



Do mountains move faith? ☆

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ABSTRACT

This study investigates the relationship between exposure to the 2005 earthquake in Pakistan and religiosity. We use detailed information on 19,340 Pakistani individuals, including time devoted to religious activities and the intensity of the damage generated by the earthquake, to analyze how religiosity is related to earthquake exposure. Our key finding is that exposure to the earthquake positively correlates with religiosity. This finding supports the religious coping hypothesis that individuals enhance religiosity following an extreme event. We also observe that the strength of religious coping varies with education and age. Additionally, men and women differ regarding the relationship between exposure to the earthquake and religiosity. Finally, we find that being affected by the earthquake is associated with higher social and individual religiosity.

1. Introduction

Natural disasters can influence the behavior of individuals in many ways, affecting social preferences (Conzo, 2018), time preferences (Cassar et al., 2017), and risk-taking behavior (Cameron and Shah, 2015). A natural disaster experience can also influence religiosity. According to the “religious coping” hypothesis (Pargament, 1997; Pargament et al., 2000), individuals can react to natural disasters by increasing their religiosity to cope with these events through the comfort found in religious practices. They may seek spiritual support and meaning after unpredictable and unbearable events. Conversely, the “shattered assumptions” hypothesis predicts that traumatic events can reduce religiosity by shattering victims’ views about themselves and their world (Janoff-Bulman, 2002; de Castella and Simmonds, 2013).

The “religious coping” hypothesis has found some support in the literature. In a worldwide study, Bentzen (2019) shows that people become more religious experiencing earthquakes. Sibley and Bulbulia (2012) investigate the effects of the 2011 earthquake in Christchurch, finding that residents of the affected region became more religious after the event; in contrast, the religiosity of the rest of the New Zealand

population decreased over the same period.¹ A well-known historical example of an earthquake’s positive influence is the Pentecostal movement’s substantial rise following the San Francisco earthquake in 1906 (Hough, 2005; Winchester, 2005).

This paper investigates the relationship between exposure to the 2005 earthquake in Pakistan and religiosity, which occurred on the October 8, 2005, 100 km northeast of Islamabad, the capital city of Pakistan. The earthquake measured 7.6 on the Richter magnitude scale and is considered the deadliest earthquake to hit South Asia since 1935, with an official death toll of 87,350. It caused massive destruction in northern Pakistan, leaving an estimated 4 million people homeless.

The timing of the natural disaster just before the beginning of the winter also contributed to its detrimental effects; hence, this earthquake was an extreme natural disaster in the lifetime of the Pakistani population. Furthermore, compared to other events like seasonal storms, which can be forecast, earthquakes are unpredictable disasters and are entirely exogenous to religiosity or any other social phenomena. This earthquake, therefore, provides the opportunity to study the influence of natural disasters on religiosity as a natural experiment.

It must be stressed that the earthquake occurred during an electoral

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¹ Related to our question, Cesur et al. (2018) consider the influence of military deployments on religiosity, finding support for the “religious coping” hypothesis.

year in Pakistan, which raises the question of whether major political changes occurred at the same time or even whether such changes occurred because of the earthquake; however, significant political changes did not occur in 2005 in Pakistan. Elections were held in August and October 2005, and President Musharraf's party remained in power. Furthermore, Pakistan's main religious parties, Jamat-e-Islami and Jamiat Ulema-i-Islam, actively participated in the relief activities in earthquake-hit areas, providing enormous aid to obtain electoral support in the upcoming national elections. These activities may have affected the religiosity patterns of people, i.e., earthquake survivors may attend religious services more frequently to please religious leaders and receive more material aid.

To address the relationship between exposure to earthquakes and religiosity, we use the Pakistan Time Use Survey (PTUS), which contains detailed information on individuals' time use and socio-demographic indicators. This dataset allows measuring religiosity through the time devoted to religious activities; thus, we can assess the religiosity of individuals. We decompose this time for religious activities into two subcomponents: the time used for individual religious practices and meditation and the time used for participating in religious activities; therefore, we have information about individual and social religiosity.

Our paper contributes to the literature on the impact of natural disasters on religiosity.² Bentzen (2019) analyses the effect of earthquake risk on religiosity for a large sample of individuals in 96 countries. Religiosity is measured through six variables, which are all dummy variables, except attendance at religious services. Earthquake risk is measured in the district where the individual lives. In the first part, the paper links the earthquake risk in a specific district to people's religiosity at the individual level. Recent earthquakes are controlled so that the investigation can focus on the long-term effects of earthquake risk. Bentzen (2019) finds that higher earthquake risk in a district leads to higher religiosity. In the second part, the author performs an event study to check if a change in the earthquakes (the number of earthquakes that hit) between interview waves changes religiosity at the district level, observing a positive impact on religiosity. This current study relates to the second part of Bentzen (2019) since we investigate how religiosity changed after an earthquake.

Unlike Bentzen (2019), our investigation then presents four contributions. First, our focus on the 2005 earthquake in Pakistan provides information about the impact of natural disasters in this very populated Muslim country in South Asia, while Bentzen (2019)'s work provides a worldwide analysis; her results can vary from one country to another and one religion to another. Therefore, to the best of our knowledge, this is the first study to analyze the effect of natural disasters on religiosity in a developing country with a Muslim majority. Second, we run estimations at the individual level, not the district level. Namely, we investigate whether individuals specifically affected by the earthquake have changed their religiosity. Therefore, we can better identify the influence of natural disasters on individuals, and we can control for their individual characteristics. Third, we have better measures for religiosity and earthquake exposure, allowing better identification of the relationship. Exposure to earthquakes is considered through two variables to consider the intensity of exposure. Religiosity is measured by the time devoted to religious activities, which provides precise information for the individual level of religiosity compared to binary measures like information on whether people go weekly to the mosque or pray at least once daily. Fourth, we compare the influence of the natural disaster on the individual and social religiosity of those exposed to a great earthquake. A natural disaster may affect individual and social religiosity differently. The role of social religiosity is of grave importance in resilience following an earthquake; however, this dimension has been relatively unexplored in the extant literature.

The paper proceeds as follows. Section 2 presents the literature

review, Section 3 displays the data and methodology, Section 4 reports the results, and Section 5 concludes.

2. Literature review

2.1. Disasters

Many studies exist on definitions of disasters, often having similarities but differing based on discipline, a multidisciplinary term. What constitutes a disaster, and what conditions may arise from a disaster? Social scientists argue that disasters should be seen as agents of social change (Quarantelli, 1988), as individuals exposed to disasters become traumatized (Dynes and Quarantelli, 1992). According to Quarantelli (2000), a disaster is an event that entails five key elements, with the two most significant being a sudden event and a severe disturbance in the practices of exposed units. In a related way, Alexander (2005) describes disaster as an event with ever-changing socio-economic consequences.

2.2. Historical origins of the perception of disasters

Historical perceptions of the origin of disasters play a vital role in coping mechanisms. The disaster response depends on how individuals perceive the particular disaster. For example, if the origin of the disaster were considered a supernatural force, religious measures would be taken to cope with the resulting hardships; however, for human-made disasters, coping strategies focusing more on technological aspects are adopted (Quarantelli, 2000).

Religions play an essential role in understanding the natural environment for individuals; for a long time worldwide, religious people have considered a wide range of natural events as sources of punishment or favor from God. Religious scriptures describe many stories of God's power, wrath, and favor in the form of natural phenomena. Dynes and Yutzy (1965) document the relationship between religion and disasters. Disaster-related stories are present in the scriptures of monotheist religions (Judaism, Christianity, and Islam) (Dynes, 2003) and the Hindu and Buddhist scriptures, indicating the global relevance of religious perspectives on disasters. Before enlightenment, most people believed that natural disasters were messages from God. Conversely, in modern secular societies, e.g., in Western Europe, most people believe in scientific explanations of natural disasters; however, we still observe that religion plays a significant role in some societies against the secularization hypothesis. In many developing countries, people in rural areas still trust superstition more than the scientific method. For example, in Ache, Indonesia, students' perceived that the earthquake and tsunami in 2004 were a punishment from God; their perceptions could not be changed, even with large-scale disaster education (Adiyoso and Kane-gae, 2012).

Religions contribute toward environmental understanding (White, 1967) and offer collective responses to social challenges as social institutions (Quarantelli, 2000). Watson and Kochore (2012) explain that in some Muslim and Christian groups, environmental challenges like droughts result from sins and defiance from cultural traditions leading to God's displeasure. We can also observe such examples in recent times; in 2009, post-election violence resulted in many casualties in Kenya, and Christian preachers associated drought with divine anger over violence (Taylor, 2011). Muslims from Mali exposed to forest desiccation and droughts believe that the natural environment is under God's control, who changes it seasonally according to his plan. Sometimes, individuals' sins and corrupt practices bring God's punishments, e.g., environmental hardships (Bell, 2014). Hindus in India believe God's anger relates to less water flow from glaciers into the Ganga river (Drew, 2012).

Moreover, individual, household, community, and country-level characteristics also matter for religious tendency. It must particularly be stressed that age and income are significant drivers of religiosity. Higher priority is given to religion by poorer people from developing countries living with a high risk of natural disasters; however, certain

² See Iyer (2016) for a recent survey on the economics of religion.

segments, particularly the elderly, even within rich countries, may feel vulnerable to various shocks like personal mishaps, natural and human-made disasters, and economic crises (Norris and Inglehart, 2011). Earlier studies documented post-disaster responses of exposed agents (Quarantelli and Dynes, 1977; Drabek, 1986; Tierney, 1995; Tierney et al., 2001; Rodriguez et al., 2007).

2.3. Religious coping with natural and human-made disasters

Natural and human-made disasters and their aftermath impact survivors' well-being. Exposed individuals may show various physical and mental health problems. In psychology, a strand of literature focuses on the relationship between disasters and health outcomes, like post-traumatic stress disorder (PTSD), which is an illness that commonly appears after traumatic events. Individuals exposed to more lethal disasters report higher levels of psychological distress. Many studies reported a positive association between PTSD and the severity of exposure to disasters (Adeola and Francis, 2009; Abramson et al., 2008; DeSalvo et al., 2007; Tak et al., 2007; Kessler et al., 2006; Lamberg, 2006; Galea et al., 2005; Goenjian et al., 2001).

Goenjian et al. (1994) examined PTSD among adults after an earthquake in Armenia, showing an increase in PTSD caused by the loss of family members. Following an earthquake in Turkey, Kiliç, Özgüven, and Sayil (2003) document a positive association between PTSD in children and depression in fathers. More likelihood of health problems was reported by those who suffered the loss of a family member, property, and livelihood after the tsunami in the Indian Ocean (Van Griensven et al., 2006). The extant literature suggests a range of coping strategies to reduce the impact of stressful events. This paper exclusively focuses on individuals' religious coping with disasters, which is the process by which individuals exposed to traumatic events try to manage adverse effects through religious activities. For Christian and Muslims, effective ways to appease God to obtain favor or cope with environmental-related punishments from divine forces include various religious interventions, prayers, fasting, ritualized recitation of the Quran, and sacrificing animals (Bell, 2014; Nita, 2013).

Aten et al. (2019) manifested the positive association between religious coping and disaster through the systematic review of the extant empirical literature on religion and disasters. García et al. (2017) show that positive religious coping leads to an increase in post-traumatic growth (PTG), whereas negative religious coping is related to an increase in post-traumatic symptoms. Baral and Bhagawati (2019) indicate negative religious coping and PTSD growth among individuals in the aftermath of an earthquake in Nepal. Henslee et al. (2015) highlight the role of religious coping in dealing with traumatic events (natural disasters), indicating a negative association between religious coping and PTSD during Hurricane Katrina among Mississippi residents. Additionally, landslide survivors draw on higher religious coping, leading to better well-being (Chen et al., 2019). Positive religious coping contributed to PTG, and negative religious coping was associated with higher post-disaster stress among Hurricane Katrina survivors (Chan and Rhodes, 2013). Hurricane Matthew survivors' spiritual fortitude is related to higher religious coping, which leads to post-disaster well-being (McElroy-Heltzel et al., 2018). García et al. (2014) report the significant impact of religious coping on PTG among survivors who lost their homes in 2010 due to an earthquake in Chile.

Furthermore, studies on health and religious coping show that mental health indicators (general mental health and PTSD) are strongly associated with variations in religious attitudes. According to Hvidt et al. (2017), religion has two opposite forces. First, there can be a positive association between religiosity and health outcomes, e.g., religious institutions are of grave importance, given that these institutions often offer various types of support in the form of food, counseling, and shelter to trauma survivors. For example, Bryant and Wong (2013) document the role of religious and spiritual coping strategies among interpersonal trauma survivors (war, child abuse, intimate partner

violence, sexual assault, and community violence). Their review of earlier studies illustrated the recovery process among trauma survivors of diverse faith traditions. Second, the opposite force relies on the fact that bad health can move faith. For example, data on 3000 young Danish twins (secular population) demonstrated the dominance of spiritual force.

Multiple factors may affect patterns in religious coping. Billig (2013) shows various measures like boosting faith (devotion to religious practices, i.e., prayers), ideological meaning, assistance from religious leadership, mutual assistance, and support from neighbors and community members helped to cope with security threats and fears of terrorist attacks. Jewish settlers' decisions to stay in the Gaza region (no longer a haven due to security issues) were associated with gender, time length of stay, high home attachment, intense religious faith, and low-risk perception of their security situation (Billig, 2006). Similarly, Billig et al. (2006) explained that emotional distress among settlers in the Gaza strip is linked to the female gender, years of education, worse perceived health situations, high-risk perception, poor religious coping, and absence of family outside the territories for the help in case of emergency.

2.4. Gender differences and Islamic religious practices

The extant literature suggests gender differences exist in religiosity and vary by religion and country due to social and cultural norms (Freese, 2004; Freese and Montgomery, 2007; Sullins, 2006). Men may show more or less religiosity than women, conditional to the religious context.

A few words must be said to explain the specific practices of Islam, a monotheistic religion with the Quran (words of Allah sent to the Prophet Muhammad) and Hadith (the saying of the Prophet Muhammad) as the primary sources of Islamic theology. The five obligatory acts (tenets of Islam) are i) Shahada: acknowledgment of single divine authority, i.e., first, Allah is the only one true God and no other gods, second Muhammad is the messenger of Allah; ii) Salat: to offer daily prayers five times; iii) Zakat: to give charity based on resources in possession each year; iv) Sawm: keeping fasts during the holy month of Ramadan; v) Hajj: a pilgrimage to Mecca for every Muslim is obligatory at least once in a lifetime, subject to physical and financial capability. Thus Islam is a faith tradition oriented by prescribed practices.

According to Prophet Muhammad (hadith), unlike men, women do not need to offer prayer in a mosque. In Islam, women are encouraged to pray at home instead of in a mosque due to motherhood and femininity; however, women are permitted to pray at a mosque as Prophet Muhammad said, "do not prevent the female servants of Allah from mosques."

Muslim men and women show comparable levels of religiousness related to religious commitment, except for mosque attendance. Hackett et al. (2016) show that in line with Islamic norms, Muslim men attend religious services at mosques more frequently than women. In other words, Muslim men appear more religious than women regarding only one measure of religiosity, i.e., social religiosity.

2.5. Religious coping with disasters in the context of Islam

Disasters accentuate the role of religion. Individuals likely turn to religious activities to cope with crises to seek comfort and relief. How do Muslims cope with disasters? In Islam, there are three potential explanations for natural disasters: i) punishment from God, ii) a warning for wrongdoers, or iii) a trial for believers.

The Quran emphasizes three ways to cope with natural disasters: piety, repentance, and patience. Religious coping is well described in Quran. For example, Quran verses explain that "Whenever someone is touched by hardship, they cry out to us, whether lying on their side, sitting, or standing" (Al Quran 10:12), and when touched with evil, they make endless prayer for good (Al Quran 41:51). Prayer is pivotal to

Muslims, and the Quran encourages believers to seek comfort through prayer. The second chapter of the Quran states that to seek comfort through prayer: “And seek help through patience and prayer. Indeed, it is burden except for the humble” (Al Quran 2:45), “O believers! seek comfort in patience and prayer. Allah is truly with those who are patient” (Al Quran 2:153).

The term “earthquake” appears directly and indirectly in the Quran, with an entire chapter focused on earthquakes. Surah 99 begins with the beginning of the end and is devoted to the final earthquake (a sign of the day of resurrection or the start of the journey to heaven or hell). It is worth mentioning that an earthquake would differ from the usual earthquakes, which are limited in space. With the final earthquake, the earth will be shaken to its utmost intensity everywhere, leading to Judgment day. The word “zilzala” is added to describe the incredible intensity of the final earthquake.

Given the role of religion as a social institution, religious practices, and coping in Islam, it is vital to mention Pakistan’s origin and background. Pakistan came into existence in 1947, following the British Indian partition, based on religion, which divided the area into India (a country with a Hindu majority) and Pakistan (a country with a Muslim majority). In Pakistan, people face various risks, i.e., droughts, floods, storms, earthquakes, famines, and epidemics. Norris and Inglehart (2011) suggest that more insecure people seek security from prayer, and there is an increase in religiosity among Pakistanis following exposure to disasters.

To summarize, in general, religious coping is predominant among coping strategies. In particular, the Quran explains that comfort follows hardships, rewards will be granted for patience, and hard times are a trial for believers. Moreover, the Quran inspires Muslims to seek comfort through prayer and reading the Quran when facing vulnerabilities.

3. Data and methodology

We use data from the PTUS, a survey of Pakistani households conducted by the Pakistan Bureau of Statistics (PBS) in 2007. The PTUS provides information on key variables like age, education, marital status, the gender of selected individuals, household location (urban vs. rural area), and income. The salient feature of PTUS is the collection of information, from a socio-economic perspective, on round-the-clock activities (24 h starting from 4.00 a.m. of the previous day to 4.00 a.m. of the interview day) of the respondents. The 24 h are divided into 48 slots using 30 min intervals. For each 30-min slot, several activities are encoded. Two respondents were selected for diary information from each surveyed household, and each individual mentioned the time used in performing different activities.

The survey includes two particular questions on religiosity. Keeping in view the objective and scope of the study, we focus on time used for “participating in religious activities” and “individual religious practice and meditation.” Our key variable, *Religiosity*, measures an individual’s religiosity level by the sum of time spent participating in religious activities and individual religious practice and meditation in minutes per day.

From a religious perspective, Pakistan is a very homogenous country, with the overwhelming majority of Pakistanis being Muslim Sunnis. According to the PBS for 2013,³ 96.28 percent of Pakistanis are Muslim. The percentage varies from 91.31 percent in Sindh to 99.44 percent in Khyber Pakhtunkhwa province. About 90 percent of Muslims are Sunnis, while Shias represent about 5 percent of Muslims. Hindus and Christians mainly represent the rest of the population, with minimal shares.

The PTUS provides the opportunity to investigate the earthquake episode and provides households with information on damage caused by the earthquake. The PTUS asked individuals, “Did this household suffer any damage to its dwelling in the earthquake of October 2005?” The

responses were coded on a scale from 1 to 4 for “completely damaged,” “partially damaged,” “not affected,” and “not applicable,” respectively. We exclude all the observations with a “not applicable” answer.⁴

We create two dummy variables to measure the intensity of the damage caused by the earthquake. We generate the variable *Completely damaged* and code it as 1 if the response is “completely damaged” and 0 otherwise. We further create the variable *Damaged*, which is equal to 1 if the respondent answers “completely damaged” or “partially damaged” and 0 otherwise.

We include several individual-level control variables. *Age* represents the respondent’s age in years. We also consider *Age*² to test a possible nonlinear relationship between age and religiosity. *Education* is the highest class that the individual has passed.⁵ The marital situation is measured with a dummy variable equal to one if the respondent is married or living with a partner (*Married*).

We control for the income at the household level, following evidence that income affects religiosity at this level (Buser, 2015). It is an ordinal variable ranging from 1 to 10 for different income ranges. If the income is up to 2000 Pakistani Rupees (PKR), it is coded as 1; if income is 10,001 PKR or more, then indicated by 10. We control for household size using the number of household members. For the location of the household (rural or urban areas), the dummy variable equals one if the household lives in a rural area and zero otherwise. We also control for the type of dwelling: pucca (solid), kutchra (non-solid), mix pucca and kutchra (semi-solid), wood/bamboo, and other.⁶

After excluding the observations on which information is unavailable, we have 19,340 observations on all the analysis variables. Table 1 presents the descriptive statistics of all the variables used in different specifications, and Appendix II provides descriptions of the variables.

Table 1
Descriptive statistics.

	Obs	Mean	Std. Dev.	Min	Max
Religiosity	19,340	87.32	91.89	0	1200
Individual religiosity	19,340	68.93	82.86	0	1200
Social religiosity	19,340	18.39	44.64	0	900
Completely damaged	17,133	0.02	0.13	0	1
Damaged	19,340	0.13	0.34	0	1
Age	19,340	31.15	16.95	10	99
Age ²	19,340	1257.90	1361.45	100	9801
Male	19,340	0.47	0.50	0	1
Education	19,340	2.69	1.83	1	7
Married	19,340	0.56	0.50	0	1
Household income	19,340	6.63	2.79	1	10
Household size	19,340	7.09	3.50	1	44
Rural area	19,340	0.60	0.49	0	1
<i>Type of dwelling</i>					
Pucca (solid)	19,340	0.56	0.50	0	1
Kutchra (non-solid)	19,340	0.25	0.43	0	1
Mix pucca and kutchra (semi-solid)	19,340	0.18	0.39	0	1
Wood/bamboo	19,340	0.00	0.04	0	1
Other	19,340	0.01	0.08	0	1
<i>Instrumental variable</i>					
Distance from the epicenter (log)	19,340	5.68	0.75	3.75	8.15

Note: This table provides descriptive statistics for the variables used in the estimations. Definitions of variables are provided in Appendix II.

⁴ There were 17,837 observations with « not applicable ».

⁵ Since education can be endogenous, we also performed all estimations without this variable. The conclusions remain the same.

⁶ The results are confirmed by using province fixed effects in the estimations.

³ <http://www.pbs.gov.pk/content/population-religion>.

Our objective is to investigate whether religious practices are affected by exposure to an earthquake. The implicit assumption is that there would be no difference in individuals' religious practices without exposure to an earthquake. To compare the religious practices of the individuals from damaged versus undamaged dwellings, we estimate the following baseline regression:

$$\text{Religiosity}_i = \beta_0 + \beta_1 \text{Exposure to earthquake} + \beta_2 \text{Individual Control variables} + \beta_3 \text{Household Control variables} + \varepsilon_i \quad (1)$$

In equation (1), the variable for exposure to an earthquake is alternatively *Completely damaged* or *Damaged*. Control variables are as described above. Individual-level control variables are age, age squared, gender, education, and marital status. Household level control variables are household income, household size, location (rural area), and type of dwelling. We test several sets of control variables in the estimations. The coefficient β_1 measures the impact of an earthquake on religiosity for the individuals whose dwelling was devastated by an earthquake, and ε is a random error term. All the specifications include robust standard errors clustered at the household level.

4. Results

This section presents our results for the influence of an earthquake on religiosity. We start with the primary estimations and then consider the influence of individual characteristics on the relationship. We finally test the possibility of a differentiated impact on individual and social religiosity.

4.1. Main estimations

We investigate the earthquake can impact religiosity. We consider the two indicators alternatively to assess whether an individual's dwelling was damaged; thus, we can check how the intensity of the exposure to an earthquake matters for the relationship between this exposure and religiosity. Table 2 presents the results with *Completely damaged*, and Table 3 presents those with *Damaged*.

We consider four specifications in Tables 2 and 3, based on the inclusion of different control variables. We can then assess our results' sensitivity to the control variables. In column (1), we include all individual-level variables. We then gradually add *Household income* and *Household size* in column (2), *Rural area* in column (3), and *Type of dwelling* in column (4), which thus reports the specification with all control variables.

We find that *Completely damaged* and *Damaged* are positively related to religiosity. The estimated coefficient is significant in all tested specifications. Therefore, our main conclusion is that exposure to an earthquake is positively associated with an individual's religiosity. This finding is in line with the religious coping hypothesis: individuals react to an earthquake by increasing their religiosity as they cope with this traumatic event through the comfort of religious practices. It accords with the former results from Sibley and Bulbulia (2012) for New Zealand and those from Bentzen (2019) on a worldwide panel.

Another significant result concerns the observation that the intensity of the exposure matters for the change in religiosity. The coefficients are higher with *Completely damaged* than with *Damaged* in all specifications. In the specification with all control variables, we observe that the coefficient is 66.524 for *Completely damaged* and 45.493 for *Damaged*. This finding suggests that exposure to an earthquake is not binary in the sense that this exposure would affect religiosity, whatever its intensity; hence, more destructive earthquakes increase religiosity. This result relates to Bentzen (2019)'s finding that greater earthquake risk leads to greater religiosity; however, while this work considers the previous disaster events in a given region, we focus on the explicit exposure affecting the individuals as the exposure, the shock realization, and its intensity all matter. Regarding economic significance, these coefficients indicate that

Table 2
Baseline estimations I.

	Dependent variable = Religiosity			
	1	2	3	4
Completely damaged	67.246*** (5.481)	69.517*** (5.490)	69.424*** (5.510)	66.524*** (6.386)
Age	1.268*** (0.260)	1.434*** (0.260)	1.435*** (0.259)	1.451*** (0.259)
Age ²	0.004 (0.003)	0.003 (0.003)	0.003 (0.003)	0.003 (0.003)
Male	−17.920*** (1.333)	−17.946*** (1.329)	−17.955*** (1.327)	−18.646*** (1.326)
Education	2.181*** (0.420)	2.119*** (0.443)	2.139*** (0.452)	2.740*** (0.461)
Married	−11.673*** (2.388)	−12.196*** (2.377)	−12.208*** (2.377)	−12.674*** (2.375)
Household income		0.702** (0.318)	0.709** (0.321)	0.971*** (0.323)
Household size		2.375*** (0.246)	2.372*** (0.247)	2.230*** (0.249)
Rural area			0.287 (1.740)	−2.573 (1.836)
<i>Type of dwelling</i>				
Kutchha (non-solid)				16.610*** (2.237)
Mix pucca and kutchha (semi-solid)				−1.545 (2.232)
Wood/bamboo				−23.165 (16.658)
Other (ref = solid)				6.601 (9.916)
Constant	44.838*** (3.460)	20.531*** (4.151)	20.272*** (4.375)	16.151*** (4.398)
N	17133	17133	17133	17133
Adj. R ²	0.087	0.096	0.096	0.101

Note: This table presents the results of ordinary least squares regressions examining the earthquake's impact on religious practices. Definitions of variables are provided in Appendix II. Standard errors (in brackets) are robust to arbitrary heteroskedasticity clustered at the household level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

having a completely damaged dwelling produces an average increase of 66 min of religiosity (i.e., the time devoted to religious activities), while having a damaged dwelling (completely or partly) generates an average increase of 45 min of religiosity. Given that the mean religiosity in the sample is 87.32 min, we can indicate that exposure to earthquakes leads to a substantial increase in religiosity.

Next, we turn to the analysis of control variables. We observe a gender effect on religiosity, as *Male* is significantly negative in all estimations, meaning higher religiosity for women than for men. Furthermore, older people have higher religiosity, as shown by the positive relationship between age and religiosity; we obtain a significant and positive coefficient for *Age*, but the coefficient for *Age²* is insignificant.

Married is negatively related to religiosity, showing that married individuals are less religious. The significantly positive coefficient for *Household income* in most estimations means that higher income is associated with higher religiosity, following Buser (2015). *Household size* is significantly positive in all estimations, meaning higher religiosity for individuals with more household members.

Finally, we observe that people who occupy kutchha (non-solid) houses show a significantly more positive association with religiosity among individuals in pucca (solid) houses. It is worth noting that the damages suffered by habitations may be endogenous. We follow the instrumental variable methodology to address this and other potential sources of endogeneity. We use distance from the earthquake's epicenter as an instrument for damage to a dwelling (completely damaged and damaged, respectively). We conjecture that the earthquake strongly hits districts near the epicenter more than distant districts. Appendix I

Table 3
Baseline estimations II.

	Dependent variable = Religiosity			
	1	2	3	4
Damaged	50.079*** (2.189)	49.663*** (2.189)	49.410*** (2.192)	45.493*** (2.245)
Age	1.227*** (0.240)	1.390*** (0.239)	1.400*** (0.239)	1.425*** (0.239)
Age ²	0.004 (0.003)	0.003 (0.003)	0.003 (0.003)	0.003 (0.003)
Male	-17.539*** (1.264)	-17.499*** (1.261)	-17.574*** (1.259)	-18.364*** (1.257)
Education	2.025*** (0.400)	1.919*** (0.421)	2.093*** (0.428)	2.791*** (0.436)
Married	-10.246*** (2.198)	-10.822*** (2.187)	-10.928*** (2.186)	-11.543*** (2.183)
Household income		0.753** (0.299)	0.817*** (0.302)	1.143*** (0.306)
Household size		2.331*** (0.224)	2.306*** (0.225)	2.172*** (0.227)
Rural area			2.530 (1.641)	-0.692 (1.721)
<i>Type of dwelling</i>				
Kutchia (non-solid)				17.557*** (2.064)
Mix pucca and kutchia (semi-solid)				-1.135 (2.107)
Wood/bamboo				-20.683 (16.119)
Other (ref = solid)				24.669*** (8.772)
Constant	45.811*** (3.237)	21.649*** (3.840)	19.356*** (4.053)	14.288*** (4.092)
N	19340	19340	19340	19340
Adj. R ²	0.106	0.115	0.115	0.121

Note: This table presents the results of ordinary least squares regressions examining the earthquake's impact on religious practices. Definitions of variables are provided in [Appendix II](#). Standard errors (in brackets) are robust to arbitrary heteroskedasticity clustered at the household level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

presents the results from the instrumental variables approach, which verifies our findings.

4.2. The influence of individual characteristics

Our primary estimations indicate that earthquake increases religiosity. The religious coping hypothesis assumes that people enhance their religiosity following a natural disaster because they cope with trauma through the comfort of religious practices; however, even if people generally react through positive religious coping, we can question whether this effect is exacerbated or mitigated by individual characteristics.

The strength of religious coping can differ with gender if men and women have different reactions following natural disasters. Women have been found to use more religious coping than men ([Hvidtjørn et al., 2014](#))⁷ and can thus increase their religiosity more after an earthquake. Education can also influence the religious reaction to natural disasters by affecting how individuals react to religious answers to explain these events ([Pargament, 1997](#)). In a related vein, household income, household size, type of dwelling, and living in a rural area can influence the social and religious environment in which the individual lives and can affect how they react to an earthquake. The benefits of religious coping

⁷ While religious coping is difficult to empirically measure, this study proxies religious coping through the effect of a personal crisis on the search for God's support (which positively affects religious coping) and on the uncertainty of God's love or punishment by God (which negatively affects religious coping).

can notably be associated with a lower income level when the earthquake results in a dramatic change in life. Finally, age can impact how religiosity evolves following natural disasters. Older individuals should have had more experience with natural disasters before the 2005 earthquake, so the effect of this event on their beliefs should be diminished.

To design empirical testing of variations in the earthquake's impact on religiosity depending on individual characteristics, we include interaction terms between variables for exposure to earthquake and *Male*, *Household income*, *Education*, *Rural area*, and *Age*. We can then study whether gender, income, education, geographic area, and age influence the earthquake's impact on religiosity. We display results with *Completely damaged* and with *Damaged*, respectively, in [Tables 4 and 5](#) to investigate whether the intensity of the exposure to earthquake matters. Several conclusions emerge.

First, we find a significant interaction variable with *Male* only with *Completely Damaged*, indicating that the earthquake's impact on religiosity is influenced by gender if the house is completely damaged. We get no significant interaction variable with *Household Income* in both estimations, suggesting that income does not influence the earthquake's impact on religiosity.

Second, we obtain a positive coefficient for the interaction variable with *Education*. Interestingly, it is significant when interacting with *Completely damaged* but not significant with *Damaged*. These results suggest that the education level affects how people cope with religiosity after an earthquake. Educated individuals affected by an earthquake increased their religiosity to a higher degree. This result can be explained by the fact that education does not diminish the tendency of people to look for supernatural explanations when facing a dramatic event. A greater intensity of the damages would induce educated people to seek more religious coping after the natural disaster destroys all of their belongings. An interpretation can be that educated individuals seek explanations after a highly dramatic trauma, leading them to become more religious than others. It can notably occur that facing significant damage is more disruptive than modest damage to an individual's worldview, which can include more secular understanding.

Third, we find a significantly positive coefficient for the interaction variable of *Rural areas* with *Damaged*, which is insignificant with *Completely damaged*; thus, we have some support that being affected by the earthquake would have a stronger impact on increasing religiosity in rural areas.

Fourth, we find support for the influence of age on the relationship. The interaction term *Age* is negative in both estimations. It is in line with our interpretation that older people are less influenced by the positive impact of the earthquake on religiosity since they have already coped with similar natural disasters in their lifetimes.

4.3. Individual and social religiosity

Until now, we have considered the broad concept of religiosity, combining individual and social religiosity; however, an earthquake's impact can affect both forms of religiosity differently.

The religious coping hypothesis assumes that individuals become more religious when coping with traumatic events because of the comfort brought by religious practices. The damages caused by an earthquake can then inversely affect social religiosity and individual religiosity. Social religiosity is associated with attending religious services and spending time in religious organizations. Individual religiosity is based on the beliefs such as the importance of God or religion in life.

A traumatic event can influence individuals to increase their social religiosity because of the comfort brought by meeting other people in a religious context. [Okulicz-Kozaryn and Adam, \(2010\)](#) shows that social religiosity is associated with greater life satisfaction than individual religiosity because it favors interpersonal contact and generates church-related friends. It can also increase an individual's religiosity by helping them find answers to unexplainable events.

Table 4
Additional estimations I.

	Dependent variable = Religiosity				
	1	2	3	4	5
Completely damaged	57.078*** (7.281)	61.952*** (15.025)	43.062*** (9.165)	94.132** (39.620)	81.830*** (11.352)
Age	1.454*** (0.260)	1.451*** (0.260)	1.457*** (0.260)	1.453*** (0.259)	1.715*** (0.062)
Age ²	0.003 (0.003)	0.003 (0.003)	0.003 (0.003)	0.003 (0.003)	
Male	−19.017*** (1.338)	−18.643*** (1.326)	−18.726*** (1.326)	−18.652*** (1.326)	−18.564*** (1.328)
Education	2.726*** (0.461)	2.739*** (0.461)	2.587*** (0.463)	2.742*** (0.461)	2.659*** (0.453)
Married	−12.708*** (2.375)	−12.688*** (2.376)	−12.697*** (2.375)	−12.671*** (2.375)	−14.189*** (1.832)
Household income	0.972*** (0.323)	0.959*** (0.325)	0.969*** (0.323)	0.969*** (0.323)	0.977*** (0.323)
Household size	2.236*** (0.249)	2.229*** (0.249)	2.234*** (0.249)	2.232*** (0.249)	2.239*** (0.249)
Rural area	−2.580 (1.836)	−2.581 (1.836)	−2.709 (1.836)	−2.519 (1.838)	−2.533 (1.837)
<i>Type of dwelling</i>					
Kutcha (non-solid)	16.563*** (2.236)	16.603*** (2.236)	16.501*** (2.236)	16.586*** (2.238)	16.606*** (2.236)
Mix pucca and kutcha (semi-solid)	−1.565 (2.232)	−1.560 (2.233)	−1.605 (2.232)	−1.555 (2.232)	−1.532 (2.233)
Wood/bamboo	−23.699 (17.062)	−23.132 (16.704)	−21.855 (16.262)	−23.074 (16.630)	−23.034 (16.702)
Other (ref = solid)	6.421 (9.852)	6.910 (10.019)	7.267 (9.642)	7.353 (9.946)	6.721 (9.813)
Completely damaged × Male	21.711** (9.536)				
Completely damaged × Household income		0.824 (2.580)			
Completely damaged × Education			10.867*** (3.599)		
Completely damaged × Rural area				−28.541 (40.135)	
Completely damaged × Age					−0.478* (0.273)
Constant	16.307*** (4.398)	16.240*** (4.405)	16.584*** (4.395)	16.080*** (4.398)	12.577*** (3.356)
N	17133	17133	17133	17133	17133
Adj. R ²	0.102	0.101	0.102	0.101	0.101

Note: This table presents the results of ordinary least squares regressions examining the earthquake's impact on religious practices. Definitions of variables are provided in [Appendix II](#). Standard errors (in brackets) are robust to arbitrary heteroskedasticity clustered at the household level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table 5
Additional estimations II.

	Dependent variable = Religiosity				
	1	2	3	4	5
Damaged	43.689*** (2.787)	42.634*** (5.182)	43.162*** (3.519)	33.416*** (4.387)	54.787*** (4.017)
Age	1.426*** (0.239)	1.424*** (0.239)	1.426*** (0.239)	1.427*** (0.239)	1.696*** (0.060)
Age ²	0.003 (0.003)	0.003 (0.003)	0.003 (0.003)	0.003 (0.003)	
Male	−18.876*** (1.332)	−18.374*** (1.256)	−18.401*** (1.258)	−18.295*** (1.255)	−18.320*** (1.258)
Education	2.783*** (0.436)	2.794*** (0.436)	2.686*** (0.456)	2.740*** (0.437)	2.717*** (0.429)
Married	−11.552*** (2.183)	−11.554*** (2.183)	−11.550*** (2.183)	−11.534*** (2.181)	−13.022*** (1.698)
Household income	1.142*** (0.306)	1.085*** (0.321)	1.142*** (0.306)	1.147*** (0.306)	1.144*** (0.306)
Household size	2.174*** (0.227)	2.164*** (0.228)	2.172*** (0.227)	2.188*** (0.227)	2.182*** (0.227)
Rural area	−0.695 (1.721)	−0.706 (1.721)	−0.740 (1.723)	−2.606 (1.813)	−0.646 (1.722)
<i>Type of dwelling</i>					
Kutcha (non-solid)	17.546*** (2.064)	17.605*** (2.069)	17.611*** (2.067)	17.484*** (2.062)	17.559*** (2.064)
Mix pucca and kutcha (semi-solid)	−1.145 (2.106)	−1.154 (2.107)	−1.164 (2.108)	−0.846 (2.108)	−1.123 (2.107)
Wood/bamboo	−20.726 (16.176)	−20.679 (16.136)	−20.575 (16.072)	−20.864 (16.222)	−20.615 (16.134)
Other (ref = solid)	24.656*** (8.756)	24.968*** (8.785)	24.920*** (8.758)	21.077** (8.753)	24.942*** (8.727)
Damaged × Male	4.012 (3.686)				
Damaged × Household income		0.466 (0.794)			
Damaged Education			0.946 (1.215)		
Damaged × Rural area				17.189*** (5.015)	
Damaged × Age					−0.299** (0.121)
Constant	14.538*** (4.089)	14.735*** (4.168)	14.595*** (4.102)	15.324*** (4.107)	10.094*** (3.187)
N	19340	19340	19340	19340	19340
Adj. R ²	0.121	0.121	0.121	0.122	0.122

Note: This table presents the results of ordinary least squares regressions examining the earthquake's impact on religious practices. Definitions of variables are provided in [Appendix II](#). Standard errors (in brackets) are robust to arbitrary heteroskedasticity clustered at the household level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Since this study aims to better understand how natural disasters affect religiosity, we next check if the earthquake affects individual and social religiosity and to know if one form is more affected than the other. Our dataset allows us a thorough investigation of this issue. More precisely, social religiosity is the time spent participating in religious activities, measured in minutes per day. Individual religiosity is the time spent for individual religious practice and meditation, measured in

minutes per day.

We perform the estimations by alternatively using the two religiosity indicators as the dependent variable. [Table 6](#) presents the results. For each religiosity indicator, we test alternatively the impact of *Completely damaged* and *Damaged* on religiosity, producing four specifications.

Completely damaged and *Damaged* are significantly positive in both estimations when explaining individual religiosity and social religiosity.

Table 6
Individual and social religiosity.

	Dependent variable = Individual religiosity		Dependent variable = Social religiosity	
	1	2	3	4
Completely damaged	54.697*** (5.419)		11.828*** (3.295)	
Damaged		32.844*** (1.928)		12.649*** (1.106)
Age	1.407*** (0.231)	1.340*** (0.213)	0.044 (0.116)	0.085 (0.106)
Age ²	−0.000 (0.003)	0.000 (0.003)	0.003** (0.001)	0.002** (0.001)
Male	−47.274*** (1.200)	−50.161*** (1.137)	28.628*** (0.680)	31.797*** (0.665)
Education	1.220*** (0.386)	1.198*** (0.368)	1.520*** (0.216)	1.592*** (0.209)
Married	−12.100*** (2.088)	−11.067*** (1.923)	−0.575 (1.055)	−0.476 (0.973)
Household income	1.028*** (0.275)	1.045*** (0.260)	−0.057 (0.134)	0.098 (0.132)
Household size	1.501*** (0.219)	1.495*** (0.198)	0.729*** (0.108)	0.677*** (0.102)
Rural area	−1.875 (1.540)	−0.376 (1.441)	−0.698 (0.781)	−0.317 (0.750)
<i>Type of dwelling</i>				
Kutchia (non-solid)	15.023*** (1.919)	15.185*** (1.773)	1.587* (0.909)	2.371*** (0.866)
Mix pucca and kutchia (semi-solid)	−0.557 (1.863)	−0.506 (1.756)	−0.987 (0.928)	−0.628 (0.911)
Wood/bamboo	−13.960 (11.819)	−11.296 (11.245)	−9.204 (7.326)	−9.387 (7.447)
Other (ref = solid)	3.004 (8.568)	21.042*** (7.643)	3.596 (5.170)	3.627 (4.664)
Constant	26.496*** (3.827)	27.943*** (3.569)	−10.346*** (2.000)	−13.655*** (1.877)
N	17133	19340	17133	19340
Adj. R ²	0.151	0.171	0.140	0.163

Note: This table presents the results of ordinary least squares regressions examining the earthquake's impact on religious practices. Definitions of variables are provided in Appendix II. Standard errors (in brackets) are robust to arbitrary heteroskedasticity clustered at the household level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Being affected by the earthquake contributes to increasing individual and social religiosity. These results suggest that being damaged by an earthquake leads individuals to turn to religiosity, while a high intensity of the damage increases individual religiosity more than social religiosity. This latter finding can be explained by the fact that a traumatic event increases people's need to find answers to unexplainable events through individual practices. At the same time, they feel less need to go to social religious activities to find coping, or they can face practical pressures after losing their home, which reduces their sociality.

The analysis of control variables shows that gender, marital status, and household income link differently to individual and social religiosity. *Male* is significantly negative when explaining individual religiosity but positive when explaining social religiosity. These findings are of interest since they show gender differences in the forms of religiosity; women have more individual religiosity than men but less social religiosity (in line with Muslim norms). *Married* is significantly negative when explaining individual religiosity but not significant when

explaining social religiosity; therefore, it shows lower individual religiosity for married individuals only, while marital status does not influence social religiosity. *Household income* is not significant in estimations explaining social religiosity, while it is significantly positive when explaining individual religiosity.

For the other control variables, the findings are similar for both religiosity indicators: *Education*, *Household size*, and *kutchia* (non-solid) type of dwelling are significantly positive in all estimations. Age is positively associated with both forms of religiosity, although results for *Age* and *Age*² differ for individual and social religiosity.

5. Conclusion

This study investigates the relationship between exposure to the 2005 earthquake in Pakistan and religiosity. We use detailed information on Pakistani individuals, including time devoted to religious activities, to analyze how their religiosity is associated with exposure to the earthquake.

Our key finding is that exposure to the earthquake positively correlates with religiosity. We find that individuals with damaged dwellings have greater religiosity, whereas religiosity is greater for those with completely damaged dwellings. This finding supports the religious coping hypothesis that individuals enhance religiosity following an extreme event, supporting the previous findings of Sibley and Bulbulia (2012) in New Zealand and Bentzen (2019) worldwide. We also observe that the strength of religious coping increases with education and age, while men and women differ in the relationship between exposure to earthquakes and religiosity. Finally, we find that being affected by the earthquake increases both social and individual religiosity. This increase is significant, given the key role of social religiosity in resilience following a natural disaster.

Our work contributes to the analysis of the influence of natural disasters on religiosity, with evidence at the individual level in a developing country for the religious coping hypothesis. The government, army, local authorities, NGOs, and religious parties mainly focused on the reconstruction of homes, hospitals, and schools, the provision of livelihood, and the betterment of physical health for the millions of survivors; however, the mental health of the trauma survivors received less attention. We suggest that interventions on mental health should also be considered in the wake of the earthquake.

This study opens avenues for new investigations. Further work is needed to consider the influence of the intensity of the earthquakes and to compare the impact of natural disasters on social versus individual religiosity in a worldwide analysis. It would also be of particular interest to compare the impact of different natural disasters on religiosity. These questions can be addressed in future research.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

data an code is attached as supplementary material

Appendix J. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.econmod.2022.106077>.

Appendix I. Instrumental variable approach

	1	2	3
Panel A: Instrumenting Completely damaged with distance from the epicenter			
Distance from the epicenter (log)	−0.164*** (0.039)	−0.272*** (0.055)	−0.282*** (0.055)
Completely damaged	258.870*** (6.409)	244.381*** (7.479)	237.033*** (8.613)
Observations	17133	17133	17133
Panel B: Instrumenting Damaged with distance from the epicenter			
Distance from the epicenter (log)	−0.294*** (0.031)	−0.320*** (0.030)	−0.325*** (0.029)
Damaged	205.521*** (6.463)	190.672*** (6.414)	185.298*** (6.163)
Observations	19340	19340	19340
Demographic controls	No	Yes	Yes
Household controls	No	No	Yes

Note: This table presents the results of the instrumental variable approach. We use distance from the epicenter as an instrument for complete damage and damage. Definitions of variables are provided in [Appendix II](#). Standard errors (in brackets) are robust to arbitrary heteroskedasticity clustered at the household level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Appendix II

Variable	Definition
Religiosity	Sum of time spent participating in religious activities, individual religious practice, and meditation in minutes per day (Source: PTUS)
Individual religiosity	Time used for individual religious practices and meditation in minutes per day (Source: PTUS)
Social religiosity	Time used for participating in religious activities in minutes per day (Source: PTUS)
Completely damaged	Completely damaged is a dummy variable coded as 1 if the dwelling is completely damaged by the earthquake and 0 otherwise. (Source: PTUS)
Damaged	Damaged is a dummy variable coded as 1 if the dwelling is completely damaged or partially damaged by the earthquake and 0 otherwise. (Source: own computation)
Age	Age of respondent (Source: PTUS)
Age ²	Squared term of the age of respondent (Source: PTUS)
Male	Male vs. female, which is a dummy variable coded as 1 if the respondent is male and 0 otherwise (Source: PTUS)
Education	Highest school class that respondents pass (Source: PTUS)
Married	Dummy variable coded as 1 if the respondent is married and 0 otherwise (Source: PTUS)
Household income	An ordinal variable ranging from 1 to 10 for different ranges of income (Source: PTUS)
Household size	The number of people living in the house (Source: PTUS)
Rural area	Dummy variable coded as 1 if the household is in a rural area and 0 otherwise (Source: PTUS)
Type of dwelling	The type of dwelling: pucca (solid), kutchra (non-solid), mixed pucca and kutchra (semi-solid), wood/bamboo, and other (Source: PTUS)
Distance from the epicenter (log)	The distance of a district from the epicenter is used as an instrument for damaged caused by Earthquakes.

References

- Abramson, David, Stehling-Ariza, Tasha, Garfield, Richard, Redlener, Irwin, 2008. Prevalence and predictors of mental health distress post-katrina: findings from the gulf coast child and family health study. *Disaster Med. Public Health Prep.* 2 (2), 77–86.
- Adeola, Francis, O., 2009. Mental health & psychosocial distress sequelae of Katrina: an empirical study of survivors. *Hum. Ecol. Rev.* 16 (2), 195–210.
- Adiyoso, Wignyo, Kanegae, Hidehiko, 2012. The effect of different disaster education programs on tsunami preparedness among schoolchildren in Aceh, Indonesia. *Disaster Mitigation of Cultural Heritage and Historic Cities* 6.
- Alexander, David, 2005. Towards the development of a standard in emergency planning. *Disaster Prev. Manag.: Int. J.* 14 (2), 158–175.
- Aten, Jamie D., Smith, Wendy R., Davis, Edward B., Van Tongeren, Daryl R., Hook, Joshua N., Davis, Don E., Shannonhouse, Laura, et al., 2019. The psychological study of religion and spirituality in a disaster context: a systematic review. *Psychological Trauma: Theory, Research, Practice and Policy* 11 (6), 597–613.
- Baral, Ishwari A., Bhagawati, K.C., 2019. Post traumatic stress disorder and coping strategies among adult survivors of earthquake, Nepal. *BMC Psychiatr.* 19 (1), 118.
- Bell, Dianna, 2014. Understanding a 'broken world': Islam, ritual, and climate change in Mali, west africa. *J. Stud. Relig. Nat. Cult.* 8 (3), 287–306.
- Bentzen, Jeanet Sinding, 2019. Acts of god? Religiosity and natural disasters across subnational world districts. *Econ. J.* 129 (622), 2295–2321.
- Billig, Miriam, 2006. Is my home my castle? Place attachment, risk perception, and religious faith. *Environ. Behav.* 38 (2), 248–265.
- Billig, Miriam, 2013. Loyalty under stress: the communal psychology of loyalty to a place. In: Miller, I.D., Moore, W.C. (Eds.), *Psychology of Loyalty*. Nova Science Publishers, NY.
- Billig, Miriam, Kohn, Robert, Levav, Itzhak, 2006. Anticipatory stress in the population facing forced removal from the Gaza strip. *J. Nerv. Ment. Dis.* 194 (3), 195–200.
- Bryant-Davis, Thema, Wong, Eunice C., 2013. Faith to move Mountains: religious coping, spirituality, and interpersonal trauma recovery. *Am. Psychol.* 68 (8), 675–684.
- Buser, Thomas, 2015. The effect of income on religiousness. *Am. Econ. J. Appl. Econ.* 7 (3), 178–195.
- Cameron, Lisa, Shah, Manisha, 2015. Risk-taking behavior in the wake of natural disasters. *J. Hum. Resour.* 50 (2), 484–515.
- Cassar, Alessandra, Healy, Andrew, von Kessler, Carl, 2017. Trust, risk, and time preferences after a natural disaster: experimental evidence from Thailand. *World Dev.* 94 (June), 90–105.
- Castella, Rosemary de, Simmonds, Janette Graetz, 2013. 'There's a deeper level of meaning as to what suffering's all about': experiences of religious and spiritual growth following trauma. *Ment. Health Relig. Cult.* 16 (5), 536–556.
- Cesur, Resul, Freidman, Travis, Sabia, Joseph J., 2018. Death, Trauma and God: the Effect of Military Deployments on Religiosity. National Bureau of Economic Research. Working Paper 24954.
- Chan, Christian S., Rhodes, Jean E., 2013. Religious coping, posttraumatic stress, psychological distress, and posttraumatic growth among female survivors four years after Hurricane Katrina. *J. Trauma Stress* 26 (2), 257–265.
- Chen, Zhuo Job, Ortega Bechara, Andrea, Worthington, Everett L., Davis, Edward Britt, Csikszentmihalyi, Mihaly, 2019. Trauma and well-being in Colombian disaster contexts: effects of religious coping, forgiveness, and hope. *J. Posit. Psychol.* 16 (1), 82–93.
- Conzo, Pierluigi, 2018. Natural disasters and social preferences: the effect of tsunami-memories on cheating in Sri Lanka. *J. Dev. Stud.* 54 (10), 1912–1931.
- DeSalvo, Karen B., Hyre, Amanda D., Ompad, Danielle C., Menke, Andy, Tynes, L. Lee, Paul, Muntner, 2007. Symptoms of posttraumatic stress disorder in a new orleans workforce following Hurricane Katrina. *J. Urban Health* 84 (2), 142–152.
- Drabek, Thomas E., 1986. Human System Responses to Disaster: an Inventory of Sociological Findings. Springer Series on Environmental Management, New York. Springer-Verlag.
- Drew, Georgina, 2012. A retreating goddess? Conflicting perceptions of ecological change near the gangotri-gaumukh glacier. *J. Stud. Relig. Nat. Cult.* 6 (3), 344–362.
- Dynes, Russell R., 2003. Noah and disaster planning: the cultural significance of the flood story. *J. Contingencies Crisis Manag.* 11 (4), 170–177.
- Dynes, Russell R., Quarantelli, E.L., 1992. The Place of the 1917 Explosion in Halifax Harbor in the History of Disaster Research: the Work of Samuel H. Prince.

- Dynes, Russell R., Yutzy, Daniel, 1965. The religious interpretation of disaster. *Topic: A Journal of the Liberal Art* Fall 34–37.
- Freese, Jeremy, 2004. Risk preferences and gender differences in religiousness: evidence from the world values survey. *Rev. Relig. Res.* 46 (1), 88–91.
- Freese, Jeremy, Montgomery, James D., 2007. The devil made her do it? Evaluating risk preference as an explanation of sex differences in religiousness. *Adv. Group Process.* 24, 187–229.
- Galea, Sandro, Nandi, Arijit, Vlahov, David, 2005. The epidemiology of post-traumatic stress disorder after disasters. *Epidemiol. Rev.* 27 (1), 78–91.
- García, Felipe E., Páez, Darío, Reyes-Reyes, Alejandro, Álvarez, Rodolfo, 2017. Religious coping as moderator of psychological responses to stressful events: a longitudinal study. *Religions* 8 (4), 62.
- García, Felipe E., Páez-Rovira, Darío, Cartes Zurtia, Giordana, Neira Martel, Héctor, Reyes Reyes, Alejandro, 2014. Religious coping, social support and subjective severity as predictors of posttraumatic growth in people affected by the earthquake in Chile on 27/2/2010. *Religions* 5 (4), 1132–1145.
- Goenjian, A.K., Molina, L., Steinberg, A.M., Fairbanks, L.A., Alvarez, M.L., Goenjian, H. A., Pynoos, R.S., 2001. Posttraumatic stress and depressive reactions among Nicaraguan adolescents after Hurricane Mitch. *Am. J. Psychiatr.* 158 (5), 788–794.
- Goenjian, Armen K., Najarian, Louis M., Pynoos, Robert S., Steinberg, Alan M., Manoukian, Gagik, Tavosian, Anahid, Fairbanks, Lynn A., 1994. Posttraumatic stress disorder in elderly and younger adults after the 1988 earthquake in Armenia. *Am. J. Psychiatr.* 151 (6), 895–901.
- Griensven, Frits van, Chakkraband, M. L. Somchai, Thienkrua, Warunee, Pengjuntr, Wachira, Lopes Cardozo, Barbara, Tantipiwatanaskul, Prawate, Mock, Philip A., et al., 2006. Mental health problems among adults in tsunami-affected areas in southern Thailand. *JAMA* 296 (5), 537–548.
- Hackett, Conrad, CaryleMurphy, McClendon, David, 2016. The Gender Gap in Religion Around the World. Pew Research Center, Washington, DC.
- Henslee, Amber M., Coffey, Scott F., Schumacher, Julie A., Tracy, Melissa, Norris, Fran H., Galea, Sandro, 2015. Religious coping and psychological and behavioral adjustment after Hurricane Katrina. *J. Psychol.* 149 (6), 630–642.
- Hough, Susan E., 2005. After the earth shook. *Science* 310 (5745), 55–56.
- Hvidtjørn, Dorte, Jacob, Hjelmberg, Skytthe, Axel, Christensen, Kaare, Hvidt, Niels Christian, 2014. Religiousness and religious coping in a secular society: the gender perspective. *J. Relig. Health* 53 (5), 1329–1341.
- Hvidt, N.C., Hvidtjørn, D., Christensen, K., Nielsen, J.B., Søndergaard, J., 2017. Faith moves mountains—mountains move faith: two opposite epidemiological forces in research on religion and health. *J. Relig. Health* 56 (1), 294–304.
- Iyer, Sriya, 2016. The new economics of religion. *J. Econ. Lit.* 54 (2), 395–441.
- Janoff-Bulman, Ronnie, 2002. Shattered Assumptions.
- Kessler, Ronald C., Galea, Sandro, Jones, Russell T., Parker, Holly A., 2006. Mental illness and suicidality after Hurricane Katrina. *Bull. World Health Organ.* 84 (December), 930–939.
- Kiliç, Emine Zinnur, Devrimci Özgüven, Halise, Sayil, İqik, 2003. The psychological effects of parental mental health on children experiencing disaster: the experience of bolu earthquake in Turkey. *Fam. Process* 42 (4), 485–495.
- Lamberg, Lynne, 2006. Katrina survivors strive to reclaim their lives. *JAMA, J. Am. Med. Assoc.* 296 (5), 499–502.
- McElroy-Heltzel, Stacey E., Van Tongeren, Daryl R., Gazaway, Sarah, Ordaz, Ana, Davis, Don E., Hook, Joshua N., Davis, Edward B., Aten, Jamie D., Shannonhouse, Laura R., Stargell, Nicole A., 2018. The role of spiritual fortitude and positive religious coping in meaning in life and spiritual well-being following Hurricane Matthew. *J. Psychol. Christianity* 37 (1), 17–27.
- Nita, Maria, 2013. Christian and Muslim climate activists fasting and praying for the planet: emotional translation of 'dark green' activism and green-faith identities. In: *How the World's Religions Are Responding to Climate Change*. Routledge.
- Norris, Pippa, Inglehart, Ronald, 2011. *Sacred and Secular: Religion and Politics Worldwide*. Cambridge Studies in Social Theory, Religion and Politics. Cambridge University Press, Cambridge.
- Okulicz-Kozaryn, Adam, 2010. Religiosity and life satisfaction across nations. *Ment. Health Relig. Cult.* 13 (2), 155–169.
- Pargament, Kenneth I., Koenig, Harold G., Perez, Lisa M., 2000. The many methods of religious coping: development and initial validation of the RCOPE. *J. Clin. Psychol.* 56 (4), 519–543.
- Pargament, Kenneth Ira, 1997. *The Psychology Of Religion and Coping: Theory, Research, Practice*. The Psychology of Religion and Coping: Theory, Research, Practice. Guilford Press, New York, NY, US.
- Quarantelli, E.L., 1988. Disaster crisis management: a summary of research findings. *J. Manag. Stud.* 25 (4), 373–385.
- Quarantelli, E.L., 2000. Disaster Planning, Emergency Management and Civil Protection: the Historical Development of Organized Efforts to Plan for and to Respond to Disasters.
- Quarantelli, E.L., Dynes, R.R., 1977. Response to social crisis and disaster. *Annu. Rev. Sociol.* 3 (1), 23–49.
- Rodriguez, Havidan, Quarantelli, Enrico, Russell, Dynes (Eds.), 2007. *Handbook of Disaster Research*. Handbooks of Sociology and Social Research. Springer-Verlag, New York.
- Sibley, Chris G., Joseph, Bulbulia, 2012. Faith after an earthquake: a longitudinal study of religion and perceived health before and after the 2011 Christchurch New Zealand earthquake. *PLoS One* 7 (12), e49648.
- Sullins, D. Paul, 2006. Gender and religion: deconstructing universality, constructing complexity. *Am. J. Sociol.* 112 (3), 838–880.
- Tak, SangWoo, Driscoll, Richard, Bernard, Bruce, West, Christine, 2007. Depressive symptoms among firefighters and related factors after the response to Hurricane Katrina. *J. Urban Health* 84 (2), 153–161.
- Taylor, Bron, 2011. Editor's introduction: toward a robust scientific investigation of the 'religion' variable in the quest for sustainability. *J. Stud. Relig. Nat. Cult.* 5 (3), 253–262.
- Tierney, Kathleen J., 1995. Impacts of Recent U.S. Disasters on Businesses: the 1993 Midwest Floods and the 1994 Northridge Earthquake.
- Tierney, Kathleen J., Lindell, Michael K., Perry, Ronald W. (Eds.), 2001. *Facing the Unexpected: Disaster Preparedness and Response in the United States*. The National Academies Press, Washington, DC.
- Watson, Liz, Hassan, Kochore, 2012. Religion and climate change in northern Kenya: new moral frameworks for new environmental challenges? *J. Stud. Relig. Nat. Cult.* 6 (September), 319–343.
- White Jr., Lynn Townsend, 1967. The historical roots of our ecologic crisis. *Science* 155, 1203–7.
- Winchester, Simon, 2005. *A Crack in the Edge of the World: America and the Great California Earthquake of 1906*. Harper Collins, New York.