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Factors behind suicides in Muslim countries: a global ecological study

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ABSTRACT

This study examines the relationship between suicide rates and social, political, and economic factors in Muslim-majority countries, considering the influence of Islam and unique socio-cultural factors. Conducted from January to December 2022, it covered 46 countries, collecting data on suicide rates, income, Human Development Index (HDI), poverty rate, life expectancy, literacy rate, and political system. Suicide rates in Muslim-majority countries could be predicted based on HDI, poverty rates, life expectancy, and literacy rates. Frequency of suicide rates varied across continents, with the highest rates in Africa. Culturally sensitive suicide prevention programs are crucial for Muslim-majority countries.

KEYWORDS

Mental health; Muslims; religion; socio-cultural factors; suicide

Introduction

According to WHO's most recent estimates, which were released in "Suicide worldwide in 2019," suicide continues to be one of the major causes of death globally. Suicide claims more lives each year than violence, war, HIV, malaria, or breast cancer combined. More than 700 000 people took their own lives in 2019 (World Health Organization, 2021). The same report indicates that male suicide fatalities outnumber female suicide deaths by more than two to one (12.6 per 100 000 males versus 5.4 per 100 000 females). Men commit suicide at a greater rate (16.5 per 100,000) in high-income countries. The greatest suicide rates for females (7.1 per 100 000) are observed in lower-middle-

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income nations (World Health Organization, 2021). South-East Asia (10.2 per 100 000), Europe (10.5 per 100 000), and Africa (11.2 per 100 000) all had suicide rates in 2019 that were higher than the global average (9.0 per 100 000). The Eastern Mediterranean region had the lowest suicide rate worldwide (6.4 per 100 000) (World Health Organization, 2021).

Various factors contribute to the increased risk of suicide, including feelings of hopelessness, mental illnesses, substance use, and psychosocial stressors (Bottino et al., 2015). Socioeconomic and social determinant of health factors such as unemployment, poverty, homelessness, social inequity, discrimination and racism are also associated with a higher risk of suicide (Jaen-Varas et al., 2019; Yildiz et al., 2019).

Islam, with approximately 1.9 billion followers, is the world's second-largest religion and has a significant presence in nearly fifty countries and territories (Lugo et al., 2011; World Population Review, 2023). Many Muslim-majority countries are located in Asia and Africa, which are predominantly low- and middle-income nations (World Population Review, 2023). It has been observed that suicide rates tend to be lower in Muslim countries, possibly due to the religious prohibition on suicide within Islam (Lester, 2006). However, caution is needed when interpreting these findings, as there are unresolved issues regarding suicide reporting, including the perception of suicide as a sinful act and the associated stigma (Eskin et al., 2019). One hypothesis for the lower suicide rates in majority Muslim countries is the prohibition of suicide in Islam. However, it is worth noting that some predominantly Muslim nations, such as Nigeria, Burkina Faso, Chad, Kazakhstan, and Sierra Leone, have suicide rates higher than the global average (Lew et al., 2022; World Health Organization, 2021). In a recent study, it was discovered that Muslims, regardless of their level of religiosity, had the lowest level of permissiveness toward suicide among the world's main religions (Saiz et al., 2021). Permissiveness was also linked to national suicide rates. In their cross-national study, Shah and Chandia (Shah & Chandia, 2010) discovered that suicide rates were higher in both men and women in nations with smaller Muslim populations, suggesting that Islam may have a preventative effect on suicide.

Suicide is influenced by complex cultural, sociological, and economic factors. Considering the socio-political diversity of Muslim-majority countries and communities, it is challenging to apply a single theory or attribute all suicides solely to religious beliefs (Eskin et al., 2019; Lester, 2006) despite religiosity often being inversely correlated with suicide (Stack, 2021).

Globally, suicide rates are higher among males than females, and a similar gender distribution is observed in Muslim-majority nations (Canetto, 2015; World Health Organization, 2021). There are significant differences in suicide rates between women and men across Muslim-majority countries. For instance, in Egypt, Jordan, Syria, and the Maldives, the rates are 0.0 for women and 0.1, 0.2, and 0.7, respectively, for men per 100,000 population. In contrast, in

Kazakhstan, the rates are 9.4 for women and 43 for men per 100,000 population (World Population Review, 2022). In Arab countries, lifetime suicide ideation ranged from 2.0% to 13.9% and was significantly associated with factors such as being female, experiencing depressive symptoms, life events, illnesses, use of sleeping pills, being single, not having children, and having a history of psychiatric disorders (Karam et al., 2008).

The Human Development Index (HDI), which takes into account factors such as life expectancy, education, literacy, and gross domestic product per capita, has shown that countries with high or very high HDIs tend to have increased suicide rates (Chen et al., 2017; Khazaei et al., 2017; Lew et al., 2022). Additionally, suicide rates have been found to be associated with urbanization, gross national income (GNI), and women's life expectancy (Ivey-Stephenson et al., 2017; Kegler et al., 2017; Otsu et al., 2004; Qin, 2005). Social factors can also contribute to suicide rates; for instance, migration from rural to urban areas can contribute to social isolation and limited access to health and welfare services, leading to higher suicide risks among immigrants compared to native populations (Voracek et al., 2009).

Therefore, the present study aimed to: (1) investigate suicide rates in Muslim-majority countries; (2) explore the factors contributing to these rates; (3) and associations between suicide rates and demographic, economic, and developmental factors in Muslim-majority countries from January 2022 to December 2022. We predicted, on the basis of prior research, that nations with a majority of Muslims would see lower suicide rates than both the global and regional averages. In addition, we anticipated that there would be a negative relationship between the suicide rate and the percentage of Muslims in a nation.

Materials and methods

Study setting and approval

This ecological study examined the associations between suicide rates and demographic, economic, and developmental factors in Muslim-majority countries during the time period from January 2022 to December 2022. Ecological studies compare groups rather than individuals, hence there are no data at the individual level. Our analyses included variables that are aggregate measures, environmental measures, or global measures. The study adhered to ethical principles and guidelines, including the Declaration of Helsinki. However, ethical approval was not required as the questionnaires surveyed aggregate statistics for entire countries and did not involve interventions, human subjects, or identifiable personal information.

Data collection

The target countries consisted of countries categorized as Muslim-majority nations, defined as countries where more than half of the population identified as Muslim (Lange, 2022; Lugo et al., 2011; World Population Review, 2022). The list of countries was taken from “Islamic World,” 2022.

Data were collected through online questionnaires administered to experts in target countries. The experts were recruited based on the following criteria: 1- working as a psychiatrists or public health official in a Muslim-majority country, 2- familiarity with the demographic, economic, and developmental factors in the respective countries, 3- ability to communicate in English in an academic capacity. Experts not meeting these criteria, incomplete questionnaires, and failure to cite reliable sources were grounds for exclusion from the study. The initial set of experts was selected through targeted announcements and outreach within relevant social media groups of experts. The first author communicated with candidates and recruited those meeting the criteria based on their curriculum vitae. Clear instructions were provided to the participants regarding the purpose of the study, the voluntary nature of their participation, and the confidential handling of data. After obtaining consent, an English online questionnaire was sent to the participants to gather information on WHO region, population parameters, suicide rate, income, political system, poverty rate, HDI, development status, and literacy rate. Participants were asked to complete the questionnaire based on reliable sources such as peer-reviewed research and reports by national and international organizations.

Statistical analysis

The collected data were analyzed to examine the relationships between suicide rates and various demographic, economic, and developmental factors in Muslim-majority countries. Statistical analyses were performed using SPSS.

Correlation analysis was conducted to assess the relationships between demographic factors and suicide rates. Regression analysis was utilized to investigate the predictive value of factors such as poverty rates, average life expectancy, and literacy rates on suicide rates. Comparisons of suicide rates were conducted based on income group and geographic factors. Appropriate statistical tests, such as t-tests and ANOVA, were used to examine the differences in suicide rates across different categories.

Results

Nine experts completed the questionnaire for 46 countries, distributed across different World Health Organization (WHO) regions. Specifically, 11

countries were from the African Region (AFR), 3 from the South-East Asian Region (SEAR), 9 from the European Region (EUR), and 21 from the Eastern Mediterranean Region (EMR). No countries from the Western Pacific Region (WPR) and Region of the Americas (AMR) had Muslim majority population. Among the selected countries, there were 13 lower-income, 12 low-middle-income, 14 upper-middle-income, and 7 high-income nations. Detailed demographic data and suicide rates for the selected countries can be found in [Table 1](#), while [Table 2](#) provides information on economic and mental health indicators.

Based on the results, no significant correlation was found between the percentage of the Muslim population in a country and the suicide rate for men or women ([Table 3](#)). However, significant correlations were observed in Muslim-majority countries between the total suicide rates and the Human Development Index (HDI) for both genders. A lower HDI was found to be a predictor of a higher suicide rate ($\beta = -10.96$, $p = 0.004$) ([Table 3](#)) ([Figure 1](#)). In Muslim-majority countries, a significant correlation was found between poverty rates and suicide rates. The analysis indicated that higher poverty rates were associated with higher suicide rates ([Figure 2](#)). Furthermore, the regression analysis revealed that the poverty rate served as a predictor for the suicide rate ($\beta = 0.09$, $p = 0.002$) ([Table 3](#)). In addition, the results demonstrated a significant correlation between the poverty rate and the male suicide rate in Muslim-majority countries. Specifically, a higher poverty rate was found to be associated with a higher male suicide rate ($p < 0.05$).

Furthermore, a significant correlation was observed between average life expectancy and the suicide rate in Muslim-majority countries ($\beta = -0.35$, $p \leq .001$). The analysis indicated that lower average life expectancy was associated with higher suicide rates ([Figure 3](#)). Moreover, life expectancy was found to be predictive of the suicide rate in Muslim-majority countries ($p < 0.001$) ([Table 3](#)). Similarly, there was a significant correlation between literacy rates and the total suicide rates for both genders in Muslim-majority countries ($\beta = -0.09$, $p \leq 0.001$). The findings revealed that lower literacy rates were associated with higher suicide rates ([Figure 4](#)). Additionally, the literacy rates were identified as predictors of the suicide rate ($p < 0.001$) ([Table 3](#)).

When considering the World Bank income groups of countries, it was found that low-income countries had significantly higher rates of total suicide compared to high-income countries (mean: 9.41 ± 4.039 , $p = 0.03$). This trend was also observed in female suicide rates ($p \leq 0.001$). However, no significant difference was found in male suicide rates based on the income group of the country ($p = 0.079$).

A significant difference in suicide rates was observed across different continents ($p = 0.01$). The African continent had the highest mean total suicide

Table 1. Suicide rate and demographic data of Muslim-majority countries.

Country	Total		Suicide Rate (per 100,000)	Male Suicide rate (per 100,000)	Female Suicide rate (per 100,000)	Continent	WHO region	Political system	Developed vs developing country
	Muslim Population (Million)	Population (Million)							
Afghanistan	34.84	39.84	6	6.2	5.7	Asia	EMR	Sharia	Developing/Emerging Low-income
Albania	1.8	2.87	3.7	5.3	2.2	Europe	EUR	Democracy	Developing/Emerging Low-income
Algeria	41.24	44.62	2.6	3.3	1.9	Africa	AFR	Democracy	Developing/Emerging Low-income
Azerbaijan	9.74	10.22	4	6.6	1.5	Asia	EUR	Democracy	Developing/Emerging Low-income
Bahrain	1.06	1.75	7.2	9.9	2.3	Asia	EMR	Monarchy	Developed country
Bangladesh	153.70	166.3	3.9	6	1.7	Asia	SEAR	Democracy	Developing/Emerging Low-income
Bosnia and Herzegovina	1.96	3.26	8.2	13.5	3.4	Europe	EUR	Democracy	Developing/Emerging Low-income
Brunei	0.36	0.44	2.5	4.2	0.8	Asia	WPR	Monarchy	Developed country
Burkina Faso	12.14	21.5	14.4	24.5	6.5	Africa	AFR	Democracy	Developing/Emerging Low-income
Chad	9.18	16.91	13.2	20.2	6.9	Africa	AFR	Democracy	Developing/Emerging Low-income
Comoros	0.81	0.89	8.5	11.3	5.8	Africa	AFR	Democracy	Developing/Emerging Low-income
Djibouti	0.86	1.00	11.9	16.3	7.6	Africa	EMR	Democracy	Developing/Emerging Low-income
Egypt	87.5	104.26	3.4	4.6	2.2	Africa	EMR	Military	Developing/Emerging Low-income
Gambia	2.00	2.49	9.6	13.3	6.2	Africa	AFR	Democracy	Developing/Emerging Low-income
Guinea	10.56	13.50	12.3	18.4	8	Africa	AFR	Democracy	Developing/Emerging Low-income
Indonesia	229.00	276.36	2.6	4	1.2	Asia	SEAR	Democracy	Developing/Emerging Low-income
Iran	82.5	85.03	5.1	7.5	2.7	Asia	EMR	Democracy	Developing/Emerging Low-income

(Continued)

Table 1. (Continued).

Country	Muslim Population (Million)	Total Population (Million)	Muslim %	Suicide Rate (per 100,000)	Male Suicide rate (per 100,000)	Female Suicide rate (per 100,000)	Continent	WHO region	Political system	Developed vs developing country
Iraq	38.47	4.12	95.7	4.7	7.3	2.4	Asia	EMR	Democracy	Developing/Emerging Low-income
Jordan	10.17	10.27	93.2	2	3	0.9	Asia	EMR	Monarchy	Developing/Emerging Low-income
Kazakhstan	13.16	18.99	70.2	18.1	30.9	6.9	Asia	EUR	Democracy	Developed country
Kuwait	2.18	0.43	74.6	2.7	3.8	0.7	Asia	EMR	Monarchy	Developed country
Kyrgyzstan	4.68	6.63	80.0	8.3	13.5	3.5	Asia	EUR	Democracy	Developing/Emerging Low-income
Lebanon	3.52	6.77	57.7	2.8	3.9	1.7	Asia	EMR	Democracy	Developing/Emerging Low-income
Libya	6.55	6.96	97.0	4.5	6.1	2.9	Africa	EMR	Democracy	Developing/Emerging Low-income
Malaysia	16.32	32.78	61.3	5.8	9	6.4	Asia	WPR	Democracy	Developed country
Maldives	0.39	0.54	98.4	2.8	4.1	0.9	Asia	SEAR	Democracy	Developing/Emerging Low-income
Mali	17.51	20.86	95.0	8	10.5	5.7	Africa	AFR	Democracy	Developing/Emerging Low-income
Mauritania	3.84	4.78	100.0	5.5	7.4	3.9	Africa	AFR	Democracy	Developing/Emerging Low-income
Morocco	37.93	37.34	99.0	7.3	10.1	7.4	Africa	EMR	Monarchy	Developing/Emerging Low-income
Niger	21.1	25.13	98.3	10.1	14.1	6.4	Africa	AFR	Democracy	Developing/Emerging Low-income
Oman	2.43	5.22	85.9	4.5	6.4	1.1	Asia	EMR	Monarchy	Developed country
Pakistan	200.40	225.20	96.5	9.8	14.6	4.7	Asia	EMR	Democracy	Developing/Emerging Low-income
Qatar	1.57	2.93	77.5	4.7	5.7	1.7	Asia	EMR	Monarchy	Developed country
Saudi Arabia	31.88	35.34	97.1	5.4	7.8	1.9	Asia	EMR	Monarchy	Developed country
Senegal	15.11	17.20	96.1	11	18.5	5.2	Africa	AFR	Democracy	Developing/Emerging Low-income
Sierra Leone	6.07	8.14	78.6	11.3	14.8	8.2	Africa	AFR	Democracy	Developing/Emerging Low-income
Somalia	10.98	16.36	99.8	14.7	22.8	7.1	Africa	EMR	Democracy	Developing/Emerging Low-income

(Continued)

Table 1. (Continued).

Country	Muslim Population (Million)	Total Population (Million)	Muslim %	Suicide Rate (per 100,000)	Male Suicide rate (per 100,000)	Female Suicide rate (per 100,000)	Continent	WHO region	Political system	Developed vs developing country
Sudan	39.59	44.91	97.0	4.8	6.3	3.3	Africa	EMR	Authoritarian	Developing/Emerging
Syria	16.7	18.28	93.0	2.1	3.5	0.8	Asia	EMR	Authoritarian	Developing/Emerging
Tajikistan	7.62	9.75	96.7	5.3	7.3	3.4	Asia	EUR	Democracy	Developing/Emerging
Tunisia	11.19	11.94	99.8	3.2	4.6	1.8	Africa	EMR	Democracy	Developing/Emerging
Turkey	79.85	85.04	99.2	2.3	3.6	1.2	Asia	EUR	Democracy	Developed country
Turkmenistan	4.83	6.12	93.3	6.1	9.4	2.9	Asia	EUR	Democracy	Developing/Emerging
United Arab Emirates	4.62	9.99	76.0	5.2	6.3	2.6	Asia	EMR	Monarchy	Developed country
Uzbekistan	26.55	33.94	96.5	8.3	11.8	4.9	Asia	EUR	Democracy	Developing/Emerging
Yemen	27.78	30.49	99.1	7.1	9	5.3	Asia	EMR	Democracy	Developing/Emerging

Table 2. Economic and developmental information of Muslim-majority countries.

Country	Income Group	HDI Score	Poverty rate (%)	Average life expectancy (years)	Literacy rate (%)
Afghanistan	LI	0.51	54.4	65.29	38.10
Albania	UMI	0.79	14.3	78.73	98.10
Algeria	LMI	0.75	5.5	77.14	81.41
Azerbaijan	UMI	0.75	6.0	73.12	99.79
Bahrain	HI	0.85	0.0	77.48	97.46
Bangladesh	LMI	0.63	24.3	73.00	74.68
Bosnia and Herzegovina	UMI	0.78	16.9	77.63	96.99
Brunei	HI	0.84	5.0	76.07	97.20
Burkina Faso	LI	0.45	41.4	62.16	39.30
Chad	LI	0.4	42.3	54.62	40.20
Comoros	LMI	0.55	42.4	64.61	58.80
Djibouti	LMI	0.52	21.1	67.34	67.90
Egypt	LMI	0.71	32.5	74.30	75.84
Gambia	LI	0.5	48.6	62.57	55.57
Guinea	LI	0.84	43.7	62.00	30.47
Indonesia	UMI	0.72	9.4	71.96	96.00
Iran	UMI	0.78	18.7	76.94	85.50
Iraq	UMI	0.67	18.9	70.80	50.14
Jordan	UMI	0.73	15.7	74.74	98.01
Kazakhstan	UMI	0.82	4.3	73.62	99.79
Kuwait	HI	0.8	0.0	75.64	96.12
Kyrgyzstan	LMI	0.7	20.1	71.59	99.50
Lebanon	UMI	0.74	27.4	79.09	94.05
Libya	UMI	0.72	33.0	73.14	91.39
Malaysia	UMI	0.81	5.6	76.36	94.64
Maldives	UMI	0.74	8.2	79.32	99.32
Mali	LI	0.43	42.1	59.81	33.07
Mauritania	LMI	0.55	31.00	59.81	52.12
Morocco	LMI	0.68	4.80	76.99	71.71
Niger	LI	0.39	40.8	62.89	59.57
Oman	HI	0.81	0.00	78.16	93.97
Pakistan	LMI	0.55	24.3	67.48	56.40
Qatar	HI	0.85	0.0	75.13	97.76
Saudi Arabia	HI	0.85	12.7	75.37	94.84
Senegal	LMI	0.51	46.7	68.31	55.62
Sierra Leone	LI	0.45	56.8	55.18	48.43
Somalia	LI		73.0	57.78	37.80
Sudan	LI	0.51	46.5	65.63	58.60
Syria	LI	0.57	35.2	76.82	86.30
Tajikistan	LI	0.67	26.3	71.36	99.78
Tunisia	LMI	0.74	15.2	76.98	81.05
Turkey	UMI	0.82	14.4	77.99	95.69
Turkmenistan	UMI	0.71	0.2	68.37	99.69
United Arab Emirates	HI	0.89	19.5	78.18	92.99
Uzbekistan	LMI	0.72	14.1	71.84	100.0
Yemen	LI	0.47	48.6	66.28	69.96

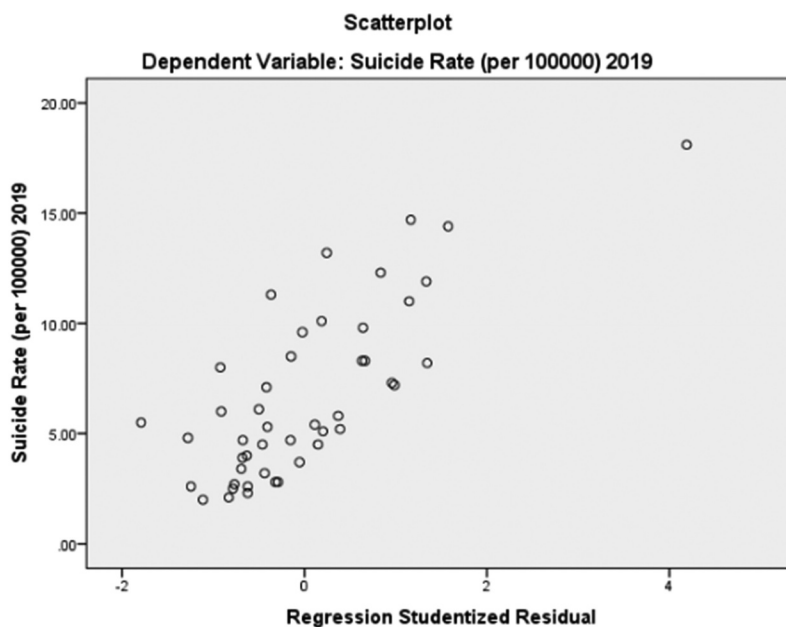
Income group: HI high income; LI low-income; LMI lower-middle-income; UMI upper-middle-income.

rate, both among males ($p = 0.04$) and females ($p \leq 0.001$). Additionally, significant differences were found in suicide rates across WHO regions ($p = 0.01$), with the African continent exhibiting the highest mean total suicide rates, male suicide rates ($p = 0.02$), and female suicide rates ($p = 0.004$).

On the other hand, no significant difference was found in total suicide rates ($p = 0.16$), male suicide rates ($p = 0.08$), or female suicide rates ($p = 0.08$) among the studied Muslim-majority countries based on their political systems. Similarly, no significant difference was observed in total suicide rates

Table 3. Univariate linear regression analysis between the variables of Muslims and total suicide rates per 100,000.

	Unstandardized Coefficients B	Standardised Coefficients Std. Error	Beta	t	P-value
(Constant)	10.734	3.607		2.975	0.005
Muslim %	-0.046	0.041	-0.169	1.137	0.262
(Constant)	13.882	2.455		5.655	<0.001
HDI Score	-10.964	3.570	-0.424	-3.071	0.004
(Constant)	4.367	0.859		5.083	<0.001
Poverty rate (%)	0.096	0.028	0.453	3.373	0.002
(Constant)	32.150	4.582		7.017	<0.001
Average life expectancy	-0.359	0.064	-0.644	5.584	<0.001
(Constant)	13.628	1.731		7.871	<0.001
Literacy rate (%)	-0.090	.022	-0.533	-4.181	<0.001

**Figure 1.** Correlation between total suicide rates and human development index.

($p = 0.44$), male suicide rates ($p = 0.55$), and female suicide rates ($p = 0.07$) between developed, developing, emerging, and low-income countries.

Discussion

This ecological study aimed to explore associations between suicide rates in Muslim-majority countries. The findings revealed no significant relationship between the Muslim population and suicide rate. However, total suicide rates were found to be predictable using variables such as the Human Development Index (HDI), poverty rates, life expectancy, and literacy rates in these

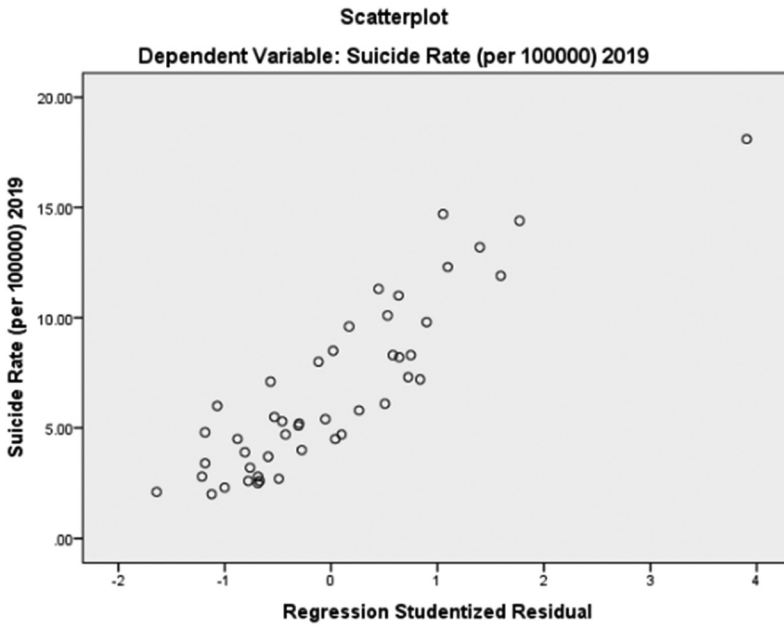


Figure 2. Correlation between poverty and suicide rates in Muslim-majority countries.

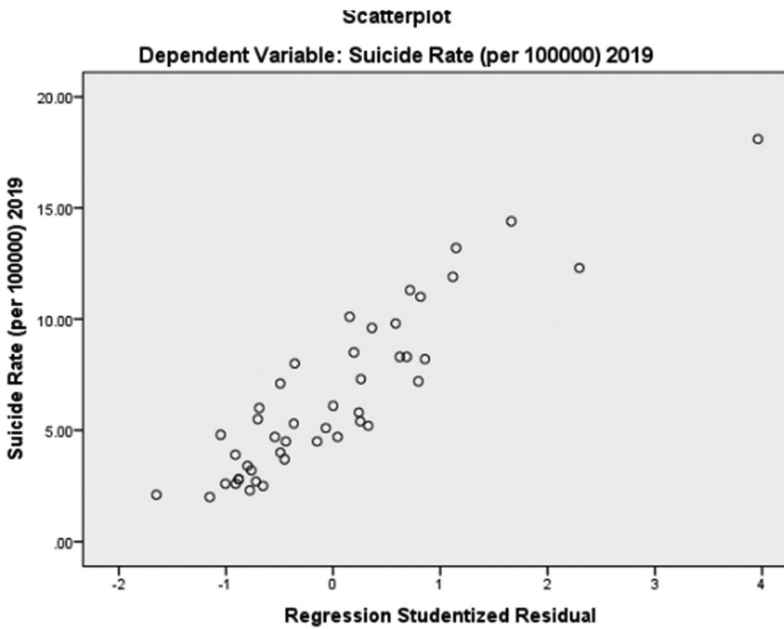


Figure 3. Correlation between average life expectancy and suicide rate in Muslim-majority countries.

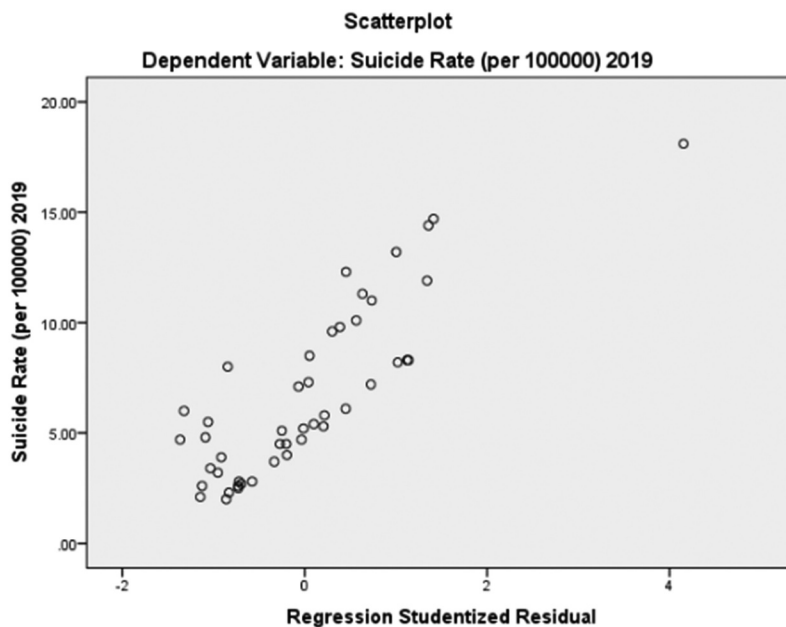


Figure 4. Correlation between average literacy and suicide rate in Muslim-majority countries.

countries. Significant variations in suicide rates were observed across different continents and WHO regions, with the African continent exhibiting the highest rates. The higher rates might reflect gender inequalities, family power dynamics, and domestic violence (Lester, 2006; Lew et al., 2022). Although political forces such as political crises and wars have been identified as predictors of suicide (Stack, 2021), no significant differences in total suicide rates were found when considering political systems in the studied Muslim-majority countries, regardless of gender.

Our study did not find a significant relationship between the percentage of Muslims in a country's population and total, male, or female suicide rates. Lew et al. (2022) report similar results in their study of majority-Muslim countries (Lew et al., 2022). Our findings also align with a previous study conducted in 11 Muslim countries, which reported a negative association between religiosity and suicide acceptability, but a positive relationship with the belief in being punished after death (Eskin et al., 2020). It is important to note that our study focused on demographic data regarding religious followers and did not specifically assess religiosity. A systematic review of publications over a decade indicated that attendance at religious services does not offer protection against suicidal ideation (Lawrence et al., 2016). However, it may provide some level of protection against suicide attempts and potentially completed suicides. Moreover, a survey conducted across 56 nations revealed that affiliation with Islam is associated with lower levels of suicide acceptability (Stack & Kposowa,

2011). Koenig et al. (2012) express that religiosity has protective effect against risk factors for suicide such as depression, anxiety, and substance abuse (Koenig et al., 2012). On the other hand, a study encompassing 12 Muslim nations demonstrated that making suicide illegal has not been effective in reducing the frequency of suicidal behavior (Eskin et al., 2019).

In terms of gender, previous research has shown that religiosity can protect women from completing suicide. Religious females were 0.87 times as likely as non-religious females to ideate or attempt suicide, whereas religious males were 1.12 times as likely to engage in suicidal behavior, according to a meta-analysis performed among young adults (Miranda-Mendizabal et al., 2019). VanderWeele et al. (2016) found similar results: women who attended religious service one per week had significantly lower suicide risk compared with those who never attended religious service (VanderWeele et al., 2016). Ozdel et al. (2009) report lower suicide risk among Turkish males with strong religious orientation, but the sample was selected from individuals who had already attempted suicide, not the general public (Ozdel et al., 2009). However, the overall direction of the literature seems to support the stronger protective effect of religion against suicide among women (Gearing & Alonzo, 2018). Male suicides have been linked to men's masculine demands, such as providing for their spouses financially and fulfilling their sexual desires, in the context of losing self-respect in Bangladesh, a country of 135 million Muslims (Khan et al., 2022).

The present study revealed a noteworthy correlation between suicide rates and the Human Development Index (HDI) in Muslim-majority countries. Specifically, a lower HDI score was associated with higher suicide rates. This relationship between HDI and suicide rates was consistent among both females and males. Similarly, Lew et al. (2022) found that females had higher mortality risk due to suicides in countries with lower HDI (Lew et al., 2022), possibly due to gender inequality and restricted freedoms. Yasir Arafat et al. (2022) similarly found an inverse relationship between HDI and suicide rate among men, women, and the general population in 46 Muslim majority countries (Arafat et al., 2022). Our findings align with a global ecological study encompassing 91 countries, which also observed variations in suicide rates based on HDI, with very high/high HDI countries displaying higher rates compared to medium HDI nations (Khazaei et al., 2017).

However, it is important to acknowledge that our study specifically focused on Muslim-majority countries, which may contribute to the divergence of our findings from studies that encompass a broader range of countries. Furthermore, we observed a significant correlation between suicide rates and poverty in Muslim-majority countries. Higher poverty rates were associated with considerably higher suicide rates among both males and females. These findings

are consistent with a systematic review that examined the association between suicide and poverty in low- and middle-income countries, indicating a global linkage between suicide rates and poverty. At the individual level, a consistent pattern emerged, demonstrating that poor economic conditions, unemployment, insufficient wealth, and severe economic events were significantly associated with suicidal behavior (Iemmi et al., 2016). Similar patterns have been reported from the United States (Hoffmann et al., 2020; Kerr et al., 2017), Germany (Näher et al., 2020), Brazil (Alves et al., 2019), and Korea (Choi et al., 2019).

The study also revealed a significant association between average life expectancy in Muslim-majority countries and suicide rates among both males and females. A lower average life expectancy was correlated with higher suicide rates. This finding is in line with a previous cross-national study that demonstrated a significant positive correlation between life expectancy and suicide rates (Shah et al., 2008). Furthermore, a global study indicated that suicide rates are positively correlated with age, which can be attributed to factors such as the concealment of suicidal attempts, challenges related to retirement, and an increased likelihood of co-morbidities (Khazaei et al., 2017). The findings of this study may be explained by the limited accessibility to mental healthcare in Muslim-majority countries in Africa and the Middle East, where life expectancy tends to be lower compared to Western countries, and where a significant portion of the population resides in rural areas (Ciftci et al., 2013; Tanhan & Young, 2022). In addition, those population is affected by social stigma that is known obstacle to help seeking behavior and accessibility to mental health services (Ciftci et al., 2013).

Furthermore, a correlation was observed between literacy rates and suicide rates among total, male, and female populations in Muslim-majority countries, indicating that lower literacy rates were predictive of higher suicide rates. A similar result has been reported from Iran, where suicide rate had an inverse relationship with literacy (Haghparast-Bidgoli et al., 2018). Interestingly, this finding contrasts with a global study where suicide rates showed a significantly positive correlation with expected years of schooling (Khazaei et al., 2017), and a study conducted across Indian states which found similar results (Arya et al., 2018). In a study focusing on Arab youth, it was revealed that there were low levels of suicide literacy, high levels of suicide stigma, and negative attitudes toward seeking professional help (Al-Shannaq & Aldalaykeh, 2021). Notably, family members, relatives, and friends were preferred as sources of psychological support, while mental healthcare professionals were less sought after. The level of suicidal literacy may be influenced by the overall literacy levels within a community.

Suicide rates were higher in low-income countries compared to high-income countries. A significant difference was observed in the mean total and female suicide rates across different income groups, but not for males.

Countries with lower income levels exhibited higher suicide rates. These findings are consistent with studies conducted in China and Brazil, which demonstrated a negative association between higher income and suicide rates (Machado et al., 2015). However, a meta-analysis revealed that nations with higher GDP per capita and greater income inequality had higher suicide rates. This increase in suicide rates could be attributed to data collected following the global recession of 2008, during which suicide rates escalated in high-income countries worldwide, coinciding with an increase in income inequality (Padmanathan et al., 2020). The significant variation in suicide rates across continents and WHO regions observed in this study may be attributed to differences in income levels and development, as well as social (e.g., gender roles, domestic violence) and political factors (e.g., armed conflicts, political unrest).

Lower reported suicide rates in countries with high religiosity may be attributed to under-reporting due to the fear of shame and disgrace (Hsieh, 2017). In Islam, suicide is regarded as a sin and even contemplating it is prohibited. Consequently, suicide prevention programs in Muslim-majority countries should address the stigma and discrimination associated with psychological disorders. Additionally, promoting economic and political stability and enhancing social welfare are crucial strategies for reducing suicide rates in these nations. It is important to develop culturally sensitive screening tools for identifying psychological distress, create religiously sensitive health promotion materials, and involve religious scholars in providing support. These measures are essential in mitigating the incidence of suicide in Muslim-majority countries.

In terms of limitations, it is important to consider that there may be multiple confounding factors beyond religion that can influence suicidality, particularly in lower-income countries. The study did not account for armed conflicts, political instability, and humanitarian disasters occurring in certain Muslim countries. The inclusion of a significant number of Eastern Mediterranean Region countries may have influenced the overall results and correlations. Additionally, the ecological study design limits the ability to establish causal relationships. Further research using more comprehensive methodologies would provide a deeper understanding of the factors influencing suicide rates in Muslim-majority countries. Moreover, research at smaller scales (e.g. community or individual levels rather than national levels) and using mixed quantitative-qualitative methodologies is necessary to further illustrate the nuances and complexities of the patterns and causes of suicide in countries with predominantly Muslim populations.

Conclusions

In conclusion, this global ecological study on factors related to suicide in Muslim-majority countries has provided valuable insights into the complex dynamics of suicide within these nations. While the study did not find a significant relationship between the religiosity and suicide rates, it shed light on several factors that influence suicidal behavior in these regions.

The findings emphasized on the importance of socio-economic factors such as income, poverty rate, literacy, and life expectancy, in predicting suicide rates. Notably, suicide rate is higher in low-income countries, pointing up the role of economic disparities in this context. Insufficient financial resources have a deep influence on every attempt to addressing suicide.

The study underscores the importance of comprehensive suicide prevention strategies in Muslim-majority countries. These strategies should encompass the destigmatization of mental health issues, economic and political stability, and social welfare improvements. Additionally, it is important for suicide prevention programs to be culturally sensitive and adaptable.

Nevertheless, it's crucial to acknowledge the limitations of the study. Factors such as conflicts, political instability, internally displaced persons, refugee, and humanitarian disasters in certain Muslim-majority countries were not accounted for, and the ecological study design cannot establish causal relationships. Furthermore, the cultural, economic, and social diversity of Muslim countries makes comprehensive generalizations difficult. As a result, further research with more comprehensive methodologies is needed to gain a deeper understanding of the cultural, economic, political, and social welfare factors influencing suicide rates in these countries. Mixed methods combining large-scale quantitative data with ground-level qualitative insights will allow for richer understanding of both broad associations and localized perspectives. While this macro-level quantitative analysis provides an initial overview of ecological trends, qualitative studies involving in-depth interviews, focus groups, or ethnographic fieldwork with individuals in Muslim communities could reveal subtler cultural factors, social dynamics, and individual experiences that influence suicidal behaviors and ideation.











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Data availability statement

The data that support the findings of this study are available from the corresponding author, upon reasonable request.

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