Relationship of Religion with Suicidal Ideation, Suicide Plan, Suicide Attempt, and Suicide Death: A Meta-analysis

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Abstract

Background: Suicide is a significant public health problem and one of the leading causes of death worldwide. The effect of religion on suicidal behaviors (i.e., ideation, plan, attempt, and death) is an important issue worthy of consideration.

Methods: Major electronic databases, including MEDLINE, Web of Science, and Scopus, were searched for the articles published until 26 April 2021. Reference lists were also screened. Observational studies addressing the associations between religion and suicidal behaviors were also examined. Between-study heterogeneity was investigated using the $\chi^2$, $I^2$, and $t^2$ statistics. The probability of publication bias was explored using the Begg and Egger tests, as well as trim-and-fill analysis. The effect size was expressed as odds ratio (OR) with 95% confidence intervals (CIs) using a random-effects model.

Results: Out of 11 389 identified studies, 63 articles were eligible, involving 8,053,697 participants. There was an inverse association between religion and suicidal ideation OR = 0.83 (95% CI: 0.78, 0.88; $P<0.001$), suicidal plan OR = 0.93 (95% CI: 0.83, 1.04; $P=0.200$), suicide attempt OR = 0.84 (95% CI: 0.79, 0.89; $P<0.001$), and completed suicide OR = 0.31 (95% CI: 0.14, 0.72; $P=0.006$). There was a no evidence of publication bias.

Conclusions: The results of this meta-analysis support the notion that religion can play a protective role against suicidal behaviors. Nonetheless, the effect of religion on suicidal behaviors varies across countries with different religions and cultures. Although this association does not necessarily imply causation, an awareness of the relationship between religion and suicide risk can be of great help in suicide prevention policies and programs.

Keywords: Suicide, Suicide plan, Suicide attempt, Completed suicide, Religion, Spirituality

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Background

Suicide is one of the top 20 leading causes of death and premature mortality in people of all ages across the globe,1,2 the third major cause of death among people aged 15-44 years, and the second leading cause of death in 10-24 year-olds.3 The individuals who die due to suicide outnumber those who die in war. In fact, for every death caused by conflict, five deaths are caused by suicide.3 Based on the World Health Organization (WHO), around one million people die from suicide every year, resulting in a global mortality rate of 16 per 100,000, or one death every 40 seconds.3 These figures underestimate the problem since they do not include attempted suicides, which are up to 20 times more common than suicide deaths;3 moreover, many people who have suicidal thoughts never seek services.3

Evidence suggests that there is no known single cause for suicide, rather it is a complicated event influenced by a variety of psychological, social, biological, cultural, and environmental factors.3,6,7 Epidemiological research has demonstrated that several behavioral factors, such as alcohol consumption,4 drug abuse,3 and smoking,10 have a role to play in suicide. Another factor that plays a pivotal role in one's lifestyle, general health, and wellbeing is religion.11 Based on the Gallup surveys conducted in 114 countries in 2009, religion plays an essential role in the lives of numerous people around the world. About 84% of adults reported that religion was an essential part of their daily lives. In 10 nations and territories, at least 98% of people claimed that religion was significant in their daily lives.12 Another poll conducted by Gallup International in 2012 involving 50,000 people selected from 57 countries across the world in five continents revealed that 59%, 23%, and 13% of participants considered themselves to be religious, non-religious, and convinced atheists, respectively.13

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The relationship between religion and suicidal behaviors was examined by a few review studies.\textsuperscript{14,15} So far, the only meta-analysis that assessed the relationship between religion and suicide is the study conducted by Wu et al in 2015.\textsuperscript{16} They only investigated the association between religion and suicide death. Nonetheless, the relationship between religion and other aspects of suicidal behaviors has not been fully assessed. Furthermore, several epidemiological studies addressing the relationship between religion and suicide have been performed and published on the relationship between religion and suicide since then. In light of the aforementioned issues, this meta-analysis aimed to update the results of the previous one with current evidence and assess the relationship between religion and all aspects of suicidal behaviors, such as suicidal ideations, suicide plans, suicide attempts, and suicide deaths.

Methods
The Vice-chancellor of Research and Technology, Hamadan University of Medical Sciences, approved and funded this systematic review. We prepared this report based on the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) statement.\textsuperscript{17}

Eligibility criteria
The exposure of interest was religious beliefs and/or practices, for example, people who manifest devotion to a deity, believe in God or gods, and follow the practices of a religion. We considered people religious regardless of what religion (Islam, Christianity, Judaism, Buddha, Hindu, Shinto, etc.) they believed in and how frequently they attended religious services. The believers were compared with nonbelievers or atheism, and the outcome of interest was suicide. Suicidal behaviors were categorized as suicidal ideation (seriously thinking about committing suicide during the past 12 months or lifetime), suicidal plan (making a plan to commit suicide during the past 12 months or lifetime), suicide attempt (actually attempting suicide during the past 12 months or lifetime), and completed suicide (suicide death).\textsuperscript{18} We excluded those studies addressing religiously motivated terrorism and suicidal operations.

Observational studies (cohort, case-control, and cross-sectional studies) addressing the relationship between religion and suicidal behaviors were included regardless of language, publishing date, nationality, race, age, and gender. The studies that compared suicide rates between different religions or did not discriminate among different types of suicidal behaviors were excluded. The studies investigating the suicidal terrorist attacks were also ruled out.

Information sources and search
Major electronic databases, including MEDLINE, Web of Science, and Scopus were searched for articles until 26 April 2021 using the keywords: (suicide or suicidal or suicidality) and (religion or religious or religiosity or spirituality or spiritual). The reference lists of the included papers were screened to identify more eligible studies.

Study selection
The search results were combined using EndNote reference manager software, and duplicate papers of the same study were removed. The titles and abstracts of the papers were screened and ineligible studies were excluded by two authors (JP and FG) independently. Disagreements were resolved by discussion. The full text of the potentially eligible papers was retrieved and examined for further evaluation.

Data extraction
The necessary extracted data from relevant studies were imported into an electronic datasheet prepared by Stata software. The following information was extracted: first author's name, year of publication, country, study population (general population, patients with mood disorders, students, workers, veterans, as well as lesbian, gay, bisexual, and transgender (LGBQ) people), age mean/range, gender, study design (cohort, case-control, cross-sectional), suicidal behaviors (ideation, plan, attempt, death), effect estimate (risk ratio, odds ratio), sample size, effect size and its related 95% confidence intervals (CIs).

Methodological quality
The Newcastle Ottawa Scale (NOS) was used for assessing the quality of the included studies.\textsuperscript{19} Based on this tool, each study is judged on three domains: (a) the selection of the study groups, (b) the comparability of the groups, (c) and the ascertainment of the exposure/outcome of interest. Each item of high quality is given a star. Up to nine stars were assigned to the highest-quality studies. Studies with six or fewer stars were deemed low-quality, while those with seven or more stars were regarded as high-quality.

Heterogeneity and reporting biases
Heterogeneity across studies was examined by $\chi^2$ test,\textsuperscript{20} and its quantity was measured by the $I^2$ statistic.\textsuperscript{21} Meta-regression analysis was performed to explore the sources of heterogeneity. The following variables were considered potential sources of heterogeneity: six WHO regions (Region of the Americas, European Region, Eastern Mediterranean Region, South-East Asian Region, Western Pacific Region, African Region), type of population (general population, people with mental/mood disorders, veterans, students, workers, people with comorbidities, drug disorders, LGBQ people), gender (female, male), study design (cohort, case-control, cross-sectional), suicide time (last month, last year), type of belief (just religious beliefs, religious observance), adjustment (adjusted, unadjusted), and quality of the studies (high, low). The possibility of publication bias was explored using Egger's test,\textsuperscript{22} Begg's test,\textsuperscript{23} and the trim-and-fill method.\textsuperscript{24}
Summary measures
The relationship between religion and suicidal behaviors was measured using risk ratio (RR) and odds ratio (OR) with their 95% CIs. Wherever reported, we used full adjusted forms of RR and OR controlled for at least one or more potential confounding factors. The data were analyzed at a significance level of 0.05 using the random-effects model. The Stata software (version 16) and RevMan (version 5.4.1) were used for data analysis.

Sensitivity analysis
When between-study heterogeneity was moderate to high ($I^2 \geq 50\%$), the sensitivity analysis was performed using the MetaPlot Stata command based on the sequential algorithm.

Results
Description of studies
A total of 11,389 references, including 9,106 articles, were identified through searching the electronic databases until 26 April 2021, and 2,283 articles through screening the reference list of included studies. After the removal of 3,504 duplicates, 7,603 references were excluded after screening their titles and abstracts. Out of 282 references considered potentially eligible after screening, 219 were excluded since they lacked one or more Population, Intervention, Comparison, Outcomes and Study (PICOS) criteria. Some papers did not separate suicidal ideation from attempted suicide cases, some reported self-harm rather than suicide, some did not report the association numerically, and some others were review articles rather than original articles. Finally, 63 references remained for meta-analysis (Figure 1) involving 8,053,697 participants. Based on the NOS, the quality of 49 studies was high and the quality of 14 studies was low (Table 1).

Association between religion and suicide
The association between religion and suicidal ideation is presented in Figure 2, pointing to a significant inverse association between religion and suicidal ideation. Based on this forest plot, the estimated OR of suicidal ideation for believers versus nonbelievers was 0.83 (95% CI: 0.78, 0.88). The overall effect measure demonstrated that religion significantly decreases the risk of suicidal ideation by 17% ($P<0.001$). Between-study heterogeneity was high ($I^2 = 95\%$). The overall effect became slightly weaker (OR = 0.88; 95% CI, 0.84, 0.91; $I^2 = 47\%$) after performing a sensitivity analysis (Table 2). There was no evidence of publication bias based on the Begg test ($P = 0.505$) and Egger test ($P = 0.130$).

The association between religion and suicide plan is displayed in Figure 3, which illustrates that the association between religion and the suicidal plan was not statistically significant. Based on this forest plot, the estimated OR
Table 1. Characteristics of the included studies

| 1st Author year | Country         | Study population | Age | Sex | Study design | Religion | Sample | NOS-stars | Quality |
|-----------------|-----------------|------------------|-----|-----|--------------|----------|--------|-----------|---------|
| Abdus 2020      | Ethiopia        | Students         | 21.00 | Both | Cross-sectional | All religions | 523    | ********   | High    |
| Akbari 2015     | Iran            | General population | 25.86 | Both | Case-control | All religions | 600    | ********   | High    |
| Almasi 2009     | Hungary         | General population | 33.64 | Both | Case-control | All religions | 388    | ********   | High    |
| Almeida 2012    | Australia       | General population | 60-101 | Both | Cross-sectional | All religions | 21,290 | ********   | High    |
| Blackmore 2008  | USA             | General population | 32.00 | Both | Cross-sectional | All religions | 36,984 | ********   | High    |
| Blossnich 2020  | USA             | LGBTQ people     | 18.29 | Both | Cross-sectional | All religions | 40,150 | ********   | High    |
| Brito 2021      | France          | General population | 18-60 | Both | Cross-sectional | All religions | 38,694 | ********   | High    |
| Burlaka 2020    | Ukrain          | Students         | 19.19 | Both | Cross-sectional | Christianity | 1,005  | ********   | High    |
| Bunshein 2016   | Israel          | General population | 18-34 | Both | Cross-sectional | Judaism      | 49,14  | ********   | High    |
| Caru 2020       | Switzerland     | Workers          | 18-65 | Male | Cohort       | All religions | 153,456 | ********   | High    |
| Caribe 2012     | Brazil          | General population | 33.49 | Male | Case-control | All religions | 224    | ********   | High    |
| Caribe 2015     | Brazil          | Mental disorders | 42.95 | Both | Cross-sectional | All religions | 164    | ********   | High    |
| Chatters 2011   | USA             | General          | 18+  | Both | Cross-sectional | All religions | 60,82  | ********   | High    |
| Currier 2017    | USA             | Veteran          | 28.60 | Both | Cross-sectional | All religions | 125    | *****      | Low     |
| de Sá Sousa 2020 | Brazil          | Student          | 16.40 | Both | Cross-sectional | All religions | 674    | ********   | High    |
| Dervic 2004     | USA             | Mental disorders | 36.80 | Both | Cross-sectional | All religions | 371    | *****      | Low     |
| Duberstein 2004 | USA             | General population | 68.30 | Both | Case-control | All religions | 172    | ********   | High    |
| Fellingham 2000 | USA             | General population | 15-34 | Male | Cohort       | Christianity  | 1,100,620 | ******** | High    |
| Garnoutte 2003  | USA             | General population | 33.70 | Both | Cross-sectional | Christianity | 1456   | ********   | High    |
| Hilton 2002     | USA             | General population | 15-34 | Male | Cohort       | Christianity  | 15,555 | *****      | Low     |
| Hoffman 2014    | USA             | Students         | 16.04 | Both | Cross-sectional | All religions | 700    | ********   | High    |
| Huang 2020      | China           | Drug abusers     | 39.22 | Both | Cross-sectional | Buddhist     | 486    | ********   | High    |
| Jacob 2019      | Spain           | General          | 46.30 | Both | Cross-sectional | All religions | 7403   | ********   | High    |
| Joel Wong 2011  | USA             | Students         | 23.11 | Both | Cross-sectional | All religions | 1,377  | ********   | High    |
| Kim 2019        | Korea           | General population | 35-49 | Female | Cross-sectional | All religions | 2,649  | ********   | Low     |
| Kovess-Masféty 2011 | Europe       | General population | No data | Both | Cross-sectional | All religions | 21,425 | ********   | High    |
| Kurihara 2009   | Indonesia       | General population | 41.40 | Both | Case-control | Hindu        | 1,80   | ********   | High    |
| Lawrence 2016   | USA             | Mental disorders | No data | Both | Cross-sectional | All religions | 321    | ********   | High    |
| Lee 2017        | Korea           | General          | 60-90 | Both | Cross-sectional | All religions | 91,151 | ********   | High    |
| Lester 2012     | USA             | General population | 23.00 | Both | Cross-sectional | All religions | 149    | ****       | Low     |
| Lyle 2016       | USA             | LGBTQ people     | 22.50 | Both | Cross-sectional | All religions | 20,702 | ********   | High    |
| Martiello 2019  | Italy           | General population | 25+  | Both | Case-control | All religions | 484    | ****       | Low     |
| Mirzaie 2013    | Iran            | Students         | 21.16 | Both | Cross-sectional | All religions | 452    | ****       | Low     |
| Nisbet 2000     | USA             | General population | 50+  | Both | Case-control | All religions | 4,863  | ****       | Low     |
| Nkansah-Amankra 2012 | USA       | General          | 26-34 | Both | Cohort       | All religions | 9,412  | ********   | High    |
| Nonnemaker 2003 | USA             | Students         | 6-18  | Both | Cross-sectional | All religions | 18,924 | ********   | High    |
| O’Reilly 2015   | UK              | General population | 16-74 | Both | Cohort       | All religions | 110,614 | ********  | High    |
| Panczak 2013    | Switzerland     | General population | 35-94 | Both | Cohort       | Christianity  | 3,688,617 | ******** | High    |
| Pelzter 2017    | Asia            | Students         | 18-30 | Both | Cohort       | All religions | 4675   | ********   | High    |
| Rasic 2009      | Canada          | General population | 15+  | Both | Cohort       | All religions | 36,984 | ********   | High    |
| Rasic 2011      | USA             | General population | 30+  | Both | Cohort       | All religions | 1091   | ********   | High    |
| Rew 2001        | USA             | General population | 10-19 | Both | Cohort       | All religions | 10,059 | ****       | Low     |
| Robins 2009     | USA             | Students         | 18-21 | Both | Cross-sectional | All religions | 454    | ********   | High    |
| Rushing 2013    | USA             | Mental disorders | 59+  | Both | Cross-sectional | All religions | 248    | ********   | High    |
| Siddhartha 2006 | India           | General population | 12-19 | Both | Cross-sectional | Hindu        | 1,205  | ****       | Low     |
| Sinai 2010      | Cross-National  | General population | No data | Both | Case-control | All religions | 8,303  | ********   | High    |
| Snarr 2010      | USA             | Veterans         | No data | Both | Cross-sectional | All religions | 52,780 | ********   | High    |
| Stolz 2016      | Multinational   | General population | No data | Both | Cross-sectional | All religions | 6,791  | ********   | High    |
of the suicidal plan for believers versus nonbelievers was 0.93 (95% CI: 0.83, 1.04). The overall effect measure indicated that religion decreases the risk of the suicide plan by 7% ($P = 0.200$). Between-study heterogeneity was high ($I^2 = 84\%$). The overall effect became stronger and significant (OR, 0.89; 95% CI, 0.83, 0.94; $I^2 = 0\%$) after performing a sensitivity analysis (Table 2). There was no evidence of publication bias based on the Begg test ($P = 0.602$) and Egger test ($P = 0.445$).

The relationship between religion and suicide attempts is displayed in Figure 4, revealing a significant inverse association between religion and suicide attempts. Based on this forest plot, the estimated OR of suicide attempts for believers versus nonbelievers was 0.84 (95% CI: 0.79, 0.89). The overall effect measure shows that religion decreases the risk of the suicidal plan by 16% ($P < 0.001$). Between-study heterogeneity was high ($I^2 = 86\%$). The overall effect became weaker (OR = 0.91; 95% CI, 0.88, 0.95; $I^2 = 45\%$) after performing a sensitivity analysis (Table 2). The Begg test revealed no evidence of publication bias ($P = 0.347$); however, the Egger test did show evidence of publication bias ($P = 0.007$). However, the trim-and-fill analysis estimated no missing studies.

The association between religion and suicide death is presented in Figure 5, which shows a significant inverse association between religion and suicide death. According to the forest plot, the estimated OR of suicide death for believers versus nonbelievers was 0.31 (95% CI: 0.14, 0.72). The overall effect measure demonstrates that religion decreases the risk of suicide death by 69% ($P < 0.001$). Between-study heterogeneity was high ($I^2 = 92\%$). The overall effect became stronger (OR, 0.25; 95% CI, 0.19, 0.33; $I^2 = 0\%$) after performing a sensitivity analysis (Table 2). There was no evidence of publication bias based on the Begg test ($P = 0.928$) and Egger test ($P = 0.177$).

### Discussion

The results of this meta-analysis pointed to the overall mild-to-moderate protective relationship of religiosity with suicidal ideation, suicide plans, and suicide attempt, as well as a strong protective relationship between religiosity and suicide death. Nevertheless, the observed association between religion and suicidal behaviors does not necessarily imply a direct cause-and-effect relationship. Suicide is a highly complex issue that is associated with a range of risk and protective factors at both individual and contextual levels.$^{1,6,7}$

Religion is a multi-factorial phenomenon; therefore, we cannot regard risk and protective factors as individual items, rather they should be deemed as a cluster. Diseases are promoted by risk factors while being prevented by protective factors. In this regard, diseases will not develop if risk and protective factors are in balance or if protective factors dominate risk factors.$^2$ Therefore, the role of religion in the prevention of suicide should be considered, along with other influential factors.

A vast majority of literature observes a protective effect of religion on suicidal behaviors rather than supports. Several mechanisms have been proposed to explain the protective role of religiosity against suicide. Most religions have strict prohibitions against suicide; therefore, those who are more committed to such religions are less likely to commit suicide. Furthermore, it has been proposed that all major religions discourage all forms of violence, including suicide, and advocate peace and unity which may be deemed life-affirming values, thereby preventing suicide.$^{1,5,9}$ In addition to sanctioning suicide, participation in organized religions allows members of the congregation and clergies to form an extended support network, which has been demonstrated to be a protective factor against suicidal behaviors.$^{4}$ Religious belief has also been linked to lower levels of violence and hostility which have constantly...

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Table 1. Continued

| 1st Author year | Country | Study population | Age | Sex | Study design | Religion | Sample | NOS-stars | Quality |
|-----------------|---------|------------------|-----|-----|-------------|----------|--------|-----------|---------|
| Stroppa 2013    | Brazil  | Mental disorders | 46-20 | Both | Cross-sectional | All religions | 168 | ****** | Low     |
| Sun 2018        | China   | General population | 15-54 | Both | Case-control | All religions | 1582 | ******* | High    |
| Taylor 2011     | USA     | General population | 18+   | Both | Cross-sectional | All religions | 6082 | ******* | High    |
| Thanh 2006      | Vietnam | General population | 14+   | Both | Cross-sectional | All religions | 2280 | ******* | High    |
| Toussaint 2015  | USA     | General population | No data | Both | Cross-sectional | All religions | 4448 | ******* | High    |
| Trevino 2014    | USA     | Chronic diseases  | 20+   | Both | Cross-sectional | All religions | 603  | ******* | High    |
| Tshe 2005       | China   | General population | 65+   | Both | Case-control | All religions | 224  | ******* | High    |
| Umaraheswari 2014 | India   | Mental disorders | No data | Both | Case-control | Hindu | 130  | ****     | Low     |
| Ursano 2015     | USA     | Veterans         | 18+   | Both | Cross-sectional | All religions | 38507 | ******* | High    |
| VanderWeele 2016| USA     | General population | 30-55 | Both | Cohort       | All religions | 89708 | ******* | High    |
| Vega Sánchez 2020 | Spain  | General population | No data | Both | Case-control | All religions | 273  | ******* | Low     |
| Wang 2015       | China   | General population | 18+   | Both | Cross-sectional | All religions | 2769 | ******* | High    |
| Yen 2005        | Taiwan  | General population | 65-74 | Both | Cross-sectional | All religions | 897  | ******* | High    |
| Zhang 2010      | China   | General population | 15-34 | Both | Case-control | All religions | 808  | ******* | Low     |

LGBQ acronym stands for lesbian, gay, bisexual, and queer/questioning.
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Figure 2. Forest plot of the association between religion and suicidal ideation.

Table 2. Results of sensitivity analysis

| Variables                  | Before the sensitivity analysis | After the sensitivity analysis |
|----------------------------|---------------------------------|-------------------------------|
|                            | Studies | $\chi^2$ | $P$ | OR (95% CI) | Studies | $\chi^2$ | $P$ | OR (95% CI) |
| Suicide ideation           | 37      | 0.001    | 95% | 0.83 (0.78, 0.88) | 30      | 0.002    | 47% | 0.88 (0.84, 0.91) |
| Suicidal plan              | 3       | 0.002    | 84% | 0.91 (0.83, 1.04) | 2       | 0.531    | 0%  | 0.89 (0.83, 0.94) |
| Suicide attempt            | 31      | 0.001    | 86% | 0.84 (0.79, 0.89) | 24      | 0.009    | 45% | 0.91 (0.88, 0.95) |
| Completed suicide          | 8       | 0.001    | 92% | 0.31 (0.14, 0.72) | 7       | 0.900    | 0%  | 0.25 (0.19, 0.33) |
Religion and suicidal behaviors

Figure 3. Forest plot of the association between religion and suicide plan.

### Values

| Study or Subgroup | log(Odds Ratio) | SE    | Weight | Odds Ratio  |
|-------------------|----------------|-------|--------|-------------|
|                    |                |       | IV, Random, 95% CI |           |
|                  |                |       | IV, Random, 95% CI |           |
|                  |                |       | IV, Random, 95% CI |           |

![Forest plot](image)

**Figure 4.** Forest plot of the association between religion and suicide attempt.

### Values

| Study or Subgroup | log(Odds Ratio) | SE    | Weight | Odds Ratio  |
|-------------------|----------------|-------|--------|-------------|
|                    |                |       | IV, Random, 95% CI |           |
|                  |                |       | IV, Random, 95% CI |           |
|                  |                |       | IV, Random, 95% CI |           |

![Forest plot](image)
been shown to be associated with suicidal behaviors.\(^{25}\)
Furthermore, many religions forbid illegal activities, including substance misuse, alcohol consumption, and smoking which have been associated with suicide.\(^{8-10}\)
Therefore, the restriction of high-risk behaviors may have an indirect protective impact against suicide.

There was considerable heterogeneity across the included studies (small \(P\) value of \(\chi^2\) and large \(I^2\) statistic). The results of the statistical tests used to examine heterogeneity should be interpreted cautiously. The \(\chi^2\) test has low statistical power when the sample size is small or the number of studies is limited. The test, on the other hand, has high power in detecting a modest level of heterogeneity when the sample size or number of the included studies is large.\(^{20}\)
Consequently, a portion of the observed heterogeneity can be attributed to the large sample size (involving 8,053,697 participants) and the great number of studies included in the meta-analysis. Nevertheless, inconsistencies across studies can account for a portion of the observed heterogeneity. The observed heterogeneity can be justified on the ground that the results of individual studies come from varied settings with different religions, as well as varying degrees of religious fidelity and adherence to religious teachings. This diversity may be a source of the observed heterogeneity.

Wu et al\(^{16}\) conducted a meta-analysis in 2015 to examine the association between religion and completed suicide. They found nine studies that altogether included 2339 suicide cases and 5252 participants. They reported an overall protective effect of religiosity from completed suicide (OR = 0.38; 95% CI: 0.21, 0.71) and concluded that religion may play a protective role against suicide in a majority of settings. The results of the referred research were consistent with the findings of the present study.

The overall measure produced from OR, estimating the probability of completed suicide, was larger than that obtained from RR, as depicted in Figure 4. The rationale for this is straightforward since OR tends to overstate the degree of the relationship.\(^{96}\)

This meta-analysis is associated with a few limitations and considerations that should be taken into account when interpreting the results. Firstly, the studies included in this meta-analysis, except in a few cases, did not set out to assess the effect of different types of religions, denominations, intensity, and spirituality on suicidal behaviors. Therefore, religion was treated as a binary entity and neither captured this dimensionality nor measured the effect of different aspects of religion on suicidal behaviors. Secondly, the number of studies addressing the association between religion and “suicide plans” was relatively small. This issue reduced the strength of association and the generalizability of the results considering the relationship between religion and suicide plans. Thirdly, we imported the adjusted forms of RR and OR into the meta-analysis wherever feasible. Nevertheless, the confounding effect could not be entirely ruled out since some studies provided crude forms of RR or OR estimates. This problem might lead to an overestimation of the overall effect size of religion. Fourthly, there were eight studies (mainly old studies) that appeared to be eligible for this meta-analysis; nonetheless, their full texts were not available and their corresponding authors did not respond. This issue might

| Study or Subgroup | log(Risk Ratio) | SE | Weight | Risk Ratio (IV, Random, 95% CI) | Risk Ratio (IV, Random, 95% CI) |
|-------------------|---------------|----|--------|-------------------------------|-------------------------------|
| 5.1.1 Case-control studies (Odd Ratio) |
| Kunhara 2009 | -1.9766 | 0.588067 | 2.5% | 0.14 (0.04, 0.44) | 
| Tsao 2005 | -1.68944 | 0.410571 | 4.3% | 0.20 (0.09, 0.44) | 
| Vega Sánchez 2020 | -1.52786 | 0.493071 | 3.3% | 0.22 (0.08, 0.57) | 
| Nisbet 2000 | -1.46787 | 0.277865 | 6.7% | 0.23 (0.13, 0.40) | 
| Martiello 2019 | -1.30933 | 0.4660918 | 3.6% | 0.27 (0.11, 0.67) | 
| Duberstein 2004 | -1.22378 | 0.458671 | 3.6% | 0.29 (0.12, 0.72) | 
| Almasi 2009 | -1.71118 | 0.280258 | 6.7% | 0.31 (0.18, 0.54) | 
| Zhang 2010 | 0.69412 | 0.179443 | 9.4% | 2.00 (1.41, 2.85) | 
| Subtotal (95% CI) | 0.31 (0.14, 0.72) | 
| Heterogeneity: Tau^2 = 1.27; Chi^2 = 85.17, df = 7 (P < 0.00001); P = 92% |
| Test for overall effect: Z = 2.74 (P = 0.006) |

5.1.2 Cohort studies (Risk Ratio) |
| O'Reilly 2015 | -1.85003 | 0.158877 | 10.1% | 0.16 (0.12, 0.21) | 
| VanderWoelle 2016 | -1.61445 | 0.170286 | 0.7% | 0.20 (0.02, 1.97) | 
| Fellingham 2000 | -1.37574 | 0.137419 | 10.7% | 0.25 (0.19, 0.33) | 
| Canu 2020 | -0.56513 | 0.025645 | 13.1% | 0.57 (0.54, 0.61) | 
| Hilton 2002 | -0.52594 | 0.007965 | 13.3% | 0.59 (0.58, 0.60) | 
| Panczak 2013 | 0.00001 | 0.090899 | 12.0% | 1.00 (0.84, 1.20) | 
| Subtotal (95% CI) | 59.9% | 0.05 (0.03, 0.16) | 
| Heterogeneity: Tau^2 = 0.05; Chi^2 = 142.60, df = 5 (P < 0.00001); P = 96% |
| Test for overall effect: Z = 7.08 (P = 0.00001) |

Total (95% CI) |
| Heterogeneity: Tau^2 = 0.08; Chi^2 = 227.96, df = 13 (P < 0.00001); P = 94% |
| Test for overall effect: Z = 8.36 (P < 0.00001) |
| Test for subgroup differences: Chi^2 = 0.72, df = 1 (P = 0.40); P = 0% |

Figure 5. Forest plot of the association between religion and suicide death.
raise the possibility of selection bias. Finally, we did not evaluate the religiously motivated suicidal operations and terrorism which is a matter of a completely different nature and has not been the subject of this research. Despite the aforementioned limitations, we developed a wide search strategy to include as many studies as possible, including 56 studies involving 8053697 participants. The current meta-analysis was able to examine the association between religiosity and the overall suicide burden.

**Conclusion**

This meta-analysis addressed the association between religiosity and suicide. The results of this study support the notion that religion can play a protective role against suicidal behaviors. Based on current evidence, religious affiliation and participation significantly decreased the risk of suicidal ideation, suicide plans, suicide attempt, and completed suicide. Although this association does not necessarily imply causation, an awareness of the relationship between religion and suicide risk can be of great help in suicide prevention policies and procedures.

**Highlights**

- This meta-analysis revealed the extent to which religion can affect suicidal behaviors (i.e., ideation, plan, attempt, and death).
- This meta-analysis pointed to the inverse association of religion with suicidal ideation, suicidal plan, suicide attempt, and suicide death.
- Religion reduced the risk of suicidal ideation, suicidal plan, suicide attempt, and suicide death by 17%, 7%, 16, and 69, respectively.
- The results of this meta-analysis can be of great help in designing suicide prevention policies and programs.

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**Authors’ contribution**

Jalal Poorolajal contributed to the study conception and design, analysis and interpretation of data, and drafting of the manuscript. Mahmoud Goudarzi contributed to the study design and critical revision. Fatemeh Goharianasl contributed to the acquisition of data and critical revision. Nahid Darvishi contributed to the study design, acquisition of data, and critical revision. All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

**Availability of data and material**

Not available.

**Conflicts of interest**

The authors declare that they have no conflict of interest.

**Consent for publication**

All authors agree with the publication of this manuscript in the current format.

**Ethics approval**

There was no human subject in this study.

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