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ORIGINAL ARTICLE

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Reported suicide mortality in selected Arab countries versus other reporting countries

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ABSTRACT

Background: Cross-country comparisons of recorded suicide deaths depend on demographic composition, reporting coverage, and denominator validity.

Objective: To compare reported suicide mortality in selected Arab countries with other reporting countries and assess the sensitivity of the comparison to demographic and calendar-year composition.

Methods: I re-analyzed suicide.csv from Omkar Gowda's Suicide Rates Overview (1985 to 2021) v1 (available to me as of the 24th of June 2026 on Kaggle). An audit of 31756 rows across 114 countries dated 1985-2020 was carried out. Descriptive analyses were based on completed age-sex records for people aged five years and older for 1985-2015. Crude and internally age-sex standardized rates were calculated along with a balanced comparison for the period of 2005-2010. Hypothesis tests suggesting the independence not supported by the data were excluded.

Results: The main analysis included 69 country-years from five Arab countries and 2,236 country-years from 95 other countries; the crude rates were 1.86 and 13.18 per 100,000 person-years, respectively; the internally standardized rates were 1.41 and 13.19. A balanced panel analysis including four Arab and 71 other countries yielded equal-country–year standardized mean values of 1.86 and 11.80. All records from 2016 did not include ages 5–14; all 328 country-years with data after 2016 used the same denominator across 12 strata. The latter records were excluded from the calculation of standardized rates.

Conclusion: Lower reported mortality rates were found in the descriptive sensitivity analysis. Nevertheless, it is not possible to conclude that the difference in suicide mortality was regional since there was limited inclusion of the Arab countries, the data were not validated against the primary sources of WHO or the state mortality reports, and there could be misclassification of cases.

KEYWORDS

Suicide mortality; Arab countries; Ecological analysis; Age standardization; Data quality; Mortality surveillance

ARTICLE HISTORY

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Introduction

Suicide mortality presents a complex set of social, economic, behavioral, and clinical risk and protective factors worldwide [1–4]. The World Health Organization estimates that more than 720,000 people die by suicide every year and that suicide was the third leading cause of death among people aged 15–29 years old worldwide in 2021 [5]. Suicide occurs globally and among countries of all income levels [6]. Therefore, it is essential to implement a multisectoral public-health suicide prevention approach, rather than only a clinical one [5,7,8].

International comparisons of suicide mortality should be made with caution since mortality data reflect both the incidence of suicide and the ability of countries to identify, certify, register, and report accurately [9]. According to the WHO, suicide and self-harm data are limited worldwide, and underreporting and misclassification are likely to be greater for suicide than for most other causes of death because of stigma and legal or cultural sensitivity [5,7]. The issue is particularly important when comparing Arab countries with other settings because of the impact of cultural, religious, legal, and health-system factors on help-seeking and official reporting [10–12].

Previous global work has shown substantial variation in suicide mortality by sex, age, region, and period [13–15]. The Global Burden of Disease analysis for 1990-2016 reported that global age-standardized suicide mortality declined over time, even though absolute mortality burdens remained large because of population growth and demographic change [16]. Sex differences are also well documented, with males generally having higher suicide mortality than females in many regions, although the magnitude of this difference varies by country and culture [5,17,18]. Age patterns are also important, because younger populations may show lower crude rates even when mental-health needs are high, whereas older populations may show higher mortality rates per 100,000 [19,20].

The source file covers eight of the Arab countries, but their age coverage, reporting periods, and denominator structures are not interchangeable [21]. We, therefore, distinguish the audit of the whole 1985-2020 file from the analysis of complete 1985-2015 age-sex records. Our aim is to describe the recorded mortality in the available countries, examine the demographic and calendar-period sensitivity, and identify the limitations preventing the regional extrapolation.

Methods

Study design and source provenance

This exploratory secondary ecological analysis was performed using the author-provided suicide.csv first available in the study's working directory on 24 June 2026. This comes from the Omkar Gowda Suicide Rates Overview (1985-2021) dataset on Kaggle version 1, updated 4 January 2023, and listed as CC0 Public Domain [21]. Upon recovery on 29 September 2026, this was compared against master.csv downloaded from version 1: their decoded contents were

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identical after the UTF-8 byte-order mark was stripped; raw-file SHA256 fingerprints are provided with the reproducibility bundle. Despite the repository's title, the observed years terminate in 2020.

The repository builds on Russell Yates's 1985–2016 collection and cites the relevant WHO suicide-prevention material, World Bank development indicators, UNDP HDI, and an earlier Kaggle compilation [21,22]. This provides repository provenance but not record-by-record validation against the WHO Mortality Database or national registries. The CSV lacks ICD codes, registration-area definitions, source extract identifiers, or completeness estimates. WHO notes that registration coverage and coding practices are factors in making cross-country comparisons [9]. As such, this work has evaluated internal consistency and does not claim independently validated, nationally specific denominators or complete ascertainment.

Eligibility and denominator audit

The columns of data were labeled by country, year, sex, and age group. We cross-checked the keys (values of a field were unique), ensured that counts were not missing, were nonnegative integers, that the denominators were positive, and that all 12 combinations of sexes (2) and age bands (5–14, 15–24, 25–34, 35–54, 55–74, and 75 or older) were present. Rates were re-calculated from counts and denominators (the rate column in the database was not used in analysis). Country names were kept as provided. A missing country or year was never replaced with a zero or imputed.

The main analysis needed 12 complete strata and was restricted to 1985-2015. All 16 country-years for 2016 had only 10 strata, omitting the ages 5-14 for both sexes. All 328 country-years for 2017-2020 had one value of population, copied over 12 rows. Equality of the values cannot be used to validate a total population, say, since, all the 2017 rows for Slovakia have 40,574 in them. Neither summation nor the retention of one value can validate a population at risk. The 2016 and later observations were therefore retained only for the audit. Missing counts affected 100 complete post-2016 country-years.

The retained denominators describe populations of people aged 5 years or older at the start of each year in the provided strata. Their sum across years is called person-years, approximated by the sum of yearly populations. This terminology does not indicate whether the population reference dates, coverage, or measurement were consistent across sources. Internal checks cannot identify systematic errors in sources if deaths, denominators, and precomputed rates have the same error.

Country groups and descriptive analyses

The categorization of Arab countries followed inclusion in the 22-state Arab League. Eligible records were available for Bahrain, Kuwait, Oman, Qatar, and the United Arab Emirates. Egypt, Jordan, and Lebanon appeared only in the excluded post-2016 extension, while the remaining 14 Arab League states were absent from the file. Thus, we have selected Arab countries that do not represent the entire Arab region, and the comparator group is not a representative sample of the rest of the world. Details of country-year inclusion and exclusion reasons are presented in the supplementary audit CSV.

Crude rates were calculated as 100,000 times the summed deaths divided by the summed person-years. Summaries of country, sex, age, and period were based on the same eligible records. In direct standardization, we applied one fixed vector of 12 age–sex weights, pooled from eligible country-years, to the stratum-specific rates. Therefore, the standardized rate was the weighted sum of the 12 age–sex-specific rates. Weights are supplied in standard_weights.csv. These are internally standardized rates for people aged five years and older (not WHO world-standard or all-age estimates); the broad age bands also leave residual demographic differences within strata [23].

To jointly assess calendar coverage and country weighting, a post-review sensitivity analysis used the fixed 2005–2010 interval. Four Arab countries (Bahrain, Kuwait, Qatar, and the United Arab Emirates) had full records for all six years; Oman did not. To control the comparator countries, we included only those with complete records in every year of this interval. We applied the same 12 reference weights to each country-year and averaged the standardized rates with equal weight for each country-year. This method eliminates unequal country-year weighting within the selected panel, although it does not overcome selection bias or differences in death registration. A second sensitivity analysis excluded country-years with all zeros without assuming that a reported zero represented missing data.

Uncertainty and reproducibility

No Mann-Whitney tests, pooled Spearman p-values or regressions asserting regional effects were retained. Country-years recur within countries and are not independent sampling units, only five Arab countries being available. Comparative ratios and standardized summaries are descriptive, with no assertions of population-level significance. Exact 95% Poisson intervals are presented for crude rates as conditional count-variation intervals with fixed denominators, but should not be interpreted as confidence bounds for a true Arab-versus-other regional effect, quantifying no serial dependence, country selection, denominator error, under-registration or misclassification. Standardized panel means are presented without inferential intervals.

The analysis was run in Python 3.12.14, with pandas 2.2.3, NumPy 2.3.5, SciPy 1.17.0 and Matplotlib 3.10.8. The supplementary package contains the exact input, executable analysis.py, source metadata, inclusion audit, reference weights, country-level estimates and figure outputs. The analytical decisions in this revision were made after reviewer feedback and were not preregistered.

Results

Data quality and country coverage

The file contained 31,756 rows, 114 countries, and 2,649 country-years. No entries had duplicate country–year–sex–age keys or missing population values. Suicide counts were missing in 1,200 rows, all within 100 post-2016 country-years; the supplied rate field nevertheless recorded zero for those rows. HDI was missing in 19,456 rows overall and 19,296 of the retained rows. The eligible dataset comprised 27,660 rows, 100 countries, and 2,305 country-years, of which 828 rows and 69 country-years were from five Arab countries (Table 1, Figure 1). Complete cell structure does not establish complete death registration.

The final row is a subset of the preceding row and is not an additional exclusion.

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Table 1. Inclusion flow and reasons for exclusion.

Record set	Rows	Country-years	Disposition
Full 1985–2020 file	31,756	2,649	114 countries audited
1985–2015 complete strata	27,660	2,305	Included; 100 countries
2016 incomplete age coverage	160	16	Excluded from rates
2017–2020 repeated denominators	3,936	328	Excluded from rates
Of the later set, missing counts	1,200	100	Missing, not zero

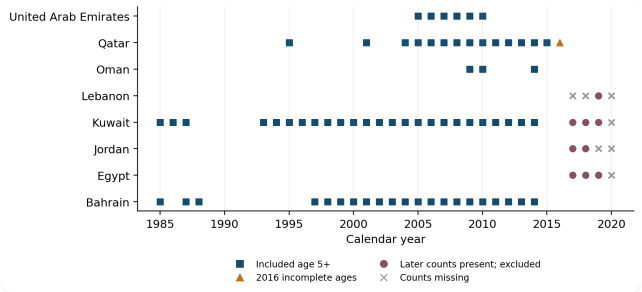


Figure 1. Observed country-year coverage for the eight Arab countries. Symbols distinguish eligible age-five-plus records, incomplete 2016 age coverage, excluded later records with counts, and missing counts. Blank years are absent from the file.

Main descriptive comparison

The five selected Arab countries contributed 2,590 deaths and 139,010,703 person-years compared with 6,730,227 deaths and 51,051,045,837 person-years in 95 other countries. Crude rates were 1.86 and 13.18 per 100,000 person-years; the descriptive crude rate ratio was 0.141. Internally age–sex-standardized rates were 1.41 and 13.19, respectively, giving a descriptive standardized ratio of 0.107 (Table 2). Neither ratio measures a causal or representative regional contrast.

Table 2. Main rates for ages five years and older during 1985–2015.

Group	Countries / years*	Deaths	Person-years	Crude rate (95% CI)	Standardized rate
Selected Arab	5 / 69	2,590	139,010,703	1.86 (1.79–1.94)	1.41
Other	95 / 2236	6,730,227	51,051,045,837	13.18 (13.17–13.19)	13.19

*Years denotes country-years. All rates are per 100,000 person-years. CI: conditional Poisson count-variation interval; standardized rates use the shared internal age–sex reference.

Country estimates and demographic patterns

Reporting was intermittent, and the number of eligible years differed substantially by country: 21 years for Bahrain, 25 for Kuwait, 14 for Qatar, six for the United Arab Emirates, and three for Oman. Country-specific crude rates ranged from 0.37 per 100,000 person-years in Oman to 2.76 in Bahrain, while internally standardized rates ranged from 0.33 to 2.00 (Table 3). Because these pooled estimates cover different calendar periods, they should not be interpreted as a contemporaneous ranking of countries. The exact years included for each country are shown in Table 3 and in the complete audit.

Table 3. Country-specific estimates for the five eligible Arab countries.

Country	Actual years included	Deaths	Person-years	Crude rate (95% CI)	Standardized rate
Bahrain	1985; 1987–1988; 1997–2014	463	16,753,926	2.76 (2.52–3.03)	2.00
Kuwait	1985–1987; 1993–2014	966	57,109,991	1.69 (1.59–1.80)	1.36
Oman	2009–2010; 2014	33	8,987,087	0.37 (0.25–0.52)	0.33
Qatar	1995; 2001; 2004–2015	506	19,657,424	2.57 (2.35–2.81)	1.69
United Arab Emirates	2005–2010	622	36,502,275	1.70 (1.57–1.84)	1.36

Rates are per 100,000 person-years. Each listed year has 12 complete age–sex strata. Confidence intervals reflect count variation only.

Reported crude rates for males and females were 2.23 and 1.13 per 100,000 person-years, respectively, in the selected Arab countries, compared with 20.79 and 5.95 in the comparator group. The corresponding descriptive male-to-female rate ratios were 1.97 and 3.50. Among age groups, the highest reported rate in the selected Arab countries was 2.58 for ages 25–34 years, whereas the comparator group had its highest rate among people aged 75 years or older (24.55). Only four deaths were recorded in the oldest Arab age stratum, so that estimate should be interpreted with particular caution (Table 4).

Table 4. Sex-specific and age-specific crude rates during 1985–2015.

Stratum	Arab deaths	Arab person-years	Arab rate	Other deaths	Other person-years	Other rate
female	524	46,250,488	1.13	1,555,482	26,159,162,870	5.95
male	2,066	92,760,215	2.23	5.174,745	24.891,882,967	20.79
5-14 years	14	19,840,486	0.07	52,250	8,378,852,751	0.62
15-24 years	390	23,651,247	1.65	806,957	8,598,999,311	9.38
25-34 years	1,102	42,770,037	2.58	1,120,740	8,372,691,846	13.39
35-54 years	994	45,456,997	2.19	2,445,381	14,283,116,151	17.12
55-74 years	86	6,637,723	1.30	1,653,642	8,764,523,037	18.87
75+ years	4	654,213	0.61	651,257	2,652,862,741	24.55

Rates per 100,000 person-years. Sex and age panels are separate summaries, not mutually exclusive rows. Conditional intervals for every row are supplied in stratum_estimates.csv.

Calendar coverage and sensitivity analyses

The balanced 2005–2010 panel comprised four Arab countries contributing 24 country-years and 71 comparator countries contributing 426 country-years. The crude rates were 2.00 and 13.25 per 100,000 person-years, respectively.

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When standardized rates were averaged with equal weight for each country-year, the corresponding means were 1.86 and 11.80, giving a descriptive ratio of 0.158 (Table 5 and Figure 2). Six-year country means ranged from 1.37 to 2.66 among the four Arab countries and from 1.05 to 34.80 among the 71 comparator countries. This wide range underscores substantial between-country heterogeneity and argues against interpreting the pooled summary as a single regional effect.

Table 5. Balanced panel and zero-count sensitivity analyses.

Analysis	Arab countries / country-years	Other countries / country-years	Arab rate(deaths / person-years)	Other rate(deaths / person-years)
2005–2010 balanced crude	4 / 24	71 / 426	2.00(1,336 / 66,910,474)	13.25(1,369,081 / 10,329,765,853)
Same panel; equal-country–year standardized mean	4 / 24	71 / 426	1.86†(same panel)	11.80†(same panel)
1985–2015 excluding all-zero country-years; crude	5 / 66	93 / 2,175	1.88(2,590 / 137,471,492)	13.19(6,730,227 / 51,019,102,116)
Same zero-count sensitivity; pooled standardized	5 / 66	93 / 2,175	1.42†(same sensitivity set)	13.20†(same sensitivity set)

† Standardized values are weighted summaries and are not calculated directly from the pooled deaths and person-years. Deaths and person-years are shown for denominator transparency.

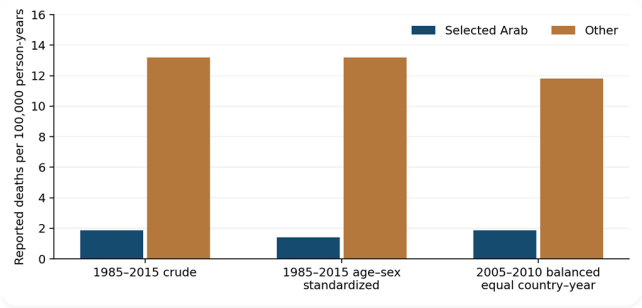


Figure 2. Descriptive comparison under three weighting schemes. The first two use 1985–2015 eligible records; the third uses a fixed 2005–2010 panel and gives each country-year equal weight. Bars are point summaries, not inferential estimates of regional effects; conditional crude-rate intervals are reported in Table 2 and the supplementary files.

The deaths and person-years underlying the crude-rate rows are shown directly in Table 5. Sixty-four eligible country-years had zero deaths in all strata, including Bahrain in 1997 and 1998 and Qatar in 1995. After excluding all-zero country-years, the Arab crude rate changed only slightly, from 1.86 to 1.88 per 100,000 person-years, and the standardized rate from 1.41 to 1.42. This post-hoc sensitivity analysis cannot distinguish a true absence of events from under-ascertainment or other reporting limitations. Period-specific crude rates are shown in Table 6; they varied with changes in the countries contributing data.

Table 6. Period-specific descriptive crude rates.

Period	Group	Deaths	Person-years	Rate
1985-1994	Selected Arab	131	8,450,700	1.55
1985-1994	Other	1,701,196	13,010,011,453	13.08
1995-2004	Selected Arab	582	25,210,566	2.31
1995-2004	Other	2,495,661	17,393,803,069	14.35
2005-2015	Selected Arab	1,877	105,349,437	1.78
2005-2015	Other	2,533,370	20,647,231,315	**12.27**

Rates are per 100,000 person-years. These are available-country summaries, not estimates from a constant longitudinal panel.

Discussion

Lower reported mortality in the selected Arab countries persisted after internal age–sex standardization and in a fixed calendar-period panel. This is a description of the recovered compilation, not proof of lower underlying incidence or of a specific amount of under-reporting. Both true mortality differences and measurement differences may contribute to this, and the dataset cannot separate them. The main contribution of the revision is to make eligibility, denominators, reference weights, and coverage transparent rather than to extend geographically by pooling incompatible records.

The denominator audit materially changes the earlier interpretation. Restricting the primary period to 1985–2015 avoids mixing an age-five-plus population with the age-15-plus structure present in 2016. Excluding the extension avoids the assumption that a repeated number is necessarily a national population. The former 1985–2020 rate estimates are withdrawn. Egypt alone contributed 311,148,822 of the previously reported 491,712,988 Arab denominator units, approximately 63.3%, despite only three years with counts. That numerical dominance amplified the effect of adding non-comparable records; it does not establish a valid Egyptian mortality rate.

WHO distinguishes reported registration data from estimates that account for incompleteness, and advises considering both population coverage and cause-of-death coding [9]. Pritchard and Amanullah examined recorded suicide alongside undetermined and other violent deaths in predominantly Islamic countries, highlighting the importance of classification when comparing low recorded suicide rates [24]. That study is contextual evidence; predominantly Islamic countries are not equivalent to Arab League states, and it does not validate the present countries or quantify their undercount.

The concentration of eligible Arab observations in Gulf countries is especially consequential. Dervic and colleagues found different recorded rates among nationals and expatriates in Dubai [25]. The current CSV lacks nationality or migration status, preventing comparable subgroup analyses. Stigma and help-seeking barriers described in Middle Eastern literature may influence care and reporting, but associations in this ecological file cannot attribute the observed contrast to religion, culture, migration, or service access [10–12]. Direct standardization addresses measured age–sex composition only.

The sex and age profiles also require caution. The male excess is consistent with established international patterns, but its magnitude varies with the included populations and

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years [17,18]. The oldest Arab stratum contains few recorded deaths, so a low pooled rate should not be treated as evidence of protection in later life. Research on older adults describes social and clinical vulnerabilities that cannot be measured in these aggregate records [19,20].

The balanced panel strips out imbalances in years and country weights in the given interval. The persistence of a lower reported Arab summary is informative for this particular comparison, but four Gulf countries are not sufficient to represent the 22 Arab League states. The panel strips in Oman and all Arab countries which appear only after 2016. Requiring complete data for fixed years could also preferentially retain more completely populated datasets; a complete set of cells is not the same as a high-quality death-registration system.

The former GDP and HDI significance claims have been removed because pooled country-year tests ignored dependence, and HDI missingness was extensive. Earlier socioeconomic research illustrates that associations vary across designs and settings [26–28]. The present dataset would require a separately specified longitudinal model, defensible covariates, and explicit handling of missingness before such questions could be addressed. Adding a complex model alone would not correct deficient outcome ascertainment or an uncertain denominator.

Public-health implications concern measurement as well as prevention. Reporting systems need consistent population coverage, explicit handling of deaths of undetermined intent, documented coding practices, and transparent source linkage. Prevention priorities should not be reduced on the basis of a low recorded rate. The WHO prevention framework supports surveillance alongside coordinated, context-sensitive preventive action [7,8].

Limitations

Repository identity and file reproducibility was verified, however, individual records were not reconciled with the original WHO Mortality Database extracts or national mortality records. Verification of the Kaggle file therefore represents verification of this analysis's reproducibility, not of the validity of the underlying mortality data. Measures of registration completeness, ICD definitions, and geographical coverage flags are absent. Five Gulf countries contribute to the main Arab analysis with highly uneven and discontinuous reporting years. The internal reference population is dominated by comparator person-years, uses broad age groups, omits children under five, and is not directly comparable with WHO world-standard estimates. The balanced interval has been selected through review and cannot represent all periods. Neither conditional count intervals nor standardization address systematic misclassification, under-registration, denominator error, or migration composition. Aggregate data cannot identify individual risk factors and the historical findings should not be presented as current national suicide estimates.

Conclusion

Based on available 1985–2015 records, the five sampled Arab countries had lower reported suicide mortality than the available comparator countries. Similar patterns were seen after internal age–sex standardization and in the balanced 2005–2010 panel, as well as after omitting country-years with no reported suicides. In contrast, later records were not suitable for the former extended-rate analysis. Independent validation against primary mortality sources and/or greater consistency in registration coverage would be needed before these descriptive contrasts could be interpreted as reflecting true regional differences in suicide mortality.

Declarations

Data availability

The source database is publicly available on Kaggle. The supplementary reproducibility package provides the analyzed CSV, executable code, audit tables, standardization weights, outputs, and source-version metadata. The version-1 repository lists the CC0 Public Domain as its license. WHO and national source conditions are distinct from the compilation's repository license.

Ethics

This study did not involve any recruitment, interventions, contact with participants or use of identifying information; it used only publicly available aggregated country–year–sex–age records. Consequently, the authors did not seek formal ethics review or approval, and no approval or exemption number is available. If the journal requires such a determination for secondary analysis of publicly available aggregate data, the author will be happy to obtain and share the relevant paperwork.

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Competing interests

The author declares no competing interests.

Author contribution

Ahed J Alkhatib, as the sole author, was responsible for the study concept and design, data curation and checking, analysis and interpretation, preparation of tables and figures, drafting and revising the manuscript, and approval of the final version.

AI assistance disclosure

OpenAI ChatGPT assisted with data checking, statistical programming, and figure preparation. The author is responsible for reviewing the analyses, checking the cited sources, and approving the final manuscript.

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