

# Undetermined and accidental mortality rates as possible sources of underreported suicides: population-based study comparing Islamic countries and traditionally religious Western countries

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## Background

Four Western countries (Greece, Ireland, Italy and Portugal) with strong Orthodox and Catholic traditions have been associated with the underreporting of death by suicide, and underreported suicides are sometimes found among deaths recorded as ‘undetermined’ or ‘accidental’.

## Aims

This population-based study tests whether there are any significant difference in patterns of suicides, undetermined deaths and accidental deaths between these four Western countries and 21 predominately Islamic countries.

## Method

World Health Organization age-standardised death rates per million population were used to compare suicide rates with combined undetermined death and accidental death (UnD+AccD) rates, from which odds ratios were calculated. Substantial odds ratios (OR > 2.0) were taken as indicative of likely underreporting of suicides. The Islamic countries come from four different historico-cultural regions, described as: less-traditional Islamic countries; former USSR countries; Gulf Arab states; and Middle Eastern and North African countries.  $\chi^2$ -tests were used to determine any significant differences between the Western comparator countries and the Islamic regions.

## Results

For the Western comparator countries, the average suicide rate was 66 per million population, the average undetermined death rate 56 per million and the average accidental death rate 58 per million, yielding a suicide:UnD+AccD odds ratio (OR) of 1.73. The average values for the other three groups were as follows.

Less-traditional Islamic countries: suicide rate, 31 per million; UnD+AccD rate, 101 per million; suicide:UnD+AccD OR = 3.3. Former USSR countries: suicide rate, 61 per million; UnD+AccD rate, 221 per million; suicide:UnD+AccD OR = 3.6. Gulf Arab states: suicide rate, 10 per million; UnD+AccD rate, 76 per million; suicide:UnD+AccD OR = 8.6. Middle Eastern and North African countries: suicide rate, 6 per million; UnD+AccD rate, 151 per million; suicide:UnD+AccD OR = 25.2. The patterns of these mortalities in the Islamic countries was significantly different from Western comparator countries.

## Conclusions

The results indicate underreporting of suicides in Islamic countries. This might inadvertently lead to reduced access to mental health preventive services in both Western and Islamic countries.

## Keywords

Self-harm; epidemiology; mortality; suicide; transcultural psychiatry.

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Suicide throughout the Western world is a considerable public health problem.<sup>1</sup> With adequate services and timely interventions, lives could be saved.<sup>2</sup> An important step in preventing suicide is to determine its true rate, which is often complicated by cultural, social and religious factors. Indeed, it is only in the latter part of the 20th century that countries such as Greece, Ireland, Italy and Portugal, with their strong Orthodox and Roman Catholic cultural traditions, have started providing more accurate suicide statistics.<sup>3–5</sup> However, while Greece, Italy and Portugal have increased their reported rates of suicide, recent research indicates that they may still be underreporting, with such deaths being accounted for in the ‘undetermined death’ (UnD) or ‘accidental death’ (AccD) categories.<sup>6</sup>

The major Western cultural influence on attitudes to suicide comes from the Bible. Yet it has been shown that there is no specific sanction against suicide in the Bible.<sup>7</sup> Conversely, in Islam there is no ambiguity: suicide is a sin and the soul is condemned to hell. So, in the Qur’an we read ‘And do not kill yourselves for surely

Allah is merciful’ (Surah An-Nisa 29) and ‘do not cast yourselves into destruction with your own hands’ (Surah Al-Baqarah 195), and these religio-cultural values are often maintained by Muslims living in Western countries.<sup>8–10</sup>

Mental health problems are recognised as being a major factor in suicide in Western countries,<sup>1,2,5,11</sup> yet mental illness occurs in all cultures and it is increasingly being acknowledged that suicidal ideation does occur among Muslim people.<sup>12–14</sup> It is evident therefore that despite the long-standing religious and cultural prohibitions, being a Muslim does not exclude one from having such an ideation. However, there are always individual variations among cultural groups so that not all Muslims will necessarily feel any conflict, while non-religious people might well feel that suicide is against their world view on the sanctity of life. Earlier studies concerning the possible underreporting of suicides have indicated that these may be hidden in the ‘undetermined death’ category, as many of the methods leading to death described in undetermined deaths are similar to lethal methods found in suicide.<sup>4,6,15–18</sup> The present

paper, utilising the latest World Health Organization (WHO) mortality data,<sup>19</sup> updated in December 2018, extends the analysis to include ‘accidental deaths’, consisting of falls, drowning and poisoning, as these methods are also found in suicide and may therefore also be a source of underreporting.<sup>6,15–18</sup>

There are 21 Islamic countries for which we have WHO data that can be compared with four Western comparator countries (Greece, Ireland, Italy and Portugal) that traditionally have strong cultural attitudes about suicide.<sup>3–5</sup> Our one working null hypothesis is that there will be no significant difference in patterns of suicide, undetermined deaths and accidental deaths between the Western comparator countries and the 21 predominately Islamic countries.

## Method

The 21 countries under review are designated as Islamic because the majority population’s religion is Islam, although is not necessarily the official state religion. Unfortunately, three major Islamic countries – Bangladesh, Indonesia and Pakistan – have no WHO reported suicide data so cannot be included in the review.

The 21 Islamic countries have varied historical and cultural backgrounds, so have been schematically assigned to four regions. Bosnia, Malaysia and Turkey, which have broadly more secular constitutions, are described as less-traditional Islamic countries. Then there are the six former USSR countries – Azerbaijan, Kazakhstan, Kyrgyzstan, Turkmenistan, Tajikistan and Uzbekistan – which may have been influenced by being formally under a secular regime for many years. The six Gulf Arab states consist of Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates. The final group contains the six Middle Eastern and North African countries of Egypt, Iran, Iraq, Jordan, Morocco and Tunisia.

The average rates of the four Western comparator countries (Greece, Ireland, Italy and Portugal) are contrasted against the average rates of the four Islamic regions and any statistical significance determined by  $\chi^2$ -tests. The 5% probability level ( $P < 0.05$ ) is taken as statistically significant. Nonetheless, we can only consider these results as being indicative rather than definitive of underreporting.

Of the 21 Islamic countries, 13 had data for the years 2014 or 2015 drawn from WHO data<sup>19</sup> and 8 had earlier index years, but each country’s latest year is noted in the tables in this paper. The only marked exception was Azerbaijan, whose latest data was for 2007.

The formal WHO categorisation of suicide is ‘intentional self-harm’, coded X64–X84, Y870, based on ICD-10, which the WHO used to determine its mortality statistics.<sup>19</sup>

Undetermined deaths are designated as ‘other external causes’ (coded 7240), defined as ‘deaths of undetermined intent, when it was not possible for the medical or legal authorities to determine whether it was accidental, self-inflicted or an assault’. Importantly, intent could not be determined (coded W20–64, 75; X10–39, 50; Y10–89). Undetermined deaths also include what are described as ‘inexplicable’ deaths.<sup>19</sup> As the above types of lethality contain a degree of violence similar to suicidal methods, it can be seen why undetermined deaths might be a source of underreported suicides.<sup>1,6,15–18</sup>

Deaths by falls, drowning and poisoning that are reported as ‘accidental’ are also a potential source of underreported suicide, as such methods are used in suicides. Hence the WHO categories of deaths by accidental falls, drowning and accidental poisoning are analysed as possible candidates for underreported suicides. Deaths attributed to accidental falls are coded W00–W19; accidental drownings are coded W65–W74; and accidental poisonings are coded X40–X49. The three categories are analysed and summed as total ‘accidental deaths’. Transport deaths were excluded from

accidental deaths because any suspicious road deaths are already included as a subcategory in the undetermined deaths category.<sup>19</sup>

This population-based study examines the most recent deaths of both genders of the three mortality categories under review: suicides, undetermined death and the three types of accidental death.

The key measures are the WHO age-standardised death rates (ASDR),<sup>19</sup> based on world populations and reported here in rates per million population for each of the mortalities.

It should be noted that six countries – Iraq, Jordan, Morocco, Saudi Arabia, Tajikistan and Tunisia – had no WHO ASDR or population data, only reporting the actual numbers of suicides. Consequently, United Nations Population Division data (<https://www.un.org/en/development/desa/population/index.asp>) were used to calculate their death rates. This was done by dividing the number of suicides by millions of population to produce a mortality rate per million.

To examine the likelihood of suicides being underreported, the official suicide rates for each country are compared against the combined rates of undetermined deaths and accidental deaths, from which a series of odds ratios (OR) are calculated. An odds ratio of suicide to combined undetermined deaths and accidental deaths (suicide:UnD+AccD) of greater than 1 to 2 (>2.00) is considered ‘substantial’ and possibly likely to contain underreported suicides.

The focus is on predominately Islamic countries but we also need to consider that there are many Muslim people living in Western countries.<sup>9,10</sup> For example, with more than three million people of Islam living in the UK<sup>20</sup> it is likely some will experience mental distress, which is likely to include suicidal ideation. Hence it is important that psychiatrists and allied care professionals are aware of possible cultural barriers for patients and their families around expressing ideas about suicidal behaviour.

This study did not require approval by an ethics committee published population-based data were used and no people or animals were directly involved.

## Results

Table 1 lists the Western comparator countries ranked by lowest suicide rates, which ranged from Greece at 37 per million population to Ireland at 101 per million. The highest undetermined deaths were in Portugal (85 per million) and the lowest in Ireland (37 per million). The accidental death rate was highest in Ireland (98 per million) and lowest in Italy (32 per million). It is noteworthy that Greece, Italy and Portugal had higher undetermined death rates than suicide rates, and Greece also had a higher accidental death rate than its suicide rate.

The highest suicide:UnD+AccD odds ratio was for Greece (OR = 3.0) and the lowest was for Ireland (OR = 1.3). The average mortality rates for the four Western comparator countries were 66 per million population for suicides, 56 per million for

**Table 1** Suicide, undetermined death and accidental death rates and ratio of suicides to combined undetermined and accidental deaths (suicide:UnD+AccD) for Western comparator countries<sup>a</sup>

Country	Suicides, per million population	Undetermined deaths, per million population	Accidental deaths, per million population	Suicide: UnD+AccD ratio
Greece	37	49	63	3.03
Italy	47	53	32	1.81
Portugal	79	85	36	1.53
Ireland	101	37	98	1.34
Average	66	56	57	1.71

a. Data from World Health Organization mortality data, updated in December 2018.<sup>19</sup>

**Table 2** Suicide, undetermined death and accidental death rates in Islamic countries, ranked by highest age-standardised death rates for suicides<sup>a</sup>

Country and year	Suicides, per million population	Undetermined deaths, per million population	Accidental deaths, per million population
1 Kazakhstan 2015	164	252	176
2 Kyrgyzstan 2015	76	144	137
3 Uzbekistan 2014	68	81	48
4 Bosnia 2014	43	64	20
5 Malaysia 2014 <sup>b</sup>	31 <sup>b</sup>	55	47
6 Iran 2015	29	151	48
7 Tajikistan 2016 <sup>b</sup>	26 <sup>b</sup>	33	35
8 Turkmenistan 2015	24	139	35
9 Qatar 2015	21	39	31
10 Turkey 2015	19	46	71
11 Kuwait 2015	15	53	36
12 United Arab Emirates 2010	13	0	31
13 Azerbaijan 2007	6	232	13
14 Bahrain 2015	5	64	15
15 Morocco 2012 <sup>b</sup>	3 <sup>b</sup>	45	16
16 Jordan 2012 <sup>b</sup>	3 <sup>b</sup>	60	14
17 Saudi Arabia 2012 <sup>b</sup>	2 <sup>b</sup>	174	7
18 Oman 2014	2	94	14
19 Tunisia 2013 <sup>b</sup>	1 <sup>b</sup>	70	6
20 Egypt 2015	1	119	33
21 Iraq 2008 <sup>b</sup>	<1 <sup>b</sup>	331	18

a. Data from World Health Organization mortality data, updated in December 2018,<sup>19</sup> unless otherwise indicated.

b. Death rates based on United Nations Population Division data (<https://www.un.org/en/development/desa/population/index.asp>), calculated by dividing the number of suicides by millions of population to produce a mortality rate per million.

undetermined deaths and 57 per million for accidental deaths, yielding a suicide:UnD+AccD odds ratio of 1.73.

Table 2 lists all the 21 Islamic countries ranked by highest to lowest reported suicide rates.

The highest were three former USSR countries: Kazakhstan, at 164 per million population; Kyrgyzstan, at 76 per million; and Uzbekistan, at 68 per million; all had higher rates than three of the comparator countries. However, the remaining countries had suicide rates <50 per million, and nine had official rates <10 per million. These were Iraq, Egypt and Tunisia, at 1 per million or lower; Oman and Saudi Arabia, at 2 per million; Jordan and Morocco, at 3 per million; Bahrain, at 5 per million; and Azerbaijan, at 6 per million.

The remaining countries ranged from 43 per million in Bosnia to 13 per million in the United Arab Emirates. As the United Arab Emirates reported no undetermined deaths, to correct for a possible underestimate when calculating that country's suicide:UnD+AccD odds ratios, it was assumed that the undetermined death rate would have at least matched their accidental death rate of 31 per million.

Every Islamic country had higher undetermined death rates than suicide rates and all except Bosnia, Kazakhstan and Uzbekistan had higher accidental death rates than suicide rates.

The patterns of the three mortality categories between the four Islamic regions were quite different. The less-traditional Islamic countries' average suicide rate was 28 per million, the average undetermined death rate was 55 per million and the average accidental death rate was 46 per million. The former USSR countries' average rates were: suicides, 61 per million; undetermined deaths, 147 per million; and accidental deaths, 74 per million. The Gulf Arab states' average rates were: suicides, 10 per million; undetermined deaths, 71 per million; and accidental deaths, 21 per million. For the Middle Eastern and North African countries the average suicide rate was just 6 per million; the average rate for undetermined deaths was 129 per million and for accidental deaths it was 22 per million.

For all practical purposes, apart from Iran (at 29 per million), statistically there were very few officially reported suicides in the Middle Eastern and North African countries.

Table 3 lists the suicide:UnD+AccD ratios for the 21 Islamic countries. There were notably wide odds ratios in Iraq (OR = 349), Egypt (OR = 152), Saudi Arabia (OR = 91) and Tunisia (OR = 76), down to the narrowest odds ratios for Kazakhstan and Tajikistan (OR = 2.6), Bosnia (OR = 2.0) and Uzbekistan (OR = 1.9).

It should be noted that every Islamic country had a suicide:UnD+srAccD odds ratio higher than the average for the four Western comparator countries.

**Table 3** All Islamic countries ranked by widest suicide:combined undetermined and accidental death (suicide:UnD+AccD) ratios

Countries	Suicides: undetermined death ratio	Suicide: accidental death ratio	Suicide: UnD+AccD ratio
1 Iraq <sup>b</sup>	331	18	349.0
2 Egypt	119	33	152.0
3 Saudi Arabia <sup>b</sup>	87	3.2	91.0
4 Tunisia <sup>b</sup>	74	5.7	76.0
5 Oman	47	7.0	54.0
6 Azerbaijan	39	2.2	40.8
7 Jordan <sup>b</sup>	20	5.0	24.7
8 Morocco <sup>b</sup>	14	4.7	20.3
9 Bahrain	13	3.0	15.8
10 Turkmenistan	6.0	1.5	7.25
11 Iran	5.0	1.7	6.86
12 Kuwait	4.0	2.4	5.93
13 United Arab Emirates	est. 2.4 <sup>c</sup>	2.4	4.80 <sup>c</sup>
14 Turkey	2.4	3.7	3.74
15 Kyrgyzstan	1.9	1.3	3.70
16 Qatar	1.9	1.5	3.33
17 Malaysia <sup>b</sup>	1.2	1.14	3.29
18 Tajikistan <sup>b</sup>	1.3	1.4	2.62
19 Kazakhstan	1.5	0.7	2.61
20 Bosnia	1.5	0.5	1.95
21 Uzbekistan	1.2	0.7	1.89

est., estimated.

a. Data from World Health Organization mortality data, updated in December 2018,<sup>19</sup> unless otherwise indicated.

b. Death rates based on United Nations Population Division data (<https://www.un.org/en/development/desa/population/index.asp>), calculated by dividing the number of suicides by millions of population to produce a mortality rate per million.

c. The rate for undetermined deaths was not available for the United Arab Emirates and was assumed to match the rate for accidental deaths.

**Table 4** Averaged suicide, undetermined death and accidental death rates for the Western comparator countries and Islamic regions

Region	Suicides, per million population	Undetermined deaths, per million population	Accidental deaths, per million population	$\chi^2$ (P) <sup>a</sup>
Western comparator countries	66	56	58	
Other Islamic countries	31	55	46	$\chi^2 = 6.80$ ( $P < 0.03$ )
Former USSR countries	61	147	74	$\chi^2 = 21.5$ ( $P < 0.001$ )
Gulf Arab states	10	71	5	$\chi^2 = 62.2$ ( $P < 0.0001$ )
Middle Eastern and North African countries	6	129	22	$\chi^2 = 93.9$ ( $P < 0.0001$ )

a.  $\chi^2$  compares Western comparator countries with Islamic regions.

## Comparing the regions

The average suicide, undetermined death and accidental death mortalities between each of the four groups and the Western comparator countries were compared.

The average less-traditional Islamic countries' suicide:UnD+AccD rates were significantly different from those of the Western comparator countries ( $P < 0.03$ ), as were those of the former USSR countries ( $P < 0.001$ ) and of the Gulf Arab States and the Middle Eastern and North African countries ( $P < 0.0001$ ). Self-evidently, the less-traditional Islamic countries were significantly different from the other three regions.

Overall, it would appear that, if there were underreported suicides, they would predominately be in the undetermined deaths category, especially in the Gulf Arab states and Middle Eastern countries but also in those countries whose accidental death rates were so much higher than their suicides rates.

## Discussion

### Limitations

The main limitation to the study is the relative paucity of reported suicides in most of the Islamic countries. Fourteen countries had an annual suicide rate of less than 25 per million population. Furthermore, we have to consider how reliable and robust are the data. Weaker systems are more likely to underreport suicide. However, we can only use the best information available, which is the consistently collected WHO annual mortality statistics.<sup>19</sup> A minor limitation was that for six of the Islamic countries, WHO reported only the numbers of suicides but no WHO population data were available. This meant that their suicide rates had to be calculated using a different source for population.

### Main findings

The null hypothesis can be rejected because each of the four Islamic groups' suicide and combined undetermined and accidental death rates were markedly different from those of the four Western comparator countries. There was a degree of internal validity in the findings as three of the less-traditional Islamic countries were only moderately significantly different from the Western comparator countries ( $P < 0.03$ ); the significance of the difference was stronger for the former USSR group ( $P < 0.001$ ) and markedly higher for the Gulf Arab states and Middle Eastern and North African countries ( $P < 0.0001$ ). This supports earlier research, which found a likelihood of underreporting of suicide in Islamic countries<sup>14</sup> that appears to have persisted more than a decade later. Furthermore, a very recent Iranian study using a new network method showed that suicide attempts and completed suicides continue to be officially underreported.<sup>21</sup> Yet probable underreporting still occurs in Western countries, as cultural attitudes persist.<sup>5,15–18</sup> This was seen in certain groups of doctors and nurses in Germany<sup>22</sup> and in the military in the USA,<sup>23</sup> and there continue to be inconsistencies in the UK and in Israel for younger people.<sup>24,25</sup> In a comparative

study of 21 Western countries, it was shown that in certain countries some age groups appeared to contain more likely underreporting than others:<sup>6</sup> these included the four Western comparator countries in our study. Indeed, Greece's suicide:UnD+AccD ratio of 3.03 suggests that cultural inhibitions about suicide are still in evidence. In the UK, with its well-established system of coroners' courts, youth (15–24 years old) suicide rates were at the same level as the rate of undetermined deaths, and it was suggested that bringing in an open verdict avoided confronting the bereaved families with the idea that their child died by their own hand, adding to their grief. In some other Western countries high rates of undetermined deaths occurred in different age groups and more often among females.<sup>15,18</sup> So if there is a degree of underreporting of suicides in some Western countries, it is not surprising that this may happen more often in Islamic countries, considering the stronger cultural taboos in Muslim countries.<sup>21</sup>

The question remains whether, despite the 'violent' methods in undetermined and accidental deaths and the significant statistical differences found between the Islamic and Western comparator countries, it can be assumed that they contain underreported suicides. The results can only be indicative but, apart from Iran at 29 per million population, suicides virtually do not occur in the Middle East and Gulf State countries. So, can such low reported rates be believed? If they can, it would imply that either their psychiatric services are far more effective in preventing suicides than those of Western countries, or that psychiatric disturbance with its link to suicidal behaviour is substantially lower than in Western nations. Moreover, it was not just that every Islamic country's undetermined death rates were higher than their suicide rates, but for 19 of the Islamic nations the accidental death rates were higher than their self-inflicted death (suicide) rates.

### Practice implications

This broad-brush population study has practice relevance for both Islamic countries and Western countries that have substantial minority Islamic populations. If patients or families do not talk about possibly 'hurting themselves', practitioners can harbour a false sense of reassurance that Muslims are exempt from experiencing suicidal ideation. This can lead to less robust enquiry when providing care and treatment, and psychiatric training needs to be aware of this possibility. Sadly, this can be compounded by patients and families who might be reluctant to raise concerns because of the stigma surrounding suicide, which still occurs across cultures, even among those without a religious allegiance.<sup>26</sup>

The danger is that if the extent of suicidal behaviour goes unrecognised, or indeed is denied, then the necessary action to support mentally disturbed individuals is undermined. Patients and families need to be able to have trust in services being non-judgemental, respectful of belief systems and confidential.

From a public health and policy point of view, mental health services in all countries, but especially those with strong cultural taboos against suicide, need to have more accurate suicide data to attract resources to reduce the risk of unmet needs.<sup>3–6,12–14</sup> These

results from 21 Islamic countries suggest that the authorities should review their situation and regard suicide as a public health problem as these results appear to be at odds with officially reported levels of suicide.

It is appreciated that the problem of assessing suicide risk for Muslim patients is that, for them and their family, psychiatric distress is often not interpreted as an illness but as sin and failure. This can further diminish the patient's self-esteem and we need to be able to enquire sensitively yet avoid challenging their religious values. It is always necessary to approach the patient from their personal perspective and we draw on the advice of an Islamic author who suggests that the psychiatrist could ask, without offence, 'have you wished that God would allow you to die somehow?'.<sup>27</sup> This could give the practitioner some idea about risk, without adding stress to an already difficult situation.

It is hoped that this study might begin the necessary debate that seeks to prevent psychiatry's ultimate catastrophe, an unnecessary death, with all the reverberations for family and society in both Western but especially Islamic countries.

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### Data availability

Data availability is not applicable to this article as no new data were created or analysed in this study.

### Author contributions

All authors contributed to the design, development and analysis of the study and its drafting, redrafting and final agreed submission.

### Declaration of interest

None.

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