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ORIGINAL PAPER

# Can Religious Beliefs be a Protective Factor for Suicidal Behavior? A Decision Tree Analysis in a Mid-Sized City in Iran, 2013

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**Abstract** This study aimed to assess using tree-based models the impact of different dimensions of religion and other risk factors on suicide attempts in the Islamic Republic of Iran. Three hundred patients who attempted suicide and 300 age- and sex-matched patient attendants with other types of disease who referred to Kerman Afzalipour Hospital were recruited for this study following a convenience sampling. Religiosity was assessed by the Duke University Religion Index. A tree-based model was constructed using the Gini Index as the homogeneity criterion. A complementary discrimination analysis was also applied. Variables contributing to the construction of the tree were stressful life events, mental disorder, family support, and religious belief. Strong religious belief was a protective factor for those with a low number of stressful life events and those with a high mental disorder

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score; 72 % of those who formed these two groups had not attempted suicide. Moreover, 63 % of those with a high number of stressful life events, strong family support, strong problem-solving skills, and a low mental disorder score were less likely to attempt suicide. The significance of four other variables, GHQ, problem-coping skills, friend support, and neuroticism, was revealed in the discrimination analysis. Religious beliefs seem to be an independent factor that can predict risk for suicidal behavior. Based on the decision tree, religious beliefs among people with a high number of stressful life events might not be a dissuading factor. Such subjects need more family support and problem-solving skills.

**Keywords** Classification tree model · Suicide attempt · Suicidal behavior · Religious beliefs · Stressful life events

## Introduction

Suicide is a major public health problem worldwide and is considered an antisocial behavior (Rosenberg et al. 1988). Annually almost one million people die by suicide and ten to 20 times more people will attempt suicide worldwide (Levi et al. 2003; Organization 2012). Suicide attempts are associated with significant morbidities and constitute a major predictor of later suicide (Diaconu and Turecki 2009).

The Islamic Republic of Iran is a country with a population of 75 million people, of which the proportion of young people is very high; those aged less than 20 years form 33 % of the total population (Ghanizadeh et al. 2012). Suicide rates in Iran have been estimated at 5.7 and 3.1 per 100,000 in men and women, respectively. Among western Asian countries, the Islamic Republic of Iran and Georgia have the highest rates of suicide attempts by women (Saberi-Zafaghandi et al. 2012).

Suicide is associated with the interaction of a variety of factors, such as cultural traditions, religion, socioeconomic status, and political issues. Other related factors are drug use and psychiatric problems such as depression as indicators of being under high levels of stress (Akbari et al. 2015; Bryan and Rudd 2012; Hawton et al. 2001).

Given that attempted suicide is a multifactorial problem, determinants of suicidal behavior must be identified (Rogers 2001). There is a considerable number of publications on suicide; however, the majority of them have concentrated on one dimension, e.g., religious beliefs or problem-solving capabilities. While assessing the variables separately provides a crude and basic evaluation of suicide risk, a combination of relevant factors must be taken into account for a comprehensive assessment. Therefore, the present study used a multidimensional approach to assess the effects of different factors with an emphasis on the role of religion in response to the question, "Can religion in an Islamic society be a protective factor for suicidal behavior?"

## Materials and Methods

### Samples

This study was conducted from March to June 2013 as a hospital-based matched case–control study in one of the larger cities of southeast Kerman Province, Iran. All subjects

were recruited from Afzalipour Hospital which cares for many internal medicine and gynecological cases and hosts a referral center for all suicide attempters in Kerman Province. For this study, subjects who had attempted suicide were selected as cases, and controls were selected from among eligible healthy subjects who accompanied other patients. The Ethics Committee of Kerman University of Medical Sciences investigated and approved this study (ethics code: k/92/21), and written informed consent was obtained from all cases and controls.

It has been shown that multifactorial statistical models work well when the sample size per number of independent variables is at least 10 (Peduzzi et al. 1995).Since this study

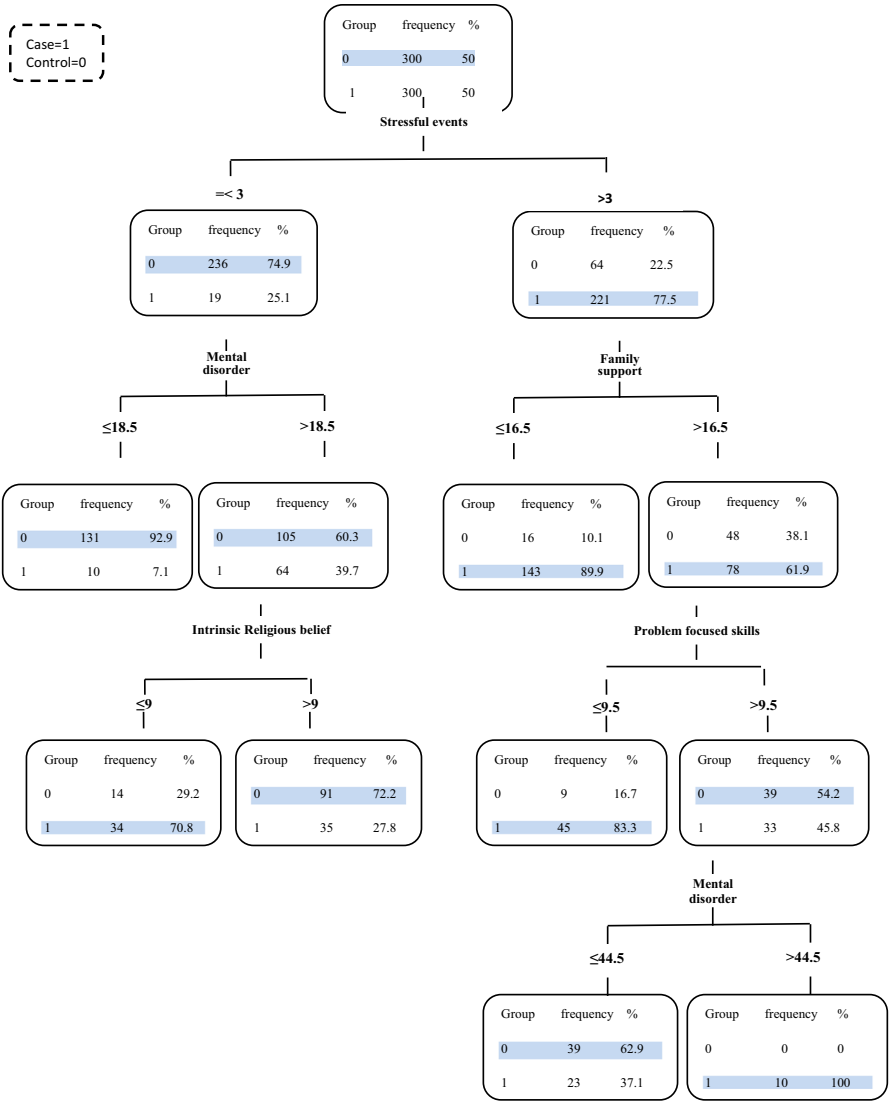


**Fig. 1** Schematic model of the tree classification in suicide attempting

measured 28 variables, 300 cases and 300 controls were recruited. Subjects older than 15 years of age in both genders were eligible if they referred to Afzalipour Hospital after attempting suicide by hanging, gunshot wound, poisoning, ingestion, inhalation, injection, cutting, drowning, electrocution, or other methods. Subjects were excluded if they were not permanent residents of Kerman. Because of important methodological advantages that were especially relevant in the setting of the current study, subjects for the control group were recruited from among outpatients from the same hospital by matching their ages (within 3 years) and genders with subjects in the case group; control subjects had no history of suicidal behavior. Data were collected from all subjects through confidential, face-to-face interviews conducted by trained interviewers with only the interviewer and interviewee present.

## Independent Variables

Independent variables were age, gender, marital status, education, the number of stressful life events over the past year, mental health, perceived social support, religious beliefs, stress-coping strategies (problem- and emotion-focused skills), and economics, social and personality traits (psychoticism, neuroticism, and extraversion).

Personality traits were assessed using the revised Eysenck Personality Questionnaire (EPQRS), which was validated for the Iranian population personality traits. EPQRS consists of 36 yes/no items that assess neuroticism, extraversion, and psychoticism (12 for each trait). The reliability of EPQRS was assessed by Bakhshipour and Bagherian (2006) in the Iranian population.

Religiosity was assessed using the Duke University Religion Index (DUREL) which has 5 items and assesses 3 dimensions of religiosity: organizational, non-organizational, and intrinsic religious activities. Cronbach's alpha, reported by Saffari et al. (2014), was between 0.86 and 0.92 for the Persian version. Coping skills were assessed by the Persian version of the Billings and Moos Coping questionnaire which consists of 19 items that assess problem- and emotion-focused coping skills. This questionnaire was translated to Persian by Pour Shahbaz (1993), and Cronbach's alpha was reported to be 0.74–78. Stressful life events were assessed using the Holmes and Rahe Stress Scale (HRSS). Consequently, a checklist consisting of the top 10 stressful events with a Chronbach's alpha score of 0.67 was used.

Socioeconomic status was measured using the 10-item questionnaire proposed by Noori et al. (2014). Chronbach's alpha for the tool was 0.66. General Health Questionnaires (GHQ-28) were used to detect psychiatric distress related to general medical illness. GHQ-28 is a 28-item self-report questionnaire that assesses four dimensions of psychiatric distress (depression, anxiety, social impairment, and hypochondriasis). Cronbach's alpha for the GHQ-28 questionnaire in the current study was 0.94. The reliability of this questionnaire has been confirmed by other studies as well (Ebrahimi et al. 2007). The current study also used the Multidimensional Scale of Perceived Social Support (MSPSS) questionnaire which is comprised of 12 items. The Chronbach's alpha reliability of this questionnaire in the Iranian population was reported by Joshanloo et al. (2006) as 0.89 to 0.93.

## Statistical Analysis

Decision tree analysis is a statistical method that can handle both quantitative and qualitative variables. Tree-based models explore data to select the best independent variable

with the best cutoff point that creates two groups with maximum homogeneity within each group and maximum heterogeneity between them. Therefore, tree methods are not affected when collinear independent variables exist. After the first split is selected, the same process is applied to each subgroup (i.e., node) so as to create a tree structure (Podgorelec et al. 2002). Therefore, the tree method can reveal complex associations as well as associations that might be significant for subgroups (Su et al. 2012). Because of the complex role of religion, especially in an Islamic society, and the impact of various dependent factors on suicidal behavior, the data in this study were analyzed using tree methods.

The Gini Index is the most widely used criterion for measuring non-homogeneity. The Gini was calculated for all variable/cutoffs. To avoid an over-fitted tree, some stopping rules, such as minimum number of parent and child nodes, are required (Marco and Paola 2012). In this study, the minimum number of observations (sample size) for the parent and child nodes in the tree model was 30 and 10, respectively. Furthermore, to select a tree with minimum complexity and acceptable prediction ability, the final tree was pruned, starting from the terminal nodes. A terminal node was deleted when its elimination caused a misclassification cost that was significantly lower than the reduction in complexity. The complexity parameter of the new tree was then calculated. This process continued until the root node was reached. Finally, complexity parameters were plotted against tree size (number of terminal nodes), and the optimal tree was selected. Group membership was defined for all subjects, and model accuracy was evaluated using sensitivity and specificity.

The discrimination analysis method was also applied. This method calculates a weighted linear combination of independent variables so as to create an index with maximum mean difference between two groups. Weights are calculated by multiplying the inverse of the variance–covariance matrix of independent variables by the vector of mean differences between two groups.

## Results

The sample in this study included 300 cases of attempted suicide with a mean age of $24.9 \pm 8.3$ years. Women comprised 54.33 % of suicide attempters; 33.53 % of attempters were single and 40 % were married. Most sample cases had finished middle and secondary school; 77.6 % of the cases resided in town, 13.6 % in suburbs, and the rest in villages.

Variables contributing to the construction of the tree were stressful events, mental disorder, family support, and intrinsic religious beliefs. Other dimensions of religious beliefs did not appear in the tree. The tree was comprised of 7 nodes with sensitivity and specificity rates of 77.3 and 87 %, respectively (Fig. 1).

The first variable that best separated the two groups was stressful life events with a cutoff at 3. For those with $<3$ stressful life events, variables that classified the subjects were mental disorders and intrinsic religious beliefs. About 93 % of those with a low number of stressful life events ($<3$) and a low score for mental disorder problems ($<18.5$) did not attempt suicide (node 1). Those who had a high mental disorder score were not likely to commit suicide if their intrinsic religious beliefs score was $>9$ (node 3). However, those with a high mental disorder score ($>18.5$) and a low intrinsic religious beliefs score ($<9$) were highly likely to attempt suicide (node 2). Around 71 % of subjects falling into this category (34 out of 48) attempted suicide.

Conversely, for those subjects with more than 3 stressful life events, family support, problem-solving skills, and mental disorders became important. About 90 % of subjects

with $>3$ stressful life events and a family support score of $<16.5$ fell into the suicide category (node 4). Even those with a high family support score but low problem-focused coping skills score ($<9.5$) were very likely to attempt suicide (node 5). Interestingly, the majority of those (around 63 %) with a high number of stressful life events who had high family support, high problem-focused coping skills, and low mental disorder scores were more likely not to attempt suicide (node 6).

In the discrimination analysis, 7 variables contributed to the calculation of the weighted score: perceived social support by family, perceived social support by friends, problem coping, neuroticism, religious beliefs, number of stressful life events, and GHQ scores. Stressful life events had the highest standardized coefficient (−0.40). Perceived social support by friends had the lowest standardized score (0.13). Sensitivity and specificity rates of the discrimination analysis were 80 and 81 %, respectively.

## Discussion

This study used tree modeling to explore the influence of several variables on suicidal behavior. Among all variables, four were significant: stressful events, mental disorder, family support, and religious beliefs, which, in many studies, have been mentioned as factors affecting suicide attempt (Beghi et al. 2013; Christiansen et al. 2013).

Neuner et al. (2008) found that risk factors for inpatient suicide attempts were assault, personality disorder, previous suicide attempt, psychopharmacological treatment resistance, suicidal thoughts at admission, schizophrenia, depression, and female gender. In their study, Kaslow et al. (2002) confirmed that "numerous and/or severe negative life events, a history of child maltreatment, high levels of psychological distress and depression, hopelessness about the future, and alcohol and drug problems were factors associated with attempter status." Factors protecting against suicide were "hopefulness, self-efficacy, coping skills, social support, and effectiveness in obtaining material resources."

The findings of the current study showed that these variables are the most important factors for predicting suicide attempts in Iranian society; among these variables, stressful life events was the first (most important) risk factor for predicting suicidal behavior. In other similar studies, it was concluded that the stressful life events factor was the best predictor of suicidal behavior among adolescents (Beghi et al. 2013; Christiansen et al. 2013). Other predictive factors included family support, mental disorders, and intrinsic religious beliefs. Stressful life events may create a defective cycle which predisposes one to suicide attempts. If this process is not controlled, it can lead to mental disorders. Some studies with results consistent with those of the current study identified mental disorder as a risk factor for suicidal behavior (Miret et al. 2013; Pilowsky et al. 2014).

Based on the findings, it can be concluded that people with high intrinsic religious beliefs scores, even if their mental disorder scores were high, were not likely to attempt suicide. Similarly, Asadi et al. evaluated the effects of religious beliefs, perceived social support, stress-coping strategies, and general health on predicting the risk of suicide attempts. They confirmed that religious beliefs may have an important role in reducing the risk of suicide (Asadi et al. 2013). To explain, people with a strong emotional connection and an inner sense of duty to God had a lower number of suicidal thoughts (Gartner et al. 1991).

The current study also revealed that, from the two subgroups of the DUREL, religious beliefs had an significant inverse association with suicidal behavior, but there was no significant correlation between religious practices and suicide attempts.

Perhaps the explanation of this finding is that people in the Islamic community achieve spiritual health through religious practices such as praying and attending a mosque. Some people are negligent in performing religious practices despite their religious belief, but suicide attempters, as many studies have shown (Molock et al. 2006; Shakeri et al. 2006; Walker and Bishop 2005), are in a lower grade in terms of both spiritual health (religious beliefs) and religious practices than those who do not have suicidal thoughts. Another noteworthy issue in interpreting the results of the DURAL religion questionnaire is that if "all subscales are included in a single statistical model, multiple collinearity between subscale scores could interfere with accurate estimate of effects for each subscale," (Koenig and Bussing 2010).

Since religious beliefs as a preventive factor for suicidal behavior was not significant for those who experienced stressful events, it is necessary for families and society to teach proper social skills.

The current study may have several limitations. Firstly, it is not easy to extrapolate the findings of this study to the whole country without any considerations; Kerman city, however, has a population more or less comparable with the population of Iran from such aspects as their socioeconomics, ethnicity, and religious beliefs. Therefore, the current findings may be used to generate some hypotheses to be explored in further studies. The second limitation of this study is that an attendant's mental and emotional condition might not be good, so they might not respond correctly to questions.

One point of strength of this study is that a large number of variables for identifying risk factors for suicidal behavior have been examined, while previous studies have examined a small number or only one of these variables. Other advantages of this study include the use of DUREL, which is the best questionnaire for evaluating religious dimensions and other risk factors, and the adequate and acceptable sample size investigated. Moreover, the main risk factors for suicide attempting were considered. Because the questionnaires were completed by the researchers, there was a low number of non-responses.

The grouping of patients in low- and high-risk categories (in terms of suicidal behavior) may be applicable for other experts. For example, psychologists can detect high-risk patients by calculating the criteria in the questionnaire and, based on the group to which the patients belong, cure them. The current findings may help policymakers reduce the suicide rate and its associated predisposing factors; however, given the importance of this issue, future studies need to be carried out in other provinces to explore the risk factors associated with suicidal behavior in order to help this group of patients.

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**Compliance with Ethical Standards**

**Conflicts of interest** None to declare.

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