traditions, such as China.

The poor understanding of supernatural beliefs and healthcare use in China is concerning for several reasons. First, supernatural beliefs in China are highly prevalent. Over 600 million Chinese (47.8% of the total population) can be identified with a religious affiliation (Pew Research Center, 2012), and thus, presumably some belief in the supernatural. A growing body of empirical research indicates that many MSM in China also subscribe to supernatural beliefs (Pan, Tang, Cao, Ross, & Tucker, 2017; Pan et al., 2016), particularly those who have experienced a dramatic life changing event such as HIV diagnosis (Pan et al., 2017). Second, because Judeo-Christian supernatural beliefs are so fundamentally different from those of Buddhist and Confucian traditions (Stark, Hamberg, & Miller, 2005), it is questionable whether research conclusions based on supernatural beliefs in a sentient higher-being (e.g., Judeo-Christian conceptions of God) are generalizable to supernatural beliefs rooted in Buddhist principles such as Karma. Given that same-sex sexual relations face greater moral stigmatization in Islamic and Judeo-Christian traditions compared to Buddhist traditions, Buddhist MSM may be less likely to perceive adverse health outcomes as divine retribution brought on by their own sexual behaviors (Siker, 2007). Third, biomedical healthcare services in China remain underutilized for conditions ranging from primary health care to screening for sexually transmitted infections (Wong et al., 2018; Wu & Lam, 2016), especially among stigmatized populations such as MSM (Watson et al., 2018). Fourth, if SES does indeed impact individual supernatural beliefs within China, then supernatural beliefs may have differential consequences for MSM healthcare use depending on one's SES.

The present study considers these knowledge gaps in proposing and testing several related hypotheses regarding the potential consequences of supernatural beliefs and SES for three healthcare use outcomes among Chinese MSM: commitment to a primary health care provider and testing history for HIV and syphilis. We test these hypotheses by analyzing data from a Chinese nation-wide online survey of MSM. Our findings offer important insights for advancing current knowledge regarding the health implications of supernatural beliefs in general and for MSM more specifically.

Explanatory models of health and illness

Explanatory models of health and illness refer to individuals' culturally-based understandings about the etiology, symptoms, pathophysiology, disease progression, and appropriate treatment of a given illness (Kleinman et al., 1978). Such models are invariably shaped by contextual social norms, values, and practices, and constitute foundational assumptions upon which conscious health behavior decisions are based. Explanatory models vary widely within a given population, and may or may not be concordant with related notions of *disease* (i.e., 'altered body states or processes that deviate from norms as established by Western biomedical science') (Fabrega, 1971). When explanatory models become incompatible with or are unsupported by biomedical models of *disease*, risk for inappropriate or underuse of biomedical healthcare services can increase (Kleinman et al., 1978). One of the most powerful contributors to non-biomedical explanatory models is belief in the supernatural.

Beliefs in the supernatural are widespread and characterized by conviction in forces that are 'beyond scientific understanding or the laws of nature' ("Supernatural," 2018). Within the Buddhist and Judeo-Christian traditions, respective beliefs in Karma and an omnipotent higher-being are examples of belief in the supernatural. However, although often associated with religion and spirituality, beliefs in the supernatural need not be grounded in any theological framework and/or personal characteristics. Indeed, individual supernatural beliefs are often idiosyncratic and contradictory with other personal beliefs (Stark et al., 2005).

How does belief in supernatural explanatory models of health and illness affect healthcare service use?

Supernatural beliefs can have profound implications for use of biomedical healthcare, which it can influence in several ways (Figure 1).

First, individuals with supernatural beliefs may avoid biomedical healthcare services because they perceive their health to be beyond the locus of their own control (i.e., supernatural determinism). That is, perceived inevitability of health outcomes could undermine sense of self-efficacy, which in turn deters use of healthcare services. Under the broader construct of *fatalism*, this theory has been tested and robustly corroborated by numerous studies in North America, Europe, and Singapore (Kremer et al., 2009; Straughan & Seow, 1998; Vyas et al., 2014).

Second, individuals with supernatural beliefs may be more likely to forgo or delay biomedical healthcare services because of a belief that one can personally influence their health outcomes via supernaturally-mediated interventions (i.e. human manipulation of the supernatural). Individuals who subscribe to such beliefs may be more likely to first seek supernatural means of improving their health (e.g., prayer for healing or material offering to gods in exchange for health) before turning to biomedical interventions and healthcare services.

Third, individuals with supernatural beliefs may *intentionally* avoid or defer biomedical health services as a way of achieving suffering and expressing moral penance to a supernatural force (Baumeister & Scher, 1988). Common to many religious and cultural traditions is a belief that supernatural forces ultimately govern punishments for moral transgressions (Shweder, Much, Mahapatra, & Park, 1997). Hence, individuals with strong convictions in cosmic moral order may seek to redress perceived moral transgressions through intentional self-harm. Desires to express moral penance may be especially relevant for the health care decisions of MSM who believe that same-sex sexual relations are immoral and that moral virtue can be achieved through physical suffering.

How does socioeconomic status influence belief in supernatural explanatory models of health and illness? Explanations by the deprivation-compensation and demythologized beliefs theories

In addition to religious traditions, beliefs in the supernatural appear to be significantly associated with socioeconomic status (SES). Evidence from the US indicates that as SES rises, beliefs in supernatural interventions within everyday life tend to decline (Schieman,

2010). This inverse relationship can be explained by two complementary theories: the deprivation-compensation theory and the demythologized beliefs theory.

The *deprivation-compensation theory* posits that individuals living in deprived socioeconomic conditions will be *more* likely to believe that supernatural forces intervene in the affairs of everyday life. For lower SES individuals, appealing to such forces offers additional hope for achieving otherwise elusive goals, and belief in supernatural forces can provide psychological comfort when faced with challenges associated with socioeconomic deprivation (Schieman, 2010).

Meanwhile, the *demythologized beliefs theory* posits that higher SES individuals will be *less* likely to believe in supernatural forces intervening in everyday life, because supernatural explanations of life events will be superseded by secular and exclusively scientifically-based explanations as exposure to higher levels of education and income rises (Schieman, 2010). The role of SES and the effects of belief in supernatural explanatory models of health and illness on healthcare use, however, remains unclear.

How does SES shape the effect of belief in supernatural explanatory models of health and illness on healthcare use? Explanation by fundamental cause theory

Fundamental cause theory (FCT) posits that individuals of higher SES are consistently better able to avoid disease and illness because of their relative advantages in financial resources, knowledge, status, and social capital (Carpiano et al., 2008). Hence, the exposure to and adverse health effects of disease risk factors may be less pronounced in higher (versus lower) SES groups because access to such resources effectively dampens the health impacts of a given risk factor. FCT complements and extends the two abovementioned theories regarding SES and supernatural beliefs by offering insight into how such potential SES-supernatural belief associations may impact health use—in terms of potential *health risks* and *health promoting resources*.

To the extent that supernatural explanatory models of health and illness constitute a putative risk factor for poorer biomedical healthcare use, FCT is consistent with deprivation-compensation theory (higher supernatural beliefs among lower SES persons) and demythologized beliefs theory (lower levels of such beliefs among higher SES persons). Thus, from an FCT perspective, SES patterns exposure to health risks posed by supernatural explanatory models.

In terms of health-promoting resources, FCT argues that SES constitutes the extent and array of flexible resources (e.g., health literacy, money to afford health-promoting amenities, social connections to others knowledgeable about health risks and treatments) that may countervail or buffer health risks posed by supernatural explanatory models of health, increasing the likelihood that higher SES individuals may draw on them to maintain health—including accessing and potentially deriving greater benefit from seeking biomedical healthcare. Thus, with respect to resources, FCT also motivates the hypothesis that lower SES individuals may be more susceptible to any adverse effects of belief in supernatural explanatory models of health and illness because of less access to health-promoting resources. Consistent with this conjecture is the corollary that, to the extent that high SES

individuals may still utilize supernatural explanatory models, their possession of greater health-enhancing resources will still minimize any risks posed by such models and make them more likely than their lower SES peers, contributing to disparities in health care use. However, to date, no published studies have yet examined the relationship between supernatural beliefs, SES, and healthcare use in China, a country undergoing massive social and economic changes.

Religion and supernatural beliefs in China

In China, spiritual practices such as ancestor worship, temple offerings, and prayers are relatively common, and often credited with an ability to influence objectively measurable outcomes such as personal health (C. Yang, 1961). Religious affiliation data suggest that supernatural beliefs are relevant to the lives of hundreds of millions in China today (Stark & Liu, 2011). In 2012, China had an estimated 244 million Buddhists (18% of 1.3 billion), 294 million adherents of folk religions (22%), 68 million Christians (4%), 25 million Muslims (2%) (Pew, 2012). Following official proscription of religious and spiritual practices in the 1960s and 1970s, Chinese citizens since the 1980s have largely been at liberty to practice 'normal religions' as defined by the state, given that activities did not pose a perceived threat to social stability (F. Yang, 2012). Recent studies indicate that supernatural beliefs may have significant implications for sexual health behaviors in China, particularly among MSM (Pan et al., 2017, 2016), a population that bears a disproportionate HIV burden and faces strong social stigmatization from some religious communities and society at-large (Neilands, Steward, Choi, Steward, & Choi, 2008).

Healthcare use and MSM in China

In the current study, we examine three healthcare use outcomes among MSM: having a primary care physician, HIV testing history, and syphilis testing history.

Having an established primary care physician is an important part of accessing primary care health services, which is associated with more equitable access to health services, better quality of clinical care, and prevention of chronic illnesses (Starfield, Shi, & Macinko, 2005). Thus, the Chinese health care delivery system is currently undergoing a process of decentralization, whereby primary care providers would assume a greater proportion of the patient load currently being handled by secondary and tertiary hospitals (Wu & Lam, 2016). Unfortunately, efforts at service decentralization have had limited success, and primary care use remains low (Wu & Lam, 2016), especially among stigmatized populations such as MSM (Watson et al., 2018).

Given that HIV diagnosis is the logical first step to initiating care services, the World Health Organization recommends that MSM receive annual HIV and syphilis tests (World Health Organization, 2015). Unfortunately, HIV and syphilis test uptake remains suboptimal among both MSM in China (Ong et al., 2018; Wong et al., 2018).

Study hypotheses

Given these considerations, we test three hypotheses:

H1: Belief in supernatural explanatory models of health and illness (IV) is inversely associated with healthcare use (current primary care provider, HIV test history, and syphilis test history) (DV) (*belief in supernatural explanatory models of health and illness*)

H2: SES is inversely associated with supernatural beliefs (DV) (as per *deprivation-compensation* and *demythologized-beliefs theories*)

H3: SES modifies associations between supernatural beliefs and healthcare use (as per *fundamental cause theory*).

Methods

Study design and participants

We test these hypotheses using data collected nationally in May 2017 through a cross-sectional online survey. The survey link was distributed through online social media by two large gay community-based organizations. Prior to enrollment, the survey was field-tested with 20 MSM.

Eligibility criteria were: born biologically male, ever had anal or oral sex with a male, being between 16 and 30 years of age, and had seen a physician in the last two years. The latter two requirements were imposed because participants were enrolled as part of a broader study focused on the healthcare experiences of young MSM. Participants completed an electronic consent form before beginning the survey. Each participant received the equivalent of \$7.50 USD mobile phone credit. Ethical approval for this study was obtained from the Institutional Review Boards of (IRB) the University of North Carolina at Chapel Hill and the Guangdong Provincial Dermatology Hospital.

Measures

Key Independent Variables—*Beliefs about supernatural explanatory models of health and illness* were assessed by three items selected, translated, and adapted from the Religious Health Fatalism Questionnaire (Franklin, David, & Wallston, 2008), and informed by qualitative in-depth interviews with MSM in China. Each item contained a statement to which participants reported their level of endorsement on a scale of 1 to 5 from strongly disagree to strongly agree. The first item measured participants' degree of belief in supernatural external loci of control over health: '*My health is determined by the divine (e.g., gods, Buddha[s], Bodhisattvas, ancestral spirits, deities or ghosts).*' The second item assessed the extent to which participants believed that engaging in religious activities could help expedite recovery from illness: '*Engaging in religious activities can help expedite recovery from illness.*' The third item measured participants' degree of belief that illness could be a form of supernatural punishment for immoral behavior: '*Illness can be a form of supernatural punishment for immoral behavior.*' The summation of these three items yielded a supernatural beliefs score ranging from 3 to 15. The Cronbach's alpha score (0.87) also indicated strong consistency across items.

Socioeconomic status (SES) was measured using educational attainment and monthly personal income. Table 1 details the specific categories used for these variables' scales.

Measures of healthcare use—Three, single-item dichotomous measures were used to assess healthcare use: currently have a primary care provider, ever tested for HIV, and ever tested for syphilis. We defined primary care provider as a community non-specialist physician whom the respondent trusted and visited on a regular basis.

Control variables—Our analyses also include a range of sociodemographic and behavioral control variables. Sociodemographic variables were: age (continuous), sexual orientation (gay vs. not gay), migrant status (lacks vs. possesses official household registration in current village or city of residence), urban (versus rural) residency, marital status (single, married, divorced/widowed), and religious affiliation (none, Buddhist, Christian/Muslim/other). Behavioral and HIV status variables included: condomless sex at last anal intercourse (yes vs. no), primarily receptive (vs. insertive or versatile) positioning when having anal sex, anticipated healthcare discrimination (ever refrained from a necessary medical examination or treatment because afraid of being discriminated against because of your sexual orientation; yes, no, unsure), and ever tested positive for HIV (yes vs. no).

Data analysis—To test hypothesis 1, each healthcare use measure was regressed on the supernatural beliefs score using binary logistic regression models. Hypothesis 2 was tested by regressing the supernatural beliefs score on income and education using ordinary least squares regression. Hypothesis 3 was tested by regressing measures of healthcare usage on a two-way interaction term between (a) the supernatural beliefs score and (b) education and income, in separate binary logistic regression models. Supernatural belief scores and age were modeled as mean centered continuous variables. All of these models adjusted for the aforementioned control variables, though HIV testing models did not include HIV diagnosis as a control variable. Analyses were conducted using Stata/IC 15.1 (College Station, USA) and SAS 9.3 (Cary, North Carolina, USA).

RESULTS

Overall, 1689 individuals clicked the survey link, and 1084 were found to be ineligible for the study, with 451 MSM excluded because they had not seen a doctor in the past 24 months. Of the 605 eligible participants who began the survey, 503 reached completion (83% completion rate) and constituted the study sample. Study participants reported residing in Taiwan, Hong Kong, and 30 of 31 provincial-level administrative units in mainland China.

Descriptive findings

Table 1 presents the descriptive statistics for our study variables. Regarding outcomes variables, 14.7% currently had a primary care provider, 85.7% had ever tested for HIV, 55.1% had ever tested for syphilis.

For our key independent variables, the mean supernatural beliefs score was 5.37 (standard deviation: 2.47, range: 3–15), indicating that most participants expressed disagreement with the statements about supernatural beliefs. However, 37% of participants expressed ambivalence or agreement with at least one of the three supernatural beliefs statements. For SES, most participants had at least some vocational or four-year college level education (73.4%) and earned at least \$435 USD per month (54.9%).

Healthcare use and belief in supernatural explanatory models of health and illness

Table 2 presents adjusted odds ratios (aORs) and 95% confidence intervals (95% CIs) between supernatural belief scores and the three healthcare use variables. Results partially support the first hypothesis that belief in supernatural explanatory models of health and illness is associated with lower likelihood of healthcare use. Each unit increase in supernatural belief score was significantly associated with 13% lower odds of having a primary care doctor (aOR: 0.87, 95% CI: 0.77–0.98) and 15% lower odds of ever testing for HIV (aOR: 0.85, 95% CI: 0.76–0.95). Supernatural beliefs score was not significantly associated with syphilis test history.

SES differences in beliefs in supernatural explanatory models of health and illness

Next, we tested for SES differences in supernatural belief scores. Contrary to our second hypothesis, which tested the deprivation-compensation and demythologized-beliefs theories, belief in supernatural explanatory models of health and illness was not significantly associated with any level of educational attainment (Type III SS F-value: 0.65; $p=0.52$) or income (Type III SS F-value: 1.67; $p=0.17$) (results not shown).

Moderation by education and income

Table 3 presents results of the interaction analysis. These results, plotted as graphs presented in Figures 2 and 3, provide evidence that both supports and contradicts our third hypothesis regarding FCT and SES-related resources. Consistent with FCT, the inverse association between higher supernatural belief scores and lower likelihood of HIV testing was significantly stronger among men who did not complete four-year college (vs. men who completed four-year college) ($p<0.05$). However, in the HIV and syphilis testing models, supernatural belief score among men with the highest (vs. lowest) income levels was inversely associated with the probability of being tested for HIV ($p=0.06$) and syphilis ($p<0.01$). Figures 2 and 3 show plots of these associations. Neither income nor education significantly moderated the association between supernatural beliefs and having a primary care provider.

Sensitivity analysis

To account for younger participants who may not have reported ‘college education’ because they were currently in college, we repeated the analyses on a subset of participants who were 25 years of age or older ($n=224$). Results of the full model and parsimonious models were comparable (results available upon request).

Discussion

Belief in explanatory models of health and illness can profoundly shape individuals’ use of healthcare services. We sought to understand how such beliefs might impact healthcare use in a traditionally non-Judeo-Christian context and among MSM, a population often stigmatized as a result of religious beliefs and values. Based on a nationwide online survey conducted in China among MSM, our results have important implications for clinical practice and public health research and extend the literature of explanatory models of health and illness and health behaviors by demonstrating the public health relevance of

supernatural beliefs among MSM and societies strongly influenced by Confucian and Buddhist traditions. We discuss the implications of these specific findings below.

Supernatural explanatory models of health and illness associated with less uptake of healthcare services

We hypothesized and found evidence that belief in supernatural explanatory models of health and illness is inversely associated with less uptake of two important healthcare services. This finding is consistent with previous research conducted among non-MSM outside of China (Kremer et al., 2009; Straughan & Seow, 1998; Vyas et al., 2014). Although mechanisms of association could not be conclusively established in this study, we infer three non-mutually exclusive pathways by which belief in supernatural explanatory models of health and illness could have directly deterred participants from having a primary care doctor and testing for HIV. Specifically, individuals with stronger supernatural beliefs may have (1) perceived limited control over their health vis-à-vis supernatural forces (supernatural determinism), (2) appealed to supernaturally-mediated interventions before seeking biomedical healthcare services (human manipulation of the supernatural), and/or (3) intentionally foregone healthcare services as a means of demonstrating moral penance (supernatural retribution).

No evidence in support of the deprivation-compensation and demythologized belief theories

Contrary to our second hypothesis based on the deprivation-compensation and demythologized belief theories of how SES is associated with supernatural beliefs, we found no evidence that beliefs in supernatural explanatory models of health and illness correlated with educational attainment or income. Such findings diverge from research conducted in the US (Schieman, 2010), and may be a reflection of the different cultural contexts of spiritual beliefs and SES in contemporary China and the US. If the demythologized belief theory (i.e. higher SES individuals have weaker beliefs in the supernatural) is indeed significantly contributing to weaker supernatural beliefs among individuals with higher SES in the US, then three factors may be precluding observation of similar trends in the current study from China. First, because atheism and lack of supernatural belief are already highly prevalent in modern Chinese society (Hackett et al., 2012), the marginal effect of higher-level education or income on diminishing propensity to subscribe to such beliefs may be insignificant.

Second, any potential for education or income to displace supernatural beliefs with secular beliefs may be counterbalanced by opposing trends. Among many well-educated urban professionals in China, religious systems such as Buddhism and Christianity has been associated with concepts of modernity, progressiveness, and peace (Teo, 2018). For Chinese citizens who achieve their material and socioeconomic aspirations, a search for transcendental meaning may be more likely to ensue, possibly leading to stronger supernatural beliefs. Results of a national survey in 2007 indicate that Chinese citizens in the highest household income quartile were significantly more likely to report popular folk religion practices and beliefs than those in the second and third quartiles (49% vs 43%) (F. Yang & Hu, 2012).

Third, previously observed associations between SES and supernatural beliefs among non-MSM might not be generalizable to MSM. Relatively stable levels of supernatural belief across SES gradients in our study suggests that SES is not a major determinant of supernatural beliefs among MSM. Given the overt and implicit stigmatization of same-sex sexual behaviors within many faith communities (Siker, 2007), MSM may feel excluded from communities of faith and, as a consequence, have weaker beliefs in the supernatural. It is possible that any effect of SES on supernatural beliefs among MSM is negligible compared to the effects of perceived and/or experienced homonegativity within faith communities.

Evidence that supports and contradicts fundamental cause theory

Consistent with our third hypothesis based on FCT (Carpiano et al., 2008), the inverse association between individual supernatural beliefs and HIV testing was most pronounced among men who did not complete a 4-year college. This finding suggests that potential for individual supernatural beliefs to influence HIV testing will depend upon an individual's SES. Educational attainment may be indicative of knowledge and literacy on health among many other topics, cumulative social conditions that can influence one's ability, and motivation to test for HIV and syphilis in the face of strong beliefs in supernatural determinants of health. MSM who never completed 4-year college may have fewer material and psychosocial resources conducive to HIV testing, partly due to being embedded within social networks and reference groups lacking in social capital and norms supportive of HIV screening (Berkman & Krishna, 2014; Kelly, Carpiano, Easterbrook, & Parsons, 2012). In the relative absence of access to STI testing resources, the behavioral effects of supernatural beliefs may be significantly more pronounced. However, our third hypothesis was also contradicted by observing that the inverse association between individual supernatural beliefs and both HIV and syphilis testing was more pronounced among men with *higher* levels of income. This paradoxical finding suggests that effects of supernatural beliefs on healthcare use may be qualitatively different among MSM with the lowest levels of income.

Implications for Future Research and Practice

Results of this study have broad implications for public health and social science research. First, it is important to recognize that supernatural explanatory models of health and illness are common among MSM in China and may be complicating efforts to optimize the HIV treatment cascade of care. Overall, 37% of all participants expressed some belief in supernatural explanatory models of health and illness. Longitudinal studies are needed to evaluate associations between supernatural explanatory models of illness and future HIV and syphilis testing behaviors. If belief in supernatural explanatory models of health and illness are indeed contributing to significant leakage in the HIV care continuum within China, HIV health service promotion models should explore how knowledge of individual supernatural beliefs can be used to optimize behaviors related to the cascade of care.

Second, belief in supernatural explanatory models of health and illness may be inhibiting some MSM in China from committing to a primary care physician. Even after controlling for an array of potential confounding factors, the odds of reporting a current primary care

doctor and HIV testing declined, respectively, by 13 and 15% for each point increase in the supernatural beliefs scale. As China seeks to shift healthcare service demand from secondary and tertiary hospitals to primary care settings (Wu & Lam, 2016), it may be beneficial for researchers, administrators, and practitioners to be mindful that beliefs in supernatural explanatory models of health and illness may be influencing decisions to secure a primary care physician.

Third, the deprivation-compensation and demythologized theories concerning SES and supernatural beliefs may have limited relevance among MSM within China. In contrast to findings from the US general population which indicate that supernatural beliefs decline as SES increases (Schieman, 2010), we found that strength of belief in supernatural explanatory models of health and illness were relatively stable across levels of education and income. This is not to suggest that the deprivation-compensation and demythologized theories are categorically absent among MSM China, but that other historical and social factors may be attenuating the relative impacts of income and education on MSM supernatural beliefs. Compared to SES, perceived and enacted stigmatization of same-sex sexual behaviors by faith communities may be a far stronger influence on MSM supernatural beliefs. Moreover, unlike the US, contemporary Chinese society follows decades where religious and spiritual beliefs and practices were officially proscribed and curtailed during 1960s and 1970s (F. Yang, 2012). Hence, attaining greater levels of education may not significantly decrease one's inclination to believe in the supernatural because normative 'non-beliefs' have become widespread within Chinese general society for multiple generations. However, as wealth inequality widens and religiosity continues to spread, it is conceivable that the deprivation-compensation theory may become increasingly evident within China. Future health surveillance and social indicator surveys in China should incorporate measures of belief in the supernatural in order to monitor how supernatural beliefs are impacting healthcare usage among various SES groups.

Study Limitations and Strengths

Several study limitations should be noted. First, given that the study only enrolled online MSM between the ages of 16 and 30, it is unclear how generalizable findings will be for older, off-line MSM in China. In addition, the study excluded men who did not see a doctor in the past two years. Hence, men with stronger health-seeking behaviors may have been overrepresented in the sample, in which case our observed estimates may have been conservative. Future studies should consider using both off-and on-line recruitment methods with less stringent eligibility criteria. Second, recall bias may have led to variable misclassification. As participants self-reported all study measures, exposure and outcome measures could not be independently verified.

Despite these limitations, this study provides novel and compelling evidence that belief in supernatural explanatory models of health and illness may be exerting substantial effects on MSM health care seeking behaviors in China. As STI epidemics and spiritual beliefs continue to expand within China, it will become increasingly beneficial for public health and social science researchers to collaborate and better understand how beliefs in supernatural

explanatory models of health and illness can be leveraged to enhance greater uptake of healthcare services within China.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Belief	Description	Example
Supernatural determinism	Belief that supernatural forces are the ultimate determinant of their physical health outcomes	Individual does not commit to a primary care provider because they believe their personal health outcomes are beyond their control.
Human manipulation of the supernatural	Belief that human behaviors can influence supernatural forces capable of altering health outcomes	Individual delays testing for HIV after symptoms arise because they first try praying to God to cure them of their symptoms.
Supernatural moral retribution	Belief that illness can be a form of supernatural punishment for immoral behavior	Individual intentionally delays seeking diagnosis and care for syphilis after symptoms appear because they believe that suffering is an expression of moral penance.

Figure 1:
Potential mechanisms by which beliefs in supernatural explanatory models of illness can influence healthcare use

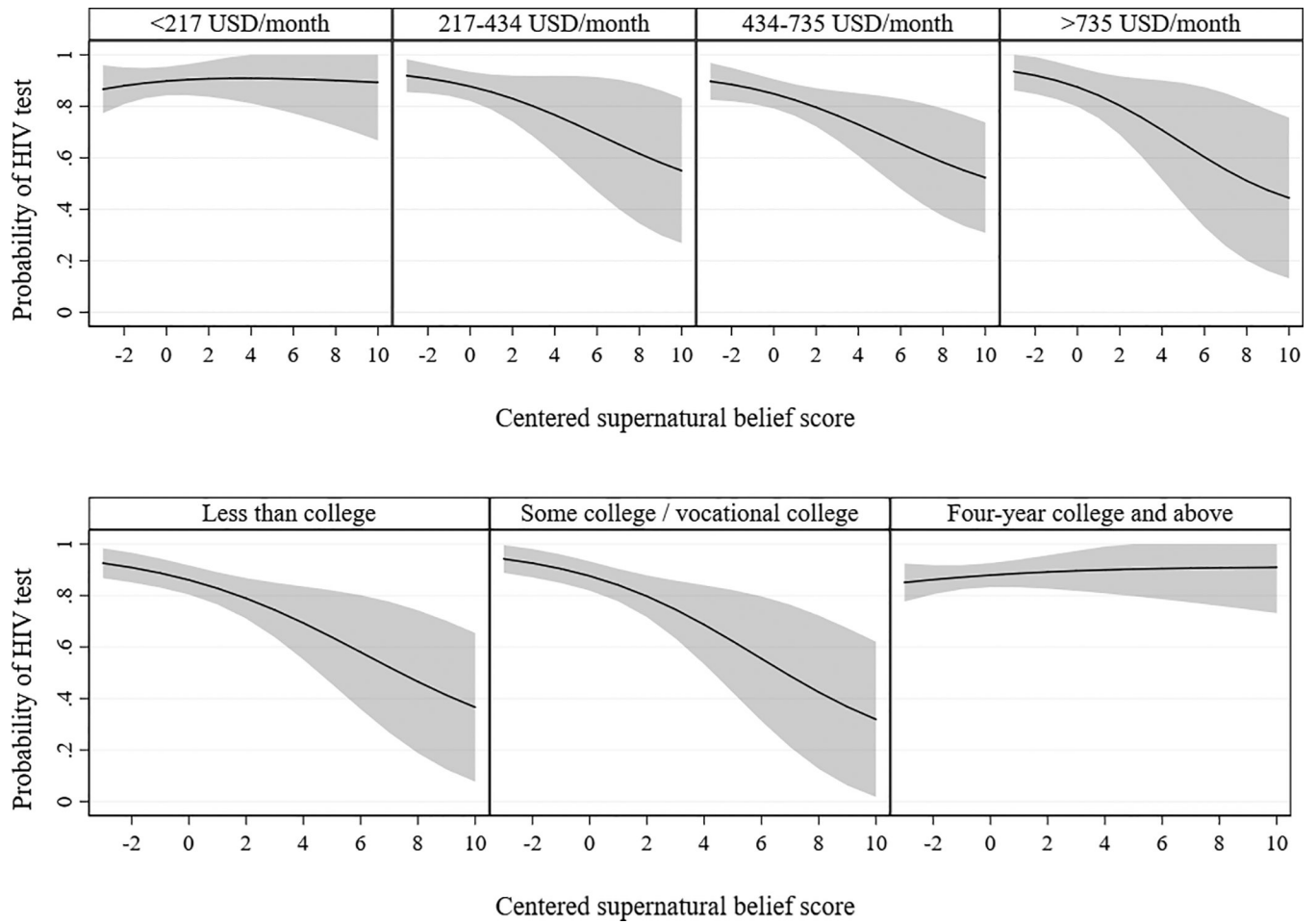


Figure 2:
Predicted probability and 95% confidence intervals of ever received HIV test by monthly income and educational attainment among men who have sex with men in China (n=503)

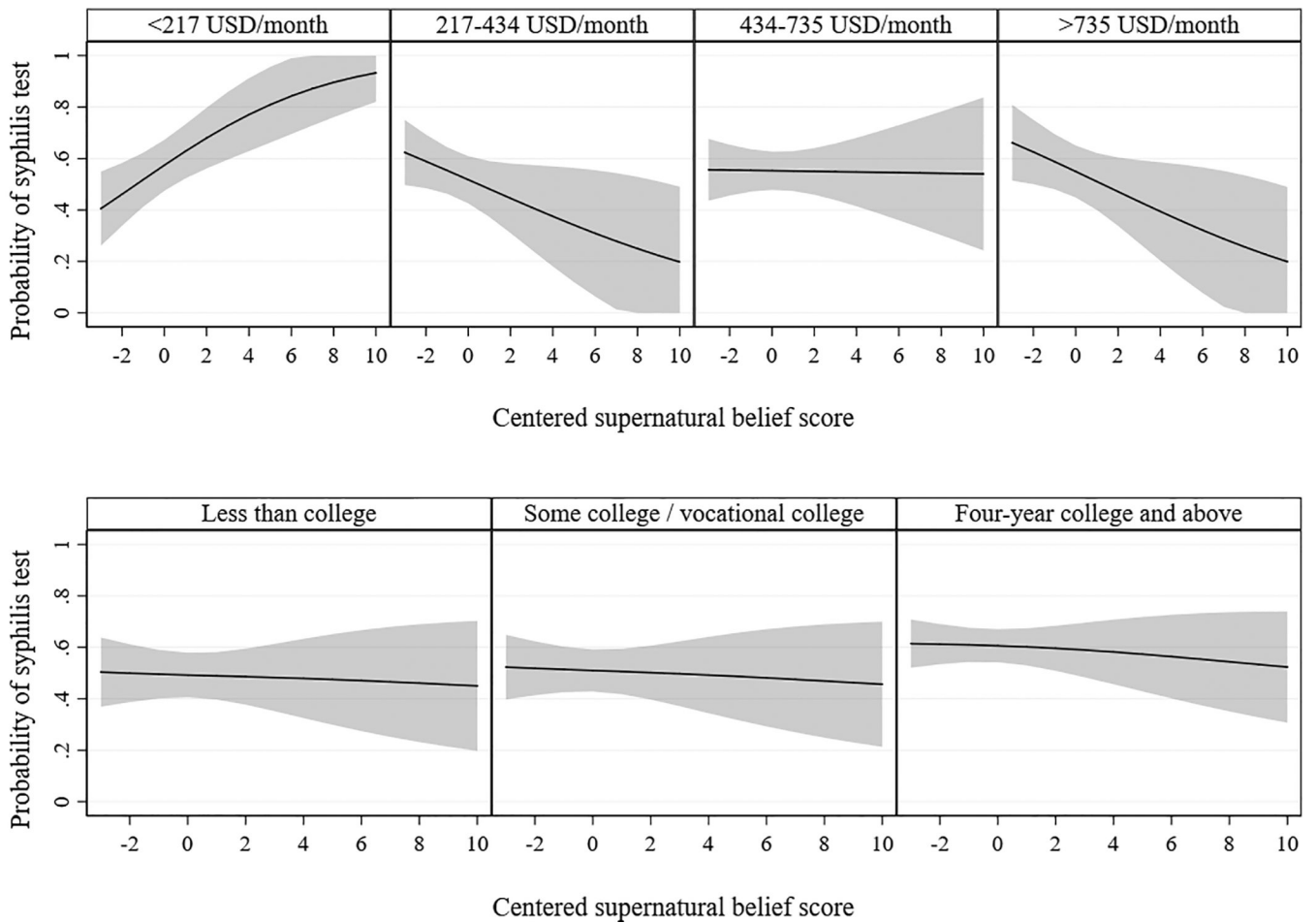


Figure 3: Predicted probability and 95% confidence intervals of ever received syphilis test by monthly income and educational attainment among men who have sex with men in China (n=503)

Table 1.

Descriptive statistics for supernatural beliefs, socioeconomic status, and sociodemographics among men who have sex with men in China, 2017 (n=503)

	n (%)
Beliefs in supernatural explanatory models of health and illness, mean (SD)	5.37 (2.47)
Socioeconomic Status	
Education	
High school or below	134 (26.6)
Some college/vocational college	141 (28.0)
Four-year college and above	228 (45.4)
Monthly personal income (USD)	
<217	111 (22.1)
217–434	116 (23.1)
435–735	173 (34.4)
>735	103 (20.5)
Sociodemographic Characteristics	
Age, mean (SD)	23.9 (3.5)
Sexual orientation	
Gay	420 (83.5)
Bisexual	60 (11.9)
Heterosexual/other/unsure	23 (4.6)
Migrant (lacks household registration in current village or city of residence)	252 (50.1)
Urban (vs. rural) residency	432 (85.9)
Marital status	
Never married	475 (94.4)
Ever married	28 (5.6)
Religious Affiliation	
None	394 (78.3)
Buddhist	82 (16.3)
Muslim/Protestant/Catholic/other	23 (4.6)
Other	4 (0.8)
Sexual behaviors, HIV status, perceived healthcare discrimination	
Condomless sex at last anal intercourse	117 (23.3)
Primarily receptive anal sex positioning	202 (40.2)
Ever refrained from a necessary medical examination or treatment because afraid of being discriminated against because of sexual orientation (yes or unsure)	256 (50.1)
Ever tested positive for HIV	73 (14.5)
Healthcare service use	
Currently has a primary care provider	74 (14.7)
Ever tested for HIV	431 (85.7)
Ever tested for syphilis	277 (55.1)

SD=standard deviation; USD=United States dollars

Table 2:

Adjusted odds ratios (95% confidence intervals) from binary logistic models regressing healthcare service usage on belief in supernatural explanatory models of health and illness among men who have sex with men in China (n=503)

	Has primary care doctor	Ever tested for HIV	Ever tested for syphilis
Supernatural beliefs	0.87 (0.77–0.98) *	0.85 (0.76–0.95) **	0.99 (0.91–1.07)
Education			
Less than college	Referent	Referent	Referent
Some college/vocational college	0.50 (0.24–1.05) †	1.11 (0.55–2.24)	1.05 (0.63–1.75)
Four-year college and above	0.75 (0.39–1.41)	1.25 (0.63–2.46)	1.58 (0.98–2.54) †
Income (USD/month)			
<217	Referent	Referent	Referent
217–434	1.61 (0.70–3.72)	0.89 (0.38–2.07)	0.89 (0.50–1.58)
435–735	1.79 (0.79–4.07)	0.67 (0.29–1.53)	0.98 (0.55–1.72)
>735	1.12 (0.43–2.98)	0.82 (0.30–2.28)	0.98 (0.51–1.87)

†
p<0.1

*
p<0.05

**
p<0.01

NOTE: USD=United States dollars

Table 3:

Adjusted odds ratios (95% confidence intervals) from binary logistic models regressing healthcare service usage on belief in supernatural explanatory models of health and illness X income and education among men who have sex with men in China (n=503)

	Has primary care doctor	Ever tested for HIV	Ever tested for syphilis
Supernatural beliefs	0.88 (0.64–1.22)	0.96 (0.70–1.31)	1.29 (1.04–1.61) *
Education			
Less than college	Referent	Referent	Referent
Some college/vocational college	0.48 (0.22–1.05) †	1.16 (0.53–2.56)	1.08 (0.64–1.81)
Four-year college and above	0.75 (0.39–1.43)	1.20 (0.58–2.51)	1.65 (1.02–2.69) *
Supernatural beliefs * Some college/vocational college	0.87 (0.62–1.22)	0.95 (0.71–1.29)	1.00 (0.80–1.24)
Supernatural beliefs * Four-year college and above	1.11 (0.85–1.44)	1.43 (1.07–1.90) *	1.00 (0.82–1.21)
Income (USD/month)			
<217	Referent	Referent	Referent
217–434	1.52 (0.64–3.60)	0.79 (0.33–1.89)	0.78 (0.42–1.42)
435–735	1.61 (0.70–3.70)	0.60 (0.25–1.42)	0.91 (0.51–1.63)
>735	0.86 (0.29–2.51)	0.77 (0.27–2.22)	0.89 (0.46–1.75)
Supernatural beliefs * 217–434 USD/month	0.95 (0.66–1.38)	0.75 (0.52–1.07)	0.66 (0.51–0.85) **
Supernatural beliefs * 435–735 USD/month	1.03 (0.75–1.40)	0.75 (0.55–1.04) †	0.77 (0.62–0.96) *
Supernatural beliefs * >735 USD/month	0.70 (0.44–1.08)	0.69 (0.46–1.02) †	0.65 (0.50–0.85) **

† p<0.1

* p<0.05

** p<0.01

NOTE: USD=United States dollars