




## Article

# Association between Religion and Health in China: Using Propensity Score Matching Method

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**Abstract:** The association between religion and health is well debated and receives continuous attention in research. Selection bias is often a major concern among the observatory data routinely used worldwide to examine this topic. Adopting the propensity score matching (PSM) method, the present study tries to assess the treatment effects of religion on self-reported health status. The final sample from the 2007 Spiritual Life Study of Chinese Residents (SLSC) contains 6194 valid responses. The average treatment effects (ATEs) estimated by the PSM method show that respondents with religious affiliations are on average significantly more likely to report being very healthy by 5.2 percentage points (by 3.6 and 9.6 percentage points among Buddhists and Protestants), especially, by 16.2 percentage points among those regarding religion as being very important in their lives. Meanwhile, ATEs of religion on reporting being very happy is 17.0 among Protestants and 13.4 among those regarding religion with high importance and 11.3 among those with “regular religious attendance”.

**Keywords:** religion; health; self-selection; propensity score matching; China

## 1. Introduction

The importance of whole person care has been widely recognized, and interests in religion and spirituality continue to grow among public health practitioners (Long et al. 2019). There has been a large volume of studies exploring the relationship between religion and health in multiple dimensions (George et al. 2002; Koenig 1998, 2009, 2012, 2015; Miller and Thoresen 2003; Demir 2019). It has been well noticed that religious involvement has, on average, a modest but robust positive relationship with better health outcome (Bruce et al. 2017; Hill et al. 2016; Li et al. 2016; VanderWeele et al. 2017) and with greater psychological well-being (Bruce et al. 2017; Hayward and Krause 2014; Koenig and Shohaib 2014; Koenig 2015).

The majority of studies in this filed are often correlational and causal effect cannot be directly inferred (Basedau et al. 2017; H. Koenig et al. 2012; Liu et al. 2011a, 2011b). There is still ongoing controversy about the causal effect of religion on health outcome due to major concerns about self-selection bias (Cragun et al. 2016; Zimmer et al. 2016; Idler et al. 2017). People with greater propensities to be religious may also be good at health maintenance (Chiswick and Mirtcheva 2013; Doane and Elliott 2016; Koenig et al. 2012; Levin 1994). Likewise, people who are sick or in poor health may also be more likely to practice religion for comfort or buffering effect (Basedau et al. 2017; Inglehart and Norris 2004; Steptoe et al. 2015; Doane and Elliott 2016).

Since it is difficult or implausible to conduct random-control tests (RCTs) of religion in many situations, the propensity score matching (PSM) method has been recommended as an alternative

for RCTs in the study of religion's effect on health (Kohls and Walach 2008). The PSM is similar to an experimental design (Austin 2014; Deb et al. 2016; Heckman and Robb 1985), but it is applied to survey or observational data with good potentiality by adjusting for observable differences (Li 2013; West et al. 2008). The method has been used extensively in health research, and has produced results that were generally consistent with the findings of randomized clinical trials (Kitsios et al. 2015). Currently, there are only few studies adopting the PSM method (Chiswick and Mirtcheva 2013; Zotti et al. 2016).

Applying the PSM method to analyze a large national population representative survey sample, we examined the potential causal effect of religious affiliation on health in terms of self-reported health and happiness in mainland China. We studied the average difference between the population groups with or without religion factor, after adjusting for demographic and socioeconomic characteristics. We also disentangled the target effects according to various dimensions, such as religious affiliations (Buddhism and Protestantism), residential location (city, town and rural), and age groups (young adult, adult and senior population).

## 2. Theoretical Framework and Background

### 2.1. Potential Mechanism between Religion and Health

Different aspects of religious practice or activities may affect health in terms of subjective well-being and self-reported health through various mechanism (Büssing and Koenig 2010; Sander 2017; Rizvi and Hossain 2017). Religious faith may enhance the happiness of individuals via the provision of a comprehensive framework for the interpretation of world events and life challenges, and thus sense of meaning and purpose in life (Inglehart 2010). Religious affiliation may provide psychological resources (e.g., self-identification, self-esteem, and self-efficacy), stress coping skills (e.g., illness, unemployment, divorce), a sense of meaning and purpose for life (Büssing and Koenig 2010; Inglehart 2010). Additionally, the social capital and social network effects of religion may also help to improve an individual's well-being (Chen and Williams 2016). Being a long-term member of a religious community helps to develop longstanding close relationships and a sense of attachment, commitment and social supports (Krause and Wulff 2005).

Many pathways have also been proposed to explain the processes and mechanisms for how religious affiliation may help to promote physical health (McCullough and Willoughby 2009; Park et al. 2017; Koenig et al. 2012). First, religion helps to regulate conduct and promote a healthy lifestyle, including preventive health behaviors, which might be difficult to adhere to on one's own (Deaton and Stone 2013; Park et al. 2017). Second, religious participation is often linked with lower likelihood of engaging in risky behaviors, such as cigarette smoking, heavy alcoholic consumption, or substance abuse (Mendolia et al. 2019; Park et al. 2017). Third, by providing stress-coping skills for life difficulties as well as a sense of peace and value, religious practices may help to strengthen positive psychological status and reduce the stressful impacts on immune, endocrine, and cardiovascular functions (Holt et al. 2017; Li et al. 2016) and clinically contribute to better health outcomes (Koenig and Cohen 2002). Additionally, in some economically less-developed areas, religious organizations may help to provide direct help of primary care and health promotion education (Deaton and Stone 2013; Holt et al. 2018). In contemporary India, the health and education services provided by the religious networks are valued equally important (Iyer 2016).

### 2.2. Religion Background in China

Most of the existing studies about religion and health have been conducted in the Western social environments (Koenig and Shohaib 2014; Liu 2011). There is only a very small volume of literature focusing on social environment where the atheism is the social norm (Thege et al. 2013) and with various forms of religious regulation, which may bring stresses to the religious followers (McCullough and Willoughby 2009; Potter 2003; Wielander 2017; Yang 2006).

During the past decades, there has been a religious awakening in China (Chau 2010; Liu 2011; Liu 2013; Ying et al. 2017). The percentage of people claiming some type of religious practice was 7% in 2001, it then rose to 10% in 2012, and 26.4% in 2014 (Lu and Zhang 2016; Wenzel-Teuber 2017). Some residents in China seek help from religion due to social stresses, or the burden of chronic diseases of themselves or family members (Liang and Qi 2015; Zheng and Wang 2014; Zhou and Sun 2017).

There is a relatively small volume of studies about the relationship of religion, happiness and health in mainland China. Often, mixed results have been reported. Some reports focused on the association of religion and mental disorders among some subpopulation groups, such as rural women (Liu and Mencken 2010; Liu 2011; Wei and Liu 2013; Wang et al. 2015). More recent studies using nationally representative population samples found a positive relationship between religion and SWB in China (Chen and Williams 2016; He et al. 2016; Lu and Zhang 2016). Zhang et al. (2019) found that, regardless of affiliation with Buddhism or Protestantism, there is a significant positive association between religion and SWB among rural residents, whereas this association is insignificant among urban respondents.

Recently, using regional population samples in China, religious involvement has been found to be linked with a lower level of risky behaviors such as drinking (He et al. 2016) or smoking (Wang et al. 2015). We have not yet identified studies focusing on religion and health in China using representative national population samples.

Following the mainstream research findings in this field, we propose that the practice in China is not fundamentally different from the rest of the world. We set the hypothesis as follows:

**Hypothesis 1.** *There are positive associations between religious affiliation and self-reported health or happiness among the respondents in mainland China.*

### 3. Data Source and Sample

The data came from the 2007 Spiritual Life Study of Chinese Residents (SLSC), a national multi-stage probability sample of 7021 respondents in mainland China. A high-quality team of international scholars designed the questionnaire and managed to collect the data through face-to-face interview surveys (ARDA (Association of Religion Data Archives)). The SLSC dataset provides a set of high quality about the spiritual and religious life of Chinese residents and until now is still the only national representative survey with such rich information for understanding the practice of religion in China (Lu and Gao 2017; Zhang et al. 2019).

Using a multi-stage probability sampling method, SLSC sampled in order of metropolitan cities, towns, and administrative villages. Within each locale, the sampling followed the order of total neighborhood committees (government-defined collections of neighborhoods), community and household. A KISH grid procedure was used to randomly select one respondent from each household for a face-to-face in-home interview. Respondents needed to be 16 years of age or older, having lived at their current residence for at least three months, and not have done a survey within the past six months.

The final survey was administered in 56 locales throughout China, including three municipal cities (Beijing, Shanghai, Chongqing), six provincial capital cities (Guangzhou, Nanjing, Wuhan, Hefei, Xi'an, and Chengdu) 11 regional-level cities, 16 small towns, and 20 administrative villages. The dataset contained sampling weights to reflect the general population parameters in the 2006 Statistical Yearbook of China.

We only used observations indicated in the original dataset by the interviewers as 'reliable'. We excluded those who "had difficulty understanding the survey questions" ( $n = 562$ ), or refused to answer or felt it hard to speak about their religious beliefs ( $n = 113$ ), as well as observations with missing values of key variables ( $n = 79$ ). We also dropped observations in some small religious groups such as Islam, Daoism, Catholicism, and Confucianism. In total, 73 observations were deleted due to this operation. The final dataset contains 6194 valid responses, which accounts for 89% of the original dataset. The descriptive statistics of the sample dataset is reported in Table 1.

**Table 1.** Descriptive statistics of the sample.

Panel A: Key Variables							
Variables		Full Sample		Without Religion		With Religion	
		N	%	N	%	N	%
Subjective Well-Being Health	Very unhealthy	32	0.52	27	0.54	5	0.41
	Unhealthy	235	3.79	190	3.82	45	3.69
	So-so	627	10.12	504	10.13	123	10.09
	Healthy	2084	33.65	1703	34.23	381	31.26
	Very healthy	3216	51.92	2551	51.28	665	54.55
Happy	Very unhappy	22	0.36	21	0.42	1	0.08
	Unhappy	198	3.2	165	3.32	33	2.71
	So-so	949	15.32	771	15.5	178	14.6
	Happy	2947	47.58	2366	47.56	581	47.66
	Very happy	2078	33.55	1652	33.21	426	34.95
Religiosity							
1. With religion	Yes	1219	19.68				
2. Religious affiliation	Don't believe anything/Having no religion	4975	80.32				
	Buddhism	1068	17.24				
3. Importance of religion	Protestantism	151	2.44				
	Don't believe anything/Having no religion	4975	80.32				
	Very important	166	2.68				
	Somewhat important	558	9.01				
	Somewhat unimportant	1287	20.78				
4. Have you ever prayed?	Not important at all/Don't know	4183	67.53				
	Yes	681	10.99				
5. Regular Attendance	Yes	177	2.86				
Total		6194	100	4975	80.32	1219	19.68
Panel B: Demographic and Socioeconomic Characteristics							
Variables		Full Sample		Without Religion		With Religion	
		N	%	N	%	N	%
Gender	Male	2968	47.92	2496	50.17	472	38.72
	Female	3226	52.08	2479	49.83	747	61.28
6. Age *		39.87	(13.63)	39.83	(13.63)	40.18	(13.65)
	Youth (<22)	679	10.83	575	10.94	104	10.3
	Adult (23–59)	5142	82.05	4307	81.93	835	82.67
7. Marriage status	Senior (>=60)	446	7.12	375	7.13	71	7.03
	Married+ living together	5028	81.18	4029	80.98	999	81.95
	Divorced+ separated+ widowed	262	4.23	204	4.1	58	4.76
8. Ethnic group	Unmarried	914	14.59	742	14.91	162	13.29
	Han (yes)	5961	96.24	4795	96.38	1166	95.95
9. Residential types	City	3041	49.1	2468	49.61	573	47.01
	Town	1627	26.27	1294	26.01	333	27.32
	Rural	1526	24.64	1213	24.38	313	25.68
10. Education level	No schooling	235	3.79	176	3.54	59	4.84
	Elementary	707	11.41	538	10.81	169	13.86
	Junior middle school	2065	33.34	1647	33.11	418	34.29
	High school	2045	33.02	1656	33.29	389	31.91
11. Economic Status	College and above	1142	18.44	958	19.26	184	15.09
	Lower	721	11.64	585	11.76	136	11.16
	Middle	3899	62.95	3124	62.79	775	63.58
	Middle-high	1458	23.54	1169	23.5	289	23.71
12. Unemployed	High	116	1.87	97	1.95	19	1.56
	yes	338	5.46	272	5.47	66	5.41
13. Social capital	Yes	4353	70.28	3391	68.16	962	78.92
14. Regions in China	Beijing	244	3.94	209	4.2	35	2.87
	Shanghai	250	4.04	152	3.06	98	8.04
	East China	318	5.13	220	4.42	98	8.04
	South China	1009	16.29	734	14.75	275	22.56
	Central China	1230	19.86	1012	20.34	218	17.88
	North China	988	15.95	837	16.82	151	12.39
	Northwest	263	4.25	238	4.78	25	2.05
	Southwest	1005	16.23	824	16.56	181	14.85
	Northeast	887	14.32	749	15.06	138	11.32
Total		6194	100	4975	100	1219	100

Note: Age \* is a continuous variable. The means are reported and the standard deviations are in the parentheses.

## 4. Statistical Method

### 4.1. Propensity Score Matching (PSM) Method

This method was adopted in the present study to address concerns about the issue of self-selection in religion and health studies and to assess the treatment effects of religion on the health outcome. The propensity score is the probability that an individual belongs to a naturally occurring treatment

group, based on the individual's background characteristics. In the present study, the propensity score estimated is the probability of a respondent practicing religion, given his/her demographic and socioeconomic characteristics. The PSM model first estimates a respondent's propensity for religious practice, then matches the propensity scores of those with a religious affiliation (the treatment group) and those without a religious affiliation (the control group). Based on the matched propensity scores, the effects of religion on health or happiness are estimated by comparing the differences between the respondents with a religion and those without a religion (Chiswick and Mirtcheva 2013; Zotti et al. 2016). After matching the propensity scores, the practicing of a religion, the treatment, is randomly assigned. Hence, the religious group (treatment group) and non-religious group (control group) can be considered as being homogeneous with respects of all observable factors except religion (Chiswick and Mirtcheva 2013). The unobserved, confounding, and selection bias are mitigated in this way (Li 2013; West et al. 2008).

#### 4.2. Empirical Estimation Steps

Specifically, we estimate the following model of self-reported health (SRH):

$$SRH_i = \beta RELIGION_i + \delta X_i + \varepsilon_i \quad (1)$$

where  $SRH_i$  is tested with binary variables of "being very healthy" and "being very happy" respectively.  $RELIGION_i$  identifies whether an individual reports to have any religious affiliation, attend religious services, or ever practice praying.  $X_i$  is a vector of demographic and socioeconomic characteristics, including gender, age, marital status, economic variables and self-reported happiness.  $\varepsilon_i$  is an error term.

For the first step of the estimation, the probability of reporting a religious affiliation, the propensity score, then was estimated and predicted with the control variables contained in Vector  $X_i$ . Since the dependent variable, 'Being very-healthy', is a dummy variable with value of '0' or '1', we applied a binary logistic model to estimate the propensity score.

For the second step, the propensity score matching step, we adopted stratified matching technique, which generally produced unbiased results (Li 2013). The variances were estimated using bootstrapping techniques. To investigate the sensitivity of the model, we also tested matching methods such as nearest neighbor matching and radius matching. All analyses were performed in STATA 14 statistical package (Stata Corp LP, College Station, TX, USA).

### 5. Study Variables

#### 5.1. Dependent Variable

"Very Happy". The survey measures the happiness by asking respondents 'Do you feel happy about your life overall? Is it very happy, somewhat happy, somewhat unhappy, or very unhappy?' Responses to this question were ranked on a five-point scale from 1 (very unhappy) to 5 (very happy). Accordingly, we construct the dummy variable of "Very Happy", which is one of the dependent variables of the empirical estimation. About 33% of the respondents in the sample reported being "Very Happy".

"Very Healthy". The respondent's self-rated health (SRH) status is widely considered as a valid proxy for current health and a reliable predictor of future health outcomes, such as morbidity and mortality (Doane and Elliott 2016). The survey measures the physical health by asking respondents 'How is your overall health these days?' and responses to this question were ranked on a five-point scale from 1 (in very poor health) to 5 (in very good health). As shown in Table 1, in total more than 50% of the sample population reported themselves as "in very good health". We then constructed a dummy variable of Very Healthy if one's overall health was reported as "5". "Very Healthy" is another dependent variable of empirical estimation. We did not combine those reporting those reporting their overall health as a "4", because these two groups together account for about 80% of the sample size, therefore will not be able to meaningfully identify those who are in very good health.

## 5.2. Explanatory Variables

### 5.2.1. With Religion

It is identified by a question ‘Regardless of whether you have been to churches or temples, do you believe in a religion?’ We use a dummy variable to indicate whether a respondent identified himself/herself as having any religious affiliation or not (Chen and Williams 2016). In total, about 20% of the respondents reported that they had at least one religious affiliation.

### 5.2.2. Religious Affiliation

An interview question asked respondents to name their specific religious beliefs. Buddhism is the largest group and accounted for about 17% of the final sample population. Protestantism is the second largest one and account for about 2.44%.

### 5.2.3. Importance of Religion

An interview question asked respondents ‘Please tell me the importance of the following items in your life. Is it very important, somewhat important, somewhat unimportant, or not at all important?’ Religion is listed together with other items such as family, friends, entertainment, politics and career. The importance of religion is recorded with a four-point scale from 1 (very unimportant) to 4 (Not important at all). While it is usually difficult to measure intrinsic religiosity and there have been various methodologies (Hall et al. 2008; Liu and Koenig 2013), self-reported importance of religion is a valid proxy (Liu et al. 2011a, 2011b; Liu and Koenig 2013).

### 5.2.4. Frequency of Religious Attendance

Religious attendance as an important indicator of religiosity has been widely adopted (Bruce et al. 2017; Chiswick and Mirtcheva 2013; Hill et al. 2016; Li et al. 2016; VanderWeele et al. 2017). An interview question in this survey first asked respondents ‘Did you worship in a conventional religious setting (regardless of a temple or a church) during the past 12 months?’, then asked about the frequency as ‘regularly or occasionally’. We only identify respondents who have regular religious attendance. The base group is ‘have no or occasional religious attendance’.

### 5.2.5. Ever Practice Praying

An interview question asks ‘Do you ever pray? Have you ever tried to communicate with God or a certain supernatural power, asking for blessings and protection?’ A dummy variable was constructed accordingly.

### 5.2.6. Demographic and Socioeconomic Characteristics

The survey dataset contains information such as gender, age, ethnic group, marital status, education levels, employment status, household economic status, and residential areas in terms of city, town and rural. In the statistical estimation, we reclassified and formed three age groups: young adults (younger than 22-years old, the age of college graduation in China), adults (between 22 and 60 years old) and senior population (older than 60 years, the official retiring age in China).

## 6. Results

Table 1 reports the descriptive statistics of the dataset. The subsamples of with/without religious practices are formed according to the religious affiliations reported. Across the various demographic and socioeconomic variables, there is no overall significant difference between the subsamples, except for a 4% higher education level among the non-religious group and moderately more social capital among the religious group.



Tables 2 and 3 report the results from a binary probit regression analysis for self-reported health and happiness. Results in Column (1) of Table 2 indicate that the probabilities of reporting being very healthy are higher by 11.9 percentage points among respondents with some religious practice. Column (2) reports the results when specific religious affiliations, Buddhism and Protestantism, are disentangled. Results in Columns (3) and (4) report the results of testing “being very happy”.

Following the same pattern, Table 3 further tested other religious activities, such as Importance of Religion, Ever Practice Praying, as well as Regular Attendance.

**Table 2.** Association between self-reported health and religion (Binary probit regression).

	(1)	(2)	(3)	(4)
Dept. Var.	Very Healthy		Very Happy	
With Religion (Yes)	0.119 *** (0.042)		0.052 (0.044)	
Buddhism		0.113 ** (0.045)		0.021 (0.047)
Protestantism		0.154 (0.107)		0.257 ** (0.108)
Health			0.457 *** (0.028)	0.457 *** (0.028)
Male	0.091 *** (0.033)	0.091 *** (0.033)	−0.118 *** (0.035)	−0.116 *** (0.035)
Age (23–59) (Ref.)				
Age (<22)	−0.641 *** (0.070)	−0.641 *** (0.070)	0.449 *** (0.073)	0.450 *** (0.073)
Age (>= 60)	0.109 (0.070)	0.109 (0.070)	0.251 *** (0.070)	0.251 *** (0.070)
Married (Ref.)				
Divorced, separated, or widowed	−0.304 *** (0.062)	−0.304 *** (0.062)	0.251 *** (0.064)	0.250 *** (0.064)
Unmarried	−0.283 *** (0.102)	−0.283 *** (0.102)	−0.163 (0.118)	−0.162 (0.118)
Edu_level	0.087 *** (0.019)	0.087 *** (0.019)	0.051 ** (0.021)	0.051 ** (0.021)
Economic status	0.125 *** (0.028)	0.125 *** (0.028)	0.267 *** (0.029)	0.268 *** (0.029)
City (Ref.)				
Town	0.339 *** (0.042)	0.339 *** (0.042)	0.251 *** (0.045)	0.252 *** (0.045)
Rural	0.211 *** (0.048)	0.211 *** (0.048)	0.155 *** (0.052)	0.153 *** (0.052)
Unemployed	−0.051 (0.074)	−0.051 (0.074)	0.040 (0.080)	0.038 (0.080)
Beijing (Ref.)				
Shanghai	−0.457 *** (0.118)	−0.455 *** (0.118)	−0.817 *** (0.139)	−0.804 *** (0.139)
East China	−0.378 *** (0.111)	−0.376 *** (0.112)	−0.610 *** (0.119)	−0.601 *** (0.120)
South China	0.157 (0.098)	0.158 (0.099)	−0.036 (0.101)	−0.028 (0.101)
Central China	−0.032 (0.093)	−0.031 (0.093)	−0.095 (0.096)	−0.089 (0.096)
North China	0.161 * (0.093)	0.161 * (0.093)	0.060 (0.096)	0.064 (0.096)
Northwest	−0.251 ** (0.116)	−0.251 ** (0.116)	−0.545 *** (0.125)	−0.542 *** (0.125)
Southwest	−0.268 *** (0.095)	−0.266 *** (0.095)	−0.446 *** (0.099)	−0.437 *** (0.099)
Northeast	−0.105 (0.096)	−0.104 (0.096)	−0.285 *** (0.101)	−0.283 *** (0.101)
Constant	−0.376 *** (0.134)	−0.378 *** (0.134)	−3.330 *** (0.186)	−3.340 *** (0.186)
Pseudo R <sup>2</sup>	0.0599	0.0599	0.1149	0.1154
Observations	6194	6194	6194	6194

Note: (1) marginal effects are reported in this table; (2) Robust Standard error reported in parentheses; \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

**Table 3.** Association between health and religious activities (Binary probit regression).

Panel A: Self-Reported Health			
	(1)	(2)	(3)
Variables	Very Healthy	Very Healthy	Very Healthy
Religion very important	0.276 *** (0.104)		
Ever Practice praying		0.018 (0.054)	
Regular Attendance			−0.028 (0.097)
Constant	−0.364 *** (0.134)	−0.353 *** (0.134)	−0.349 *** (0.134)
Pseudo R <sup>2</sup>	0.0598	0.0590	0.0590
Observations	6194	6194	6194
Panel B: Self-Reported Happiness			
	(1)	(2)	(3)
Variables	Very Happy	Very Happy	Very Happy
Religion very important	0.240 ** (0.102)		
Ever Practice praying		0.125 ** (0.057)	
Regular Attendance			0.207 ** (0.103)
Constant	−3.326 *** (0.186)	−3.343 *** (0.187)	−3.325 *** (0.186)
Pseudo R <sup>2</sup>	0.1153	0.1153	0.1152
Observations	6194	6194	6194

Note: (1) Not reported though, all estimations in Table 3 included the same control variables as in Table 2 and the estimate results are similar; (2) Standard error reported in parentheses; \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

Panel A of Table 4 reports average treatment effects (ATEs) of religion on reporting being Very Healthy and being Very Happy, estimated by PSM method, using various measurement of religiosity. As reported in Table 4, we found generally positive and robust effects of religious affiliation on health. Respondents with religious practices are on average 5.2% ( $p < 0.01$ ) more likely to report being very healthy. Buddhists and Protestants are 3.6% ( $p < 0.05$ ) and 9.6% ( $p < 0.05$ ) respectively more likely to report being very healthy. While the high importance of religion has the strongest effects of 16.2% ( $p < 0.01$ ), the estimated effects of “Ever practice praying” or “Regular religious attendance” are insignificant.

Panel B of Table 4 reports average treatment effects (ATEs) of religion on reporting being Very Happy, estimated by PSM method. While Buddhists are not significantly happier, Protestants are 17% ( $p < 0.01$ ) more likely to report being very happy. High importance of religion also has a strong effect of 13.4% ( $p < 0.01$ ). While the estimated effects of “Ever practice praying” is still insignificant, “Regular religious attendance” has significant effect of 11.3%.

Although not reported here, we performed a robustness check by applying nearest neighbor matching and radius matching of propensity scores. Very similar results were obtained from these tests.



**Table 4.** Results estimated by propensity score matching: average treatment effects (ATEs) of religion on self-reported health and happiness.

Panel A: Dept. Var. = Being Very Healthy						
Variables	(1)	(2)	(3)	(4)	(5)	(6)
With Religion	0.052 *** (0.017)					
Buddhism		0.036 ** (0.017)				
Protestantism			0.096 ** (0.045)			
Religion very important				0.162 *** (0.042)		
Ever practice praying					0.014 (0.028)	
Regular Attendance						0.032 (0.059)
Observations	6194	6194	6194	6194	6194	6194
Panel B: Dept. Var. = Being very happy						
Variables	(1)	(2)	(3)	(4)	(5)	(6)
With Religion	0.017 (0.016)					
Buddhism		−0.003 (0.018)				
Protestantism			0.170 *** (0.054)			
Religion very important				0.134 *** (0.051)		
Ever practice praying					0.028 (0.022)	
Regular Attendance						0.113 ** (0.056)
Observations	6194	6194	6194	6194	6194	6194

Note: (1) Marginal effects reported; Not reported though, all variables in Table 2 were included in the estimation when PSM method was applied; (2) Standard error reported in parentheses; \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ ; (3)  $R^2$  is not reported by the PSM method.

## 7. Discussion

Reducing Self-selection bias. The findings by binary probit regression and by the PSM method are consistent overall, and the discrepancy of the size of the effects indicates signs of selection bias. First, the sizes of the estimated effects by PSM are smaller than those by binary probit regression. This phenomenon is because the PSM method helps to control potential self-selection issues, which may inflate the effects of religion estimated by traditional probit model. Second, the coefficients of the Protestantism are insignificant when estimated by the binary probit regression method, however, the average treatment effects (ATEs) of religion on health estimated by the PSM method are highly significant. This discrepancy can be explained by the self-selection issue of practicing Protestantism in China. Protestantism especially reaches out to help the bottom class, people in poverty or disease. Many people in China turn to Protestantism due to social stresses, chronic disease burdens on themselves or family members. Subject to the self-selection bias, the probit regression method reflects the association of poor health status and Protestantism as a group. However, the PSM method has helped to alleviate the self-selection issue and reports significant effects of Protestantism both on being very health and very happy.

Religiosity. Our findings support the overall hypothesis that religiosity (as determined by having religious beliefs, affiliation with Buddhism or Protestantism, holding that religion has high importance

in life) has significant moderating effects on self-reported health statuses of “Very Healthy” and “Very Happy”. The strong and consistent health effects of Buddhism may be due to the mechanism of the healthy lifestyle, e.g., vegetarianism, it strictly advocates (Wang et al. 2015; He et al. 2016). The present study cannot perform any further robustness check with the sample, because the SLSC survey contains no questions about health behavior or lifestyle.

We have noticed that Buddhists are not significantly more likely to report being “Very Happy”. This phenomenon may be related to the philosophy of Buddhism, which values tranquility, or peace of mind, rather than “feel ecstatic”, or “extremely happy”.

**Religious attendance.** Regular attendance at religious events has no significant effects on self-reported health, but a significant and large effect on reporting being very happy. In western countries, the religions are congregational and the effects of church attendance on health may be mediated in part by a healthy lifestyle, social cohesion or mitigating stress (Koenig 2012; Bruce et al. 2017; Gillum et al. 2008; Holt et al. 2017). Since in present study, the Protestants only account for 2.44% of the sample size, the potential effects of church attendance cannot be captured significantly. Chinese temples are primarily physical places for individual religious practices rather than as congregational communities (Liu 2011; Stark 2004). Meanwhile, the psychosocial effects of religion may not be strong enough to promote health directly, however, it can still be effective enough to significantly promote the SWB of the respondents (Green and Elliott 2010; Morton et al. 2017), together with social capital effects (Holt et al. 2015), or improved sense of social status (Chen and Williams 2016).

**Practice of prayer.** In the present study, we found no significant association between the practice of prayer and health or happiness status. However, these findings are inconclusive due to the limitations of the survey question, which asked “Have you ever practiced praying?”, including no information about the frequency of the practice. Therefore, the effects captured by this question are lacking explaining power.

## 8. Limitation

While the PSM method is regarded as a valid alternative approach of randomization when applied appropriately to address Self-selection concerns, the PSM method also has its limitations. First, as a non-parametric method, the PSM has no test statistics and the bootstrapped variance is not fully justified (Ross et al. 2015). Therefore, one should be cautious when drawing statistical inferences from the PSM (Imbens 2004).

Second, the PSM estimated effects of religion reported in the present study is still subject to the omitted variable bias (Heckman et al. 1998). There are actually various factors (e.g., personality characteristics and pre-conditions) affecting a person’s religious beliefs. Self-reported health may also be affected by omitted variables such as psychosocial environment, individual lifestyle or risky health behaviors (Morton et al. 2017).

Third, some data information may be lost during the process of propensity score matching. When the score matching is unable to find suitable matches for all observations, some data in the sample may be excluded in the estimation, hence a small bias may occur (Ross et al. 2015).

Forth, the quality of the survey data may bias the results estimated by the PSM method (Li 2013; West et al. 2008). There may be measurement errors and nonrandom missing values in the dataset. Some respondents surveyed might not report their religious beliefs or behaviors honestly because atheism is still the social norm in Mainland China and they might be afraid of regulations regarding religious practices (Lu and Zhang 2016; Wenzel-Teuber 2017). Additionally, some respondents may not understand the definition of religion correctly (Liu 2013), and hence they did not answer the survey correctly.

## 9. Conclusions

Applying the PSM method to address potential self-selection concerns, the present study found that religious involvement in mainland China has an overall consistent and positive effect on self-reported

health and happiness. These positive effects on both health and happiness are especially strong among those who identified themselves as Protestants and those who regard religion as holding a high importance in life. Those associated with Buddhism in China tend to report being healthier, but not any higher level of happiness. This phenomenon may be related to the philosophy and doctrines of Protestantism and Buddhism respectively.

Being different from the findings in Western cultures, frequent religious attendance among Chinese respondents was found to have no significant effects on physical health, but are significant with regard to happiness. Having ever practiced praying or not has no associations or effects using either probit regression or the PSM method.

Meanwhile, the relationship between religion and health is still a complex topic under the context of the social and culture environment of China. In the future, studies with experimental design that can collect more information about respondents' life style and personality, may be better able to address the self-selection or omitted variable bias, and hence provide a better understanding about the mechanism between religion and health in China.

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