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Age-Specific Patterns and Cross-National Heterogeneity in Suicide Mortality Across 25 Countries: A Descriptive, Correlational, and Regression Analysis

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Abstract

Background & Objective: Suicide is a complex, preventable global public health problem characterized by substantial geographical and demographic heterogeneity. This ecological study aimed to compare suicide mortality rates per 100,000 population across Iran and 24 neighboring or regional comparator countries in 2019, focusing on age-specific patterns and between-country variation to inform context-specific prevention strategies.

Materials & Methods: Using a retrospective observational design and secondary data from the WHO Global Health Estimates, we analyzed suicide mortality across 11 ordered age-group categories. The data were examined using descriptive statistics and distributional assessments, including the Kolmogorov-Smirnov test. Comparative analyses employed Pearson and Spearman correlation coefficients and linear regression to assess associations between age-group rank and mortality rates. The study was reported in accordance with the STROBE guidelines.

Results: Across the 25 countries, suicide mortality exhibited substantial cross-national and age-specific heterogeneity. The highest mean rate was observed in Kazakhstan (32.12 ± 27.18), whereas the lowest was recorded in Syria (3.03 ± 1.10) per 100,000 population. Most countries showed statistically significant departures from normality. Spearman correlation analyses revealed predominantly strong positive associations across age-group ranks, particularly in Armenia, Azerbaijan, Jordan, Iraq, Egypt, and Tajikistan, whereas Iran, Oman, Uzbekistan, and the United Arab Emirates exhibited weaker or more heterogeneous patterns. Regression analyses demonstrated a significant positive age-related gradient in the Russian Federation, but not in Iran, Oman, Saudi Arabia, Uzbekistan, or Yemen. These findings suggest that suicide mortality patterns may reflect diverse socioeconomic, cultural, and health system factors. The discrepancy between absolute mortality rates and age-specific profiles indicates that geographical proximity does not necessarily correspond to epidemiological similarity. The study's limitations include its ecological design and the potential underreporting of suicide deaths because of social stigma.

Conclusion: Suicide mortality in the studied regions is characterized by substantial geographical and age-specific heterogeneity. Effective prevention requires age-sensitive, multisectoral strategies and strengthened national surveillance systems.

Keywords: Suicide, Age-Specific Mortality, Epidemiology, Iran, Public Health.

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Introduction

Suicide is a major yet preventable global public health problem and remains a substantial cause of premature mortality. The World Health Organization (WHO) estimated that

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approximately 727,000 people died by suicide in 2021, with 73% of these deaths occurring in low and middle income countries and 56% occurring before the age of 50 years (1). Suicide was also the third leading cause of death among individuals aged 15 to 29 years, highlighting its disproportionate impact during socially and economically productive stages of life (1). Although global suicide mortality has declined overtime, substantial geographical, demographic, and temporal heterogeneity persists. Global Burden of Disease (GBD) analyses indicate that the age-standardized suicide mortality rate decreased from approximately 14.9 per 100,000 population in 1990 to 9.0 per 100,000 in 2021, although the absolute number of deaths remains considerable (2).

Suicide results from a complex interplay of biological, psychological, social, economic, cultural, and environmental factors. Mental disorders, particularly depression and alcohol use disorders, as well as previous suicide attempts, are established risk factors. However, suicidal behavior may also occur during acute crises involving relationship conflict, financial hardship, chronic illness or pain, bereavement, violence, social isolation, and displacement (1). Accordingly, effective prevention requires a multidimensional public health approach that incorporates early identification and treatment, psychosocial support, restrictions on access to lethal means, responsible media practices, and community-based interventions (1, 3). Age-standardized and age-specific analyses are particularly important for international comparisons because differences in population age structures can substantially influence crude mortality rates (2, 4).

The Eastern Mediterranean Region (EMR) exhibits considerable epidemiological heterogeneity because of differences in demographic structures, socioeconomic conditions, health system capacity, cultural and legal contexts, and access to mental health services. Previous systematic reviews have documented substantial variation in suicide mortality and suicidal behavior across EMR countries while highlighting the potential for underestimation because of stigma, incomplete registration systems, and inconsistent classification practices (5). A regional situation analysis estimated an overall age-standardized suicide mortality rate of approximately 6.7 per 100,000 population during 2000 to 2019, while emphasizing important concerns about data quality and substantial variation between countries (6). Such limitations complicate direct international comparisons because observed differences may reflect both genuine epidemiological variation and differences in case ascertainment and reporting practices (6, 7).

Furthermore, an important epidemiological feature warranting attention in global and EMR populations is the gender paradox in suicidal behavior. Females generally exhibit higher rates of suicidal ideation and nonfatal suicide attempts, whereas males experience substantially higher suicide mortality, a difference largely attributed to the use of more lethal methods and sociocultural differences in help-seeking behavior (5, 8). However, in several parts of the EMR and South Asia, the gender gap in suicide mortality is narrower or exhibits distinct age and sex interactions compared with Western populations, underscoring the need for careful demographic profiling.

Iran represents an important setting within this regional context. A systematic review and meta-analysis estimated the suicide mortality rate in Iran at 8.14 per 100,000 population, with rates of 9.1 and 5.0 per 100,000 among males and females, respectively (8). More recent evidence indicates heterogeneity according to demographic, socioeconomic, and geographical characteristics (9), while suicide methods also vary substantially across the EMR (10). Nevertheless, standardized comparative evidence examining Iran alongside

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neighboring and regional comparator countries across different age groups remains limited. Therefore, the present study compares suicide mortality rates per 100,000 population in Iran and 24 neighboring or regional comparator countries in 2019, with particular attention to age-specific patterns and between-country heterogeneity. The study adopts a descriptive ecological rather than causal approach and aims to provide comparative epidemiological evidence that may inform surveillance, priority setting, and context-specific suicide prevention planning.

Materials and Methods

Study Design, Setting, and Reporting Framework

This study was designed as a retrospective, observational, ecological, and comparative epidemiological analysis of suicide mortality in Iran and neighboring or regional comparator countries. The country was the unit of analysis, and suicide mortality rates per 100,000 population were compared across predefined age-group categories for 2019. The study used secondary, aggregated, country-level data and did not involve individual participants. The reporting framework was developed in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) recommendations, including the specification of the study design, setting, eligibility criteria, variables, data sources, missing-data procedures, potential sources of bias, and statistical methods (11).

Geographic Scope, Data Source, and Study Population

The analytical dataset comprised 25 countries: Afghanistan, Armenia, Azerbaijan, Bahrain, Egypt, India, Iran, Iraq, Jordan, Kazakhstan, Kuwait, Kyrgyzstan, Lebanon, Oman, Pakistan, Qatar, the Russian Federation, Saudi Arabia, Syria, Tajikistan, Türkiye, Turkmenistan, the United Arab Emirates, Uzbekistan, and Yemen. Iran was designated as the reference country. Because the dataset included countries beyond Iran's immediate land neighbors, countries sharing a land border with Iran were distinguished analytically from additional regional comparator countries. All observations referred to 2019.

The study used secondary country-level data on suicide mortality, with observations classified by country and age group. The WHO Global Health Estimates provide comparable mortality estimates by country, age, sex, and cause of death and integrate information from national vital registration systems and other data sources (12, 13).

Eligibility, Variables, and Outcome Definition

Countries were eligible for inclusion if they belonged to the prespecified geographical study region and had valid country-level suicide mortality data for 2019 for at least one predefined age group. Suicide mortality was assessed across 11 age-group categories, ordered from younger to older: 15 to 19, 15 to 24, 15 to 29, 25 to 34, 30 to 49, 35 to 44, 45 to 54, 55 to 64, 65 to 74, 75 to 84, and 85 years or older. Most countries contributed 11 observations, whereas Egypt, Turkmenistan, and Uzbekistan contributed 10 because one observation was missing for each country.

The primary outcome was the suicide mortality rate, expressed as the number of deaths per 100,000 population. Country, age group, study year, and mortality rate were the principal study variables. The mortality rate was defined as the number of suicide deaths divided by the corresponding population and multiplied by 100,000. When the original data source reported age-standardized rather than crude rates, this distinction was identified explicitly, and the reported rate was retained in accordance with the source's definition (12 to 14).

Data Management and Statistical Analysis

Before analysis, the dataset was checked for completeness, duplicate records, inconsistent

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country identifiers, numerical errors, missing observations, and implausible values. Missing values were retained as missing and were neither replaced with zero nor imputed in the primary analysis.

Descriptive statistics included the mean, standard deviation (SD), median, interquartile range (IQR), minimum, maximum, and range, as appropriate. Given the small number of observations per country and evidence of positive skewness, the median and IQR were emphasized where appropriate. Distributional characteristics were evaluated through graphical inspection, skewness and kurtosis assessments, and the Kolmogorov-Smirnov test with Lilliefors correction and Monte Carlo estimation. Formal normality testing was not used as the sole basis for statistical decisions because country-specific sample sizes were generally small (11 to 13).

Correlation, Age-Group Coding, and Regression Analysis

The primary unit of analysis was the country by age-group observation. Because observations from different age groups within the same country are clustered and do not constitute statistically independent population samples, correlation and regression analyses were conducted separately for each country and interpreted strictly as exploratory, macro-level ecological associations.

Although some of the 11 predefined WHO age-group categories overlap, such as 15 to 19, 15 to 24, and 15 to 29 years, and the categories are not uniformly spaced, all 11 were retained to preserve comprehensive coverage of the young-adult transition spectrum available in the secondary dataset. The age groups were coded sequentially from 1 to 11 solely to represent their ordinal ranking from younger to older categories rather than continuous chronological age.

Given this ordinal structure, the small number of observations per country (N = 10 to 11), and the nonnormal distributions observed in most countries, Spearman's rank correlation coefficient (ρ) was used to assess monotonic associations across all 25 countries. In addition, simple linear regression analyses, accompanied by Pearson's correlation coefficient (r), were restricted to the six countries whose age-specific mortality distributions did not deviate significantly from normality: Iran, Oman, the Russian Federation, Saudi Arabia, Uzbekistan, and Yemen. This classification was based on the Kolmogorov-Smirnov test with Monte Carlo estimation, using $p > 0.05$ as the criterion for not rejecting the null hypothesis of normality.

Model adequacy and influence diagnostics for the regression models were evaluated using predicted values, unstandardized and standardized residual ranges, the Durbin-Watson statistic for residual autocorrelation, tolerance, and the variance inflation factor (VIF). Statistical inference was based on a significance level of $\alpha = 0.05$. In the correlation matrices, single (*) and double (**) asterisks indicated statistical significance at $p < 0.05$ and $p < 0.01$, respectively (13).

Missing Data, Reproducibility, and Ethical Considerations

Analyses requiring unavailable observations used a complete-case approach. No single-value imputation was performed because missingness was limited and country-specific sample sizes were small. The analytical dataset, variable definitions, data-cleaning procedures, and statistical syntax should be retained to facilitate reproducibility.

Because the study used aggregated, nonidentifiable secondary data and involved neither direct participant recruitment nor individual-level records, informed consent was not applicable. Nevertheless, institutional requirements concerning ethical review or exemption should be verified and reported.

Finally, international comparisons were interpreted cautiously because differences in

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age structure, death registration completeness, classification practices, and case ascertainment may influence observed suicide mortality estimates. The WHO emphasizes that its estimates integrate multiple data sources and standardized methods to improve cross-country comparability (12, 14).

Results

Descriptive Results of suicide mortality across the 11 ordered age-group categories, ranging from 15–19 years to ≥85 years, in 25 countries

The highest mean suicide mortality rate was observed in Kazakhstan (32.12 ± 27.18 deaths per 100,000 population), followed by the Russian Federation (30.81 ± 12.41) and India (20.84 ± 12.73). In contrast, the lowest mean rates were recorded in Syria (3.03 ± 1.10), Türkiye (3.48 ± 1.25), and Jordan (3.72 ± 3.52). These differences indicate substantial cross-national variation in the magnitude of suicide mortality across the age-specific observations.

The variability in suicide mortality also differed considerably among countries. Kazakhstan exhibited the greatest dispersion, with a standard deviation of 27.18 and a wide range of 15.35 to 111.48 deaths per 100,000 population, followed by India, with a range of 10.40 to 57.15, and the Russian Federation, with a range of 14.11 to 58.60. Conversely, Syria exhibited the narrowest distribution, with values ranging from 1.78 to 6.07 and a standard deviation of only 1.10. Similarly, Türkiye showed relatively low variability (*SD* = 1.25; *range* = 2.63 to 6.99). The substantial differences between the minimum and maximum values in several countries, particularly Kazakhstan, India, and the Russian Federation, suggest pronounced age-specific heterogeneity rather than a uniform distribution of suicide mortality across age groups.

In countries characterized by substantial variability, particularly Kazakhstan, India, and the Russian Federation, the median values were generally lower than the corresponding means. For example, Kazakhstan had a mean of 32.12 compared with a median of 24.11, whereas India had a mean of 20.84 and a median of 17.45. This divergence is consistent with positively skewed distributions, in which relatively high age-specific observations elevate the arithmetic mean. A similar, although less pronounced, pattern was evident in several other countries. Overall, the descriptive findings demonstrate substantial cross-national differences in both the magnitude and variability of suicide mortality, highlighting considerable geographical heterogeneity in age-specific mortality patterns.

Distribution of Suicide Mortality Data

The results revealed considerable heterogeneity in the distributional characteristics of suicide mortality across the 25 countries. Evidence of statistically significant departures from normality was observed in Afghanistan (Monte Carlo $p = 0.007$), Armenia ($p = 0.008$), Azerbaijan ($p = 0.001$), Bahrain ($p = 0.010$), Egypt ($p = 0.008$), India ($p < 0.001$), Iraq ($p = 0.014$), Jordan ($p = 0.001$), Kazakhstan ($p = 0.001$), Kuwait ($p < 0.001$), Kyrgyzstan ($p = 0.006$), Lebanon ($p = 0.012$), Pakistan ($p = 0.043$), Qatar ($p = 0.001$), Syria ($p = 0.009$), Tajikistan ($p = 0.002$), Türkiye ($p = 0.002$), Turkmenistan ($p = 0.001$), and the United Arab Emirates ($p = 0.014$). These findings indicate that the age-specific suicide mortality observations in most countries deviated significantly from a normal distribution.

In contrast, the distributions for Iran, Oman, the Russian Federation, Saudi Arabia, Uzbekistan, and Yemen did not provide statistically significant evidence of departures from normality. Their respective Monte Carlo significance values were $p = 0.272$, 0.608, 0.866, 0.400, 0.788, and 0.095. The Russian Federation showed the greatest compatibility with normality among these countries ($p = 0.866$), followed by Uzbekistan ($p = 0.788$) and Oman ($p = 0.608$). Yemen also had a p value

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above the conventional 0.05 threshold, although its value of 0.095 was comparatively close to that threshold. These findings suggest that the observed distributions in these six countries were more compatible with normality than those in most of the other study countries (Figure 1, Table 1).

The distributional findings were broadly consistent with the descriptive statistics. Countries with wide ranges and large standard deviations, such as Kazakhstan, India, and the Russian Federation, exhibited marked variability in their age-specific mortality rates, although the Russian Federation's distribution did not show a statistically significant departure from normality. Kazakhstan's exceptionally wide range and high standard deviation indicate substantial variation across the observed age groups, while India's relatively high mean and dispersion similarly reflect considerable variability. Conversely, countries such as Syria and Türkiye exhibited comparatively narrow distributions, although their formal normality tests indicated statistically significant departures from normality. This discrepancy underscores the importance of considering both graphical and descriptive evidence alongside formal statistical tests when evaluating distributional assumptions.

Taken together, these results demonstrate substantial cross-national heterogeneity in both the central tendency and distributional form of age-specific suicide mortality. The predominance of statistically significant departures from normality suggests that subsequent inferential analyses should not rely uniformly on parametric assumptions without appropriate assessment. Moreover, because each country contributed only approximately 10 to 11 observations and the age-group categories are ordered rather than independent population samples, the normality test results should be interpreted cautiously. The observed heterogeneity provides an important statistical context for the subsequent correlation and regression analyses and suggests that age-related patterns of suicide mortality may vary considerably across countries rather than conforming to a single, uniform distributional pattern (Tables 1 and 2).

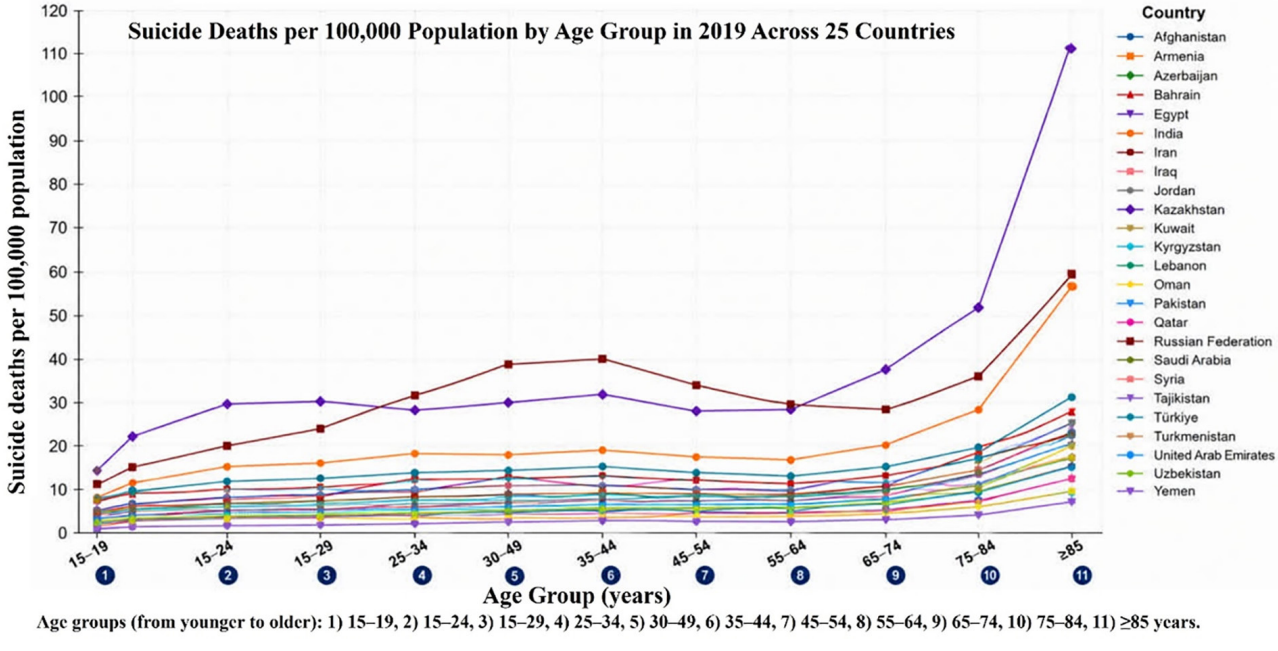


Figure 1. Age-specific patterns of suicide mortality rates (deaths per 100,000 population) across the 25 comparator countries in 2019.

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Table 1. Descriptive analyses characterized the distribution of suicide deaths per 100,000 population across 25 study countries.

Country	N	Mean	Std. Error of Mean	Median	Std. Deviation	Range	Minimum	Maximum
Afghanistan	11	9.1991	1.67652	8.5000	5.56038	21.18	3.28	24.46
Armenia	11	6.2282	2.43339	3.2300	8.07065	26.88	1.01	27.89
Azerbaijan	11	7.1773	1.77509	5.2500	5.88732	21.03	2.94	23.97
Bahrain	11	11.1609	2.10719	10.4700	6.98874	25.34	4.77	30.11
Egypt	10	5.2210	0.65764	4.3000	2.07966	7.12	3.63	10.75
India	11	20.8391	3.83757	17.4500	12.72779	46.75	10.40	57.15
Iran	11	7.1909	0.63189	6.6900	2.09573	7.36	4.91	12.27
Iraq	11	7.8855	1.65872	6.1600	5.50136	20.25	2.83	23.08
Jordan	11	3.7218	1.06115	2.6600	3.51942	12.53	1.16	13.69
Kazakhstan	11	32.1218	8.19560	24.1100	27.18173	96.13	15.35	111.48
Kuwait	11	5.1255	1.71660	3.8800	5.69333	20.53	1.51	22.04
Kyrgyzstan	11	12.8064	1.84966	11.3400	6.13462	22.11	7.72	29.83
Lebanon	11	4.2155	0.52598	3.7400	1.74449	6.32	2.76	9.08
Oman	11	7.1464	1.12517	6.0700	3.73176	12.81	3.25	16.06
Pakistan	11	13.8882	1.67002	13.1500	5.53884	19.86	9.03	28.89
Qatar	11	7.8036	1.56507	7.0500	5.19074	19.23	3.03	22.26
Russian Federation	11	30.8055	3.74163	28.2700	12.40958	44.49	14.11	58.60
Saudi Arabia	11	6.9745	0.79550	7.2000	2.63837	8.15	1.86	10.01
Syria	11	3.0282	0.33125	2.8300	1.09862	4.29	1.78	6.07
Tajikistan	11	9.2436	2.03765	7.5500	6.75813	24.28	4.18	28.46
Turkey	11	3.4755	0.37686	3.0200	1.24991	4.36	2.63	6.99
Turkmenistan	10	9.4460	1.24735	8.4250	3.94445	13.89	6.45	20.34
United Arab Emirates	11	7.8218	1.06023	7.3600	3.51638	14.49	2.57	17.06
Uzbekistan	10	10.8940	0.77595	10.6600	2.45376	7.13	8.12	15.25
Yemen	11	9.6900	0.98679	8.3100	3.27281	12.28	6.24	18.52

Spearman Rank Correlation between Suicide Rates and Age-Group Patterns across the Studied Countries

The findings revealed substantial heterogeneity in the relationships between age-group rank and suicide mortality patterns across the countries examined. Strong, statistically significant positive correlations were observed in several countries, particularly Armenia (ρ = 0.991, $p < 0.001$), Azerbaijan (ρ = 0.991, $p < 0.001$), Jordan (ρ = 1.000, $p < 0.001$), Iraq (ρ = 0.964, $p < 0.001$), Egypt (ρ = 0.976, $p < 0.001$), Tajikistan (ρ = 0.936, $p < 0.001$), Syria (ρ = 0.882, $p < 0.001$), and Afghanistan (ρ = 0.864, p = 0.001). These coefficients indicate strong monotonic associations between the ordering of age-group categories and the corresponding suicide mortality patterns. Substantively, the findings suggest that, in these countries, suicide mortality rates exhibit a systematic relationship with age-group rank, with the observed pattern becoming more pronounced as the analysis progresses from younger to older age categories.

A similarly strong positive association was reported for Iran, although its pattern differed from those observed in several of the aforementioned countries. Specifically, the association between age-group rank and the corresponding suicide mortality pattern in Iran was not statistically significant in some comparisons.

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Table 2. The distribution of suicide deaths per 100,000 population across 25 study countries.

Country	N	Test Statistic	Asymp. Sig. (2-tailed)d	Monte Carlo Sig. (2-tailed)e	99% Confidence Interval	
					Lower Bound	Upper Bound
Afghanistan	11	0.301	0.006	0.007	0.005	0.009
Armenia	11	0.299	0.007	0.008	0.005	0.01
Azerbaijan	11	0.342	0.001	0.001	0.00	0.001
Bahrain	11	0.294	0.009	0.01	0.007	0.012
Egypt	10	0.309	0.008	0.008	0.006	0.01
India	11	0.389	0.00	0.00	0.00	0.00
Iran	11	0.197	.200[f]	0.272	0.261	0.284
Iraq	11	0.284	0.014	0.014	0.011	0.017
Jordan	11	0.332	0.001	0.001	0.00	0.002
Kazakhstan	11	0.331	0.001	0.001	0.00	0.002
Kuwait	11	0.432	0.00	0.00	0.00	0.00
Kyrgyzstan	11	0.303	0.006	0.006	0.004	0.008
Lebanon	11	0.288	0.011	0.012	0.009	0.015
Oman	11	0.159	.200[f]	0.608	0.596	0.621
Pakistan	11	0.257	0.041	0.043	0.038	0.049
Qatar	11	0.343	0.001	0.001	0.00	0.001
Russian Federation	11	0.13	.200[f]	0.866	0.858	0.875
Saudi Arabia	11	0.181	.200[f]	0.4	0.388	0.413
Syria	11	0.296	0.008	0.009	0.006	0.011
Tajikistan	11	0.327	0.002	0.002	0.001	0.003
Turkey	11	0.326	0.002	0.002	0.001	0.003
Turkmenistan	10	0.351	0.001	0.001	0.00	0.002
United Arab Emirates	11	0.286	0.013	0.014	0.011	0.017
Uzbekistan	10	0.146	.200[f]	0.788	0.778	0.799
Yemen	11	0.234	0.095	0.095	0.087	0.102

However, Iran showed strong positive correlations with the United Arab Emirates (ρ = 0.842, p = 0.002), Oman (ρ = 0.818, p = 0.002), and Lebanon (ρ = 0.727, p = 0.011). These findings indicate that Iran's age-specific mortality profile was more closely aligned with those of these countries than with those of several other countries in the dataset. Conversely, the correlations between Iran and Afghanistan (ρ = -0.382), Syria (ρ = -0.291), and several Central Asian and Middle Eastern countries were weak or negative and did not reach statistical significance. Thus, Iran appears to differ from the predominantly positive pattern observed in several of the country comparisons.

The countries of the South Caucasus and parts of the Middle East exhibited particularly strong concordance in their age-related suicide mortality profiles. Armenia and Azerbaijan showed exceptionally strong positive correlations with Afghanistan (both ρ = 0.991, $p < 0.001$) and Iraq (ρ = 0.991 for both comparisons, $p < 0.001$). Their correlations with Iran were also very strong, with coefficients of ρ = 0.955 for Armenia and ρ = 0.927 for Azerbaijan ($p < 0.001$ for both comparisons). Armenia was additionally strongly correlated with Syria (ρ = 0.927, $p < 0.001$), Tajikistan (ρ = 0.900, $p < 0.001$), Saudi Arabia (ρ = 0.873, $p < 0.001$), and Kazakhstan (ρ = 0.827, p = 0.002). Azerbaijan demonstrated a comparable pattern, with strong correlations with Tajikistan

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(ρ = 0.918, p < 0.001), Syria (ρ = 0.945, p < 0.001), Saudi Arabia (ρ = 0.900, p < 0.001), Kazakhstan (ρ = 0.855, p = 0.001), and India (ρ = 0.745, p = 0.008). The consistency of these associations suggests that several countries share similar age-related patterns in the ordering of their suicide mortality rates.

Central Asian countries also exhibited predominantly positive associations. Tajikistan showed some of the strongest correlations in the dataset, particularly with Kazakhstan (ρ = 0.973, p < 0.001), as well as with Iraq (ρ = 0.936, p < 0.001), Jordan (ρ = 0.936, p < 0.001), and Afghanistan (ρ = 0.936, p < 0.001). Kyrgyzstan was positively correlated with Afghanistan (ρ = 0.700, p = 0.016), Armenia (ρ = 0.618, p = 0.043), Egypt (ρ = 0.758, p = 0.011), and Syria (ρ = 0.818, p = 0.002). Kazakhstan likewise showed strong correlations with Afghanistan (ρ = 0.836, p = 0.001), Azerbaijan (ρ = 0.855, p = 0.001), Armenia (ρ = 0.827, p = 0.002), and several other countries. Collectively, these findings indicate a relatively consistent age-related structure among several countries in Central Asia and the wider Eurasian region.

A notable pattern was also observed for India. India exhibited statistically significant positive correlations with Turkmenistan (ρ = 0.936, p < 0.001), Türkiye (ρ = 0.770, p = 0.009), Qatar (ρ = 0.745, p = 0.008), Pakistan (ρ = 0.727, p = 0.011), Afghanistan (ρ = 0.718, p = 0.013), Iran (ρ = 0.709, p = 0.015), and Syria (ρ = 0.818, p = 0.002). In contrast, the correlation with the United Arab Emirates was negligible and not statistically significant (ρ = -0.055, p = 0.881). This contrast indicates that India's age-related mortality pattern was relatively similar to those of several countries but differed considerably from that of the United Arab Emirates.

The Gulf countries displayed a more heterogeneous pattern of associations. Bahrain showed statistically significant positive correlations with Uzbekistan (ρ = 0.718, p = 0.013), Turkmenistan (ρ = 0.864, p = 0.001), the Russian Federation (ρ = 0.682, p = 0.021), Pakistan (ρ = 0.827, p = 0.002), Oman (ρ = 0.900, p < 0.001), and Egypt (ρ = 0.773, p = 0.005). Qatar was significantly correlated with Turkmenistan (ρ = 0.827, p = 0.002) and Türkiye (ρ = 0.758, p = 0.011), whereas its correlations with most other countries were not statistically significant. Saudi Arabia exhibited a particularly strong association with Uzbekistan (ρ = 0.955, p < 0.001), but its associations with Afghanistan, the United Arab Emirates, Türkiye, Tajikistan, Syria, and several other countries were generally weaker and mostly not statistically significant. These findings suggest that geographical proximity alone does not fully account for similarities in age-related suicide mortality patterns.

The Russian Federation exhibited statistically significant positive correlations with Afghanistan (ρ = 0.718, p = 0.013), Uzbekistan (ρ = 0.836, p = 0.001), Turkmenistan (ρ = 0.736, p = 0.010), Tajikistan (ρ = 0.791, p = 0.004), Syria (ρ = 0.818, p = 0.002), and Iran (ρ = 0.836, p = 0.001). This pattern is noteworthy because it indicates a relatively broad alignment between the Russian Federation's age-related suicide mortality profile and those of several Central Asian and Middle Eastern countries. Nevertheless, the correlation with the United Arab Emirates was weak and not statistically significant (ρ = 0.139, p = 0.701), further illustrating the heterogeneous structure of the observed regional associations.

Among the countries characterized by comparatively weak or statistically nonsignificant relationships, Oman and Uzbekistan are particularly noteworthy. Oman showed no statistically significant association with Afghanistan (ρ = -0.009, p = 0.979), Armenia (ρ = -0.100, p = 0.770), Azerbaijan (ρ = -0.045, p = 0.894), or most other countries, despite exhibiting moderate positive coefficients in comparisons with the United Arab Emirates and Türkiye. Uzbekistan similarly showed

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weak or statistically nonsignificant associations with many countries, including Afghanistan (ρ = 0.582, p = 0.060), Armenia (ρ = 0.355, p = 0.285), Azerbaijan (ρ = 0.409, p = 0.212), and Yemen (ρ = -0.309, p = 0.385). These findings suggest that the age-related suicide mortality profiles of these countries may differ substantially from those of countries exhibiting stronger positive correlations.

Taken together, the Spearman correlation matrix indicates that positive monotonic associations predominate in the reported country comparisons, although their magnitude and statistical significance vary considerably. The strongest coefficients occur among Armenia, Azerbaijan, Jordan, Egypt, Iraq, Tajikistan, and several other countries in the Middle East, Central Asia, and the South Caucasus. In contrast, the United Arab Emirates, Oman, Uzbekistan, and several other country comparisons exhibit weak, negligible, or negative associations. Importantly, these results should be interpreted as evidence of similarities in the *rank-order age patterns* rather than as evidence that increasing age directly causes higher suicide mortality rates.

From a broader epidemiological perspective, the observed positive associations may indicate that several countries share comparable age-related structures in their suicide mortality patterns. Such similarities could reflect common demographic characteristics, socioeconomic conditions, cultural factors, access to mental health services, reporting practices, or similarities in the distribution of suicide risk across the life course. Nevertheless, the marked differences observed for countries such as Iran, Oman, Uzbekistan, and the United Arab Emirates suggest that these factors do not operate uniformly across all settings. Further analyses incorporating age-standardized suicide mortality rates, confidence intervals, temporal trends, and multivariable models are therefore needed to determine whether the observed cross-national similarities persist after accounting for differences in population structure and other potential confounding factors (Table 3).

Regression Analysis of Age-Specific Suicide Mortality in Iran

The correlation analysis revealed an almost negligible positive association between age-group category and suicide mortality in Iran (Pearson's r = 0.027, one-tailed p = 0.468, N = 11). Thus, the observed suicide mortality rates showed no meaningful linear tendency to increase or decrease as the age-group category progressed from younger to older groups. This finding suggests that, within the structure and level of aggregation of the available age-specific data, the ordinal progression across the 11 age-group categories was not meaningfully associated with variation in suicide mortality.

The regression model was likewise not statistically significant. Age-group category explained only 0.1% of the variance in suicide mortality (R^2 = 0.001; adjusted R^2 = -0.110), with a standard error of the estimate of 2.21. The overall regression model was not statistically significant, $F(1, 9)$ = 0.007, p = 0.936. The coefficient for age group was small and positive (B = 0.017, SE = 0.211; standardized β = 0.027; t = 0.082, p = 0.936), indicating that each one-unit increase in age-group rank was associated with an estimated increase of only 0.017 units in suicide mortality. However, the negligible effect size and high p value indicate that this estimated increase was not statistically significant. The fitted regression equation was therefore approximately as follows: Suicide mortality = 7.087 + 0.017 × age-group category.

The model diagnostics further support this interpretation. Predicted suicide mortality values varied only slightly, from 7.10 to 7.28, whereas the observed residuals ranged from -2.33 to 4.99. This pattern indicates that the model offered little explanatory improvement over the intercept-only model.

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Bahrain			Azerbaijan			Armenia			Afghanistan			Variables
N	Sig. (2-tailed)	Correlation Coefficient	N	Sig. (2-tailed)	Correlation Coefficient	N	Sig. (2-tailed)	Correlation Coefficient	N	Sig. (2-tailed)	Correlation Coefficient	
11	0.467	0.245	11	0.00	.991**	11	0.00	.991**	11	0.001	.864**	Age Groups
11	0.013	.718*	11	0.212	0.409	11	0.285	0.355	11	0.06	0.582	Yemen
10	0.162	0.479	10	0.405	-0.297	10	0.405	-0.297	10	0.511	-0.236	Uzbekistan
11	0.001	.864**	11	0.047	.609*	11	0.071	0.564	11	0.235	0.391	United Arab Emirates
10	0.067	0.6	10	0.06	0.612	10	0.09	0.564	10	0.405	0.297	Turkmenistan
11	0.355	0.309	11	0.00	.918**	11	0.00	.900**	11	0.005	.773**	Turkey
11	0.235	0.391	11	0.00	.945**	11	0.00	.927**	11	0.003	.800**	Tajikistan
11	0.142	0.473	11	0.00	.900**	11	0.00	.873**	11	0.015	.709*	Syria
11	0.021	.682*	11	0.16	0.455	11	0.223	0.4	11	0.039	.627*	Saudi Arabia
11	0.06	0.582	11	0.01	.736**	11	0.015	.709*	11	0.008	.745**	Russian Federation
11	0.002	.827**	11	0.259	0.373	11	0.37	0.3	11	0.811	0.082	Qatar
11	0.00	.900**	11	0.894	-0.045	11	0.77	-0.1	11	0.77	-0.1	Pakistan
11	0.247	0.382	11	0.979	0.009	11	0.979	0.009	11	0.401	-0.282	Oman
11	0.19	0.427	11	0.032	.645*	11	0.043	.618*	11	0.223	0.4	Lebanon
11	0.45	0.255	11	0.015	.709*	11	0.015	.709*	11	0.077	0.555	Kyrgyzstan
11	0.066	0.573	11	0.001	.855**	11	0.002	.827**	11	0.016	.700*	Kuwait
11	0.066	0.573	11	0.001	.855**	11	0.002	.827**	11	0.016	.700*	Kazakhstan
11	0.467	0.245	11	0.00	.991**	11	0.00	.991**	11	0.001	.864**	Jordan
11	0.401	0.282	11	0.00	.927**	11	0.00	.955**	11	0.002	.827**	Iraq
11	0.089	0.536	11	0.272	-0.364	11	0.235	-0.391	11	0.212	-0.409	Iran
11	0.005	.773**	11	0.008	.745**	11	0.015	.709*	11	0.089	0.536	India
10	0.347	0.333	10	0.00	.976**	10	0.00	.964**	10	0.00	.903**	Egypt
			11	0.401	0.282	11	0.484	0.236	11	0.631	0.164	Bahrain
						11	0.00	.982**	11	0.001	.855**	Azerbaijan
									11	0.001	.855**	Armenia

Table 3. The results of correlation among studied variables.

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Jordan			Iraq			Iran				India			Egypt	
N	Sig. (2-tailed)	Correlation Coefficient	N	Sig. (2-tailed)	Correlation Coefficient	N	Sig. (2-tailed)	Correlation Coefficient	N	Sig. (2-tailed)	Correlation Coefficient	N	Sig. (2-tailed)	Correlation Coefficient
11	.	1.000**	11	0.00	.964**	11	0.247	-0.382	11	0.013	.718*	10	0.00	.976**
11	0.235	0.391	11	0.17	0.445	11	0.593	0.182	11	0.043	.618*	10	0.2	0.442
10	0.385	-0.309	10	0.533	-0.224	10	0.002	.842**	10	0.881	-0.055	9	0.381	-0.333
11	0.056	0.591	11	0.039	.627*	11	0.537	0.209	11	0.00	.936**	10	0.06	0.612
10	0.098	0.552	10	0.162	0.479	10	0.556	0.212	10	0.009	.770**	9	0.03	.717*
11	0.00	.909**	11	0.00	.891**	11	0.433	-0.264	11	0.016	.700*	10	0.001	.867**
11	0.00	.936**	11	0.00	.918**	11	0.385	-0.291	11	0.002	.818**	10	0.00	.927**
11	0.00	.882**	11	0.003	.800**	11	0.574	-0.191	11	0.00	.873**	10	0.00	.952**
11	0.201	0.418	11	0.19	0.427	11	0.958	0.018	11	0.026	.664*	10	0.128	0.515
11	0.013	.718*	11	0.007	.755**	11	0.689	-0.136	11	0.008	.745**	10	0.016	.733*
11	0.326	0.327	11	0.312	0.336	11	0.096	0.527	11	0.011	.727*	10	0.26	0.394
11	0.832	-0.073	11	0.958	-0.018	11	0.002	.818**	11	0.133	0.482	10	0.96	-0.018
11	0.979	-0.009	11	0.894	-0.045	11	0.011	.727*	11	0.537	0.209	10	0.934	0.03
11	0.035	.636*	11	0.083	0.545	11	0.65	0.155	11	0.039	.627*	10	0.011	.758*
11	0.016	.700*	11	0.01	.736**	11	0.593	-0.182	11	0.06	0.582	10	0.067	0.6
11	0.001	.836**	11	0.001	.855**	11	0.631	-0.164	11	0.001	.855**	10	0.003	.830**
11	0.001	.836**	11	0.001	.855**	11	0.631	-0.164	11	0.001	.855**	10	0.003	.830**
			11	0.00	.964**	11	0.247	-0.382	11	0.013	.718*	10	0.00	.976**
						11	0.298	-0.345	11	0.015	.709*	10	0.00	.952**
									11	0.937	0.027	10	0.347	-0.333
												10	0.011	.758*

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Oman			Lebanon			Kyrgyzstan			Kuwait			Kazakhstan		
N	Sig. (2-tailed)	Correlation Coefficient	N	Sig. (2-tailed)	Correlation Coefficient	N	Sig. (2-tailed)	Correlation Coefficient	N	Sig. (2-tailed)	Correlation Coefficient	N	Sig. (2-tailed)	Correlation Coefficient
11	0.979	-0.009	11	0.035	.636*	11	0.016	.700*	11	0.001	.836**	11	0.001	.836**
11	0.574	-0.191	11	0.75	0.109	11	0.201	0.418	11	0.026	.664*	11	0.026	.664*
10	0.174	0.467	10	0.726	-0.127	10	0.676	0.152	10	0.96	0.018	10	0.96	0.018
11	0.502	0.227	11	0.096	0.527	11	0.096	0.527	11	0.003	.809**	11	0.003	.809**
10	0.067	0.6	10	0.043	.648*	10	0.043	.648*	10	0.025	.697*	10	0.025	.697*
11	0.853	0.064	11	0.096	0.527	11	0.001	.845**	11	0.00	.909**	11	0.00	.909**
11	0.937	0.027	11	0.071	0.564	11	0.002	.818**	11	0.00	.936**	11	0.00	.936**
11	0.555	0.2	11	0.002	.818**	11	0.133	0.482	11	0.008	.745**	11	0.008	.745**
11	0.385	-0.291	11	0.77	0.1	11	0.235	0.391	11	0.026	.664*	11	0.026	.664*
11	0.537	-0.209	11	0.555	0.2	11	0.004	.791**	11	0.00	.936**	11	0.00	.936**
11	0.071	0.564	11	0.11	0.509	11	0.16	0.455	11	0.039	.627*	11	0.039	.627*
11	0.11	0.509	11	0.37	0.3	11	0.979	0.009	11	0.45	0.255	11	0.45	0.255
			11	0.047	.609*	11	0.979	-0.009	11	0.979	-0.009	11	0.979	-0.009
						11	0.67	0.145	11	0.201	0.418	11	0.201	0.418
									11	0.001	.864**	11	0.001	.864**
												11	.	1.000**

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Syria			Saudi Arabia				Russian Federation		Qatar			Pakistan		
N	Sig. (2-tailed)	Correlation Coefficient	N	Sig. (2-tailed)	Correlation Coefficient	N	Sig. (2-tailed)	Correlation Coefficient	N	Sig. (2-tailed)	Correlation Coefficient	N	Sig. (2-tailed)	Correlation Coefficient
11	0	.882**	11	0.201	0.418	11	0.013	.718*	11	0.326	0.327	11	0.832	-0.073
11	0.247	0.382	11	0.00	.955**	11	0.001	.836**	11	0.102	0.518	11	0.047	.609*
10	0.31	-0.358	10	0.627	0.176	10	0.701	0.139	10	0.117	0.527	10	0.038	.661*
11	0.013	.718*	11	0.026	.664*	11	0.01	.736**	11	0.002	.827**	11	0.029	.655*
10	0.038	.661*	10	0.467	0.261	10	0.174	0.467	10	0.011	.758*	10	0.26	0.394
11	0.008	.745**	11	0.17	0.445	11	0.004	.791**	11	0.11	0.509	11	0.937	0.027
11	0.001	.845**	11	0.089	0.536	11	0.002	.818**	11	0.102	0.518	11	0.832	0.073
			11	0.151	0.464	11	0.056	0.591	11	0.151	0.464	11	0.631	0.164
						11	0.001	.836**	11	0.201	0.418	11	0.125	0.491
									11	0.11	0.509	11	0.37	0.3
												11	0.005	.773**

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Uzbekistan			United Arab Emirates			Turkmenistan					Turkey	Tajikistan		
N	Sig. (2-tailed)	Correlation Coefficient	N	Sig. (2-tailed)	Correlation Coefficient	N	Sig. (2-tailed)	Correlation Coefficient	N	Sig. (2-tailed)	Correlation Coefficient	N	Sig. (2-tailed)	Correlation Coefficient
10	0.385	-0.309	11	0.056	0.591	10	0.098	0.552	11	0	.909**	11	0	.936**
10	0.26	0.394	11	0.019	.691*	10	0.425	0.285	11	0.151	0.464	11	0.102	0.518
			10	0.627	0.176	9	0.732	0.133	10	0.907	-0.042	10	0.676	-0.152
						10	0.067	0.6	11	0.056	0.591	11	0.019	.691*
									10	0.011	.758*	10	0.011	.758*
												11	0	.973**

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Yemen	Correlation Coefficient	0.391
	Sig. (2-tailed)	0.235
	N	11

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

The Durbin-Watson statistic was 0.820, suggesting possible positive residual autocorrelation; however, this statistic should be interpreted cautiously given the small number of observations. Collinearity was not a concern because the model contained only one predictor, with tolerance and variance inflation factor (VIF) values of 1.00. Overall, the regression analysis provided no statistically significant evidence of a linear relationship between the ordered age-group categories and suicide mortality in Iran (Table 4).

Regression Analysis of Age-Specific Suicide Mortality in Oman

In Oman, Pearson's correlation analysis revealed a weak positive association between age-group rank and suicide mortality (r = 0.238, one-tailed p = 0.241, N = 11). This association was not statistically significant and therefore did not provide sufficient evidence of a consistent linear increase in mortality across the ordered age-group categories. Consistent with this finding, the linear regression model was not statistically significant, $F(1, 9) = 0.540$, p = 0.481. Age-group rank explained 5.7% of the variance in suicide mortality (R^2 = 0.057; adjusted R^2 = -0.048).

The regression coefficient for age-group rank was positive (B = 0.268, SE = 0.364; standardized β = 0.238; t = 0.735, p = 0.481), corresponding to an estimated increase of 0.268 units in mortality for each one-unit increase in age-group rank. The fitted regression equation was Suicide mortality = 5.541 + 0.268 × age-group rank. Nevertheless, the relatively large standard error and statistically nonsignificant coefficient indicate that the estimated positive trend was uncertain and could not be distinguished reliably from zero.

Predicted mortality values ranged from 5.81 to 8.48, whereas residuals ranged from -4.38 to 7.58, indicating considerable unexplained variability around the fitted regression line. The Durbin-Watson statistic was 0.740, suggesting possible positive residual autocorrelation, although this finding should be interpreted cautiously because of the small sample size. No collinearity was identified, as indicated by tolerance and VIF values of 1.00. Standardized residuals remained approximately within the

Table 4. Regression Analysis of Age-Specific Suicide Mortality in Iran.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations		
	B	Std. Error	Beta			Zero-order	Partial	Part
(Constant)	7.087	1.428		4.963	0.001			
AGE Groups	0.017	0.211	0.027	0.082	0.936	0.027	0.027	0.027

a. Dependent Variable: Suicide mortality rate of age groups in Iran

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range of ±2, suggesting that no observations had extremely large standardized residuals. Overall, the findings provided no statistically significant evidence of a linear association between age-group progression and suicide mortality in Oman, and the low R^2 indicated that age-group rank alone had limited explanatory value (Table 5).

Regression Analysis of Age-Specific Suicide Mortality in Saudi Arabia

Pearson's correlation analysis indicated a moderate positive association between increasing age-group rank and suicide mortality ($r = 0.492$, one-tailed $p = 0.062$, $N = 11$). This finding suggests a tendency for suicide mortality to increase across progressively older age-group categories. However, the association did not reach the conventional threshold for statistical significance ($p < 0.05$). Thus, although the observed relationship was positive, the available data did not provide sufficient statistical evidence to conclude that suicide mortality increased systematically with age-group progression in Saudi Arabia.

The regression model yielded an R^2 of 0.242 and an adjusted R^2 of 0.157, indicating that approximately 24.2% of the observed variance in suicide mortality was explained by the ordered age-group variable. However, the overall regression model was not statistically significant, $F(1, 9) = 2.867$, $p = 0.125$. The coefficient for age-group rank was positive ($B = 0.391$, $SE = 0.231$; standardized $\beta = 0.492$; $t = 1.693$, $p = 0.125$). Accordingly, each one-unit increase in age-group rank was associated with an estimated increase of 0.39 units in suicide mortality, although this estimated effect was not statistically significant. The fitted regression equation was Suicide mortality = 4.629 + 0.391 × age-group category.

The model diagnostics indicated a moderate degree of unexplained variability. Predicted suicide mortality values ranged from 5.02 to 8.93, whereas residuals ranged from -3.16 to 3.04. Standardized residuals ranged from -1.31 to 1.25, suggesting that no observations had extreme standardized residual values. The standard error of the estimate was 2.42. The Durbin-Watson statistic was 0.710, potentially indicating positive residual autocorrelation; however, this diagnostic should be interpreted cautiously given the small number of observations. Collinearity was not a concern, as indicated by tolerance and VIF values of 1.00.

Overall, the findings suggest a moderate positive but statistically nonsignificant relationship between age-group progression and suicide mortality in Saudi Arabia. The direction and magnitude of the regression coefficient indicate a possible increase in mortality across the older age-group categories, but the model did not provide sufficient evidence to establish a statistically reliable linear age gradient. The relatively modest R^2 also indicates that age-group rank alone explained only a limited proportion of the observed variability. Importantly, the nonsignificant result should not be interpreted as proof that age is unrelated to suicide mortality. Rather, the

Table 5. Regression Analysis of Age-Specific Suicide Mortality in Oman.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations		
	B	Std. Error	Beta			Zero-order	Partial	Part
(Constant)	5.541	2.471		2.242	.052			
AGE Groups	.268	.364	.238	.735	.481	.238	.238	.238

a. Dependent Variable: Suicide mortality rate of age groups in Oman

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relationship may be nonlinear or influenced by other demographic, social, cultural, and health-related factors. Furthermore, because the age-group categories are ordinal and some of them overlap, these findings should be interpreted cautiously (Table 6).

Regression Analysis of Age-Specific Suicide Mortality in the Russian Federation

Pearson's correlation analysis demonstrated a strong positive association between age-group rank and suicide mortality in the Russian Federation (r = 0.761, one-tailed p = 0.003, N = 11). This finding indicates that suicide mortality tended to increase as the analysis progressed from younger to older age-group categories. The magnitude of the correlation suggests a substantial age-related pattern, with higher-ranked age groups generally associated with higher suicide mortality. Unlike the weak, statistically nonsignificant association observed in Oman, the relationship in the Russian Federation was statistically significant.

The regression analysis provided further evidence of this association. The model yielded an R^2 of 0.579 and an adjusted R^2 of 0.532, indicating that approximately 57.9% of the observed variance in suicide mortality was explained by the ordered age-group variable. The overall regression model was statistically significant, $F(1, 9) = 12.357$, p = 0.007. The coefficient for age-group rank was positive and statistically significant (B = 2.846, SE = 0.810; standardized β = 0.761; t = 3.515, p = 0.007). Thus, each one-unit increase in age-group rank was associated with an estimated increase of 2.85 units in suicide mortality. The fitted regression equation was Suicide mortality = 13.729 + 2.846 × age-group category.

Predicted suicide mortality values ranged from 16.58 to 45.04, whereas residuals ranged from -11.57 to 13.56. Standardized residuals ranged from -1.36 to 1.60, suggesting that none of the observations had an extreme standardized residual. The standard error of the estimate was 8.49, indicating that considerable unexplained variability remained around the regression line despite the relatively strong model fit. The Durbin-Watson statistic was 0.801, potentially indicating positive residual autocorrelation. Nevertheless, because the analysis was based on only 11 age-group observations, this diagnostic should be interpreted cautiously. Collinearity was not a concern, as indicated by tolerance and VIF values of 1.00.

Overall, the findings demonstrate a statistically significant and relatively strong positive linear relationship between age-group rank and suicide mortality in the Russian Federation. The substantial R^2 value indicates that age-group progression accounted for a considerable proportion of the observed variability in suicide mortality within this dataset. The estimated increase of approximately 2.85 units for each successive age-group rank further suggests a pronounced upward age-related gradient. Nevertheless, because the age-group categories were represented by ordinal scores and the analysis included only 11 observations, the findings should be interpreted as evidence of an age-

Table 6. Regression Analysis of Age-Specific Suicide Mortality in Saudi Arabia.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations		
	B	Std. Error	Beta			Zero-order	Partial	Part
(Constant)	4.629	1.566		2.955	.016			
AGE Groups	.391	.231	.492	1.693	.125	.492	.492	.492

a. Dependent Variable: Suicide mortality rate of age groups in Saudi Arabia

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related linear pattern rather than as definitive evidence of causality (Table 7).

Age-Specific Suicide Mortality Patterns in Uzbekistan

Pearson's correlation analysis revealed a weak negative association between age-group rank and suicide mortality (r = -0.218), which was not statistically significant according to the one-tailed test (p = 0.273).

A simple linear regression model was fitted to examine the relationship between suicide mortality and numerical age-group rank. The model yielded R = 0.218 and R^2 = 0.047, indicating that suicide mortality accounted for only 4.7% of the observed variance in age-group rank. The adjusted R^2 was -0.072, and the standard error of the estimate was 3.134. The overall regression model was not statistically significant, $F(1, 8) = 0.399$, p = 0.545. The unstandardized regression coefficient was negative (B = -0.269, SE = 0.426), with a standardized coefficient of β = -0.218; however, this coefficient was not statistically significant (t = -0.632, p = 0.545). The intercept was 9.429 (SE = 4.743; t = 1.988, p = 0.082). The zero-order, partial, and part correlations were all -0.218, while tolerance and VIF were both 1.000, indicating no multicollinearity in the single-predictor model.

The model diagnostics showed predicted age-group values ranging from 5.329 to 7.246 and residuals ranging from -3.641 to 5.671, with a mean residual of zero and an SD of 2.955. Standardized residuals ranged from -1.162 to 1.810, with all observations falling within the conventional range of ±2. The collinearity diagnostics yielded eigenvalues of 1.978 and 0.022, with a maximum condition index of 9.465. Together with tolerance and VIF values of 1.000, these findings did not indicate a substantive multicollinearity problem. The Durbin-Watson statistic was 1.189.

Overall, the findings indicate a weak inverse, statistically nonsignificant association between suicide mortality and the study-specific age-group ranking (r = -0.218, one-tailed p = 0.273), with the regression model explaining only 4.7% of the observed variance in age-group rank (R^2 = 0.047) (Table 8).

Age-Specific Suicide Mortality Patterns in Yemen

Pearson's correlation analysis demonstrated a moderate positive association between age-group rank and suicide mortality (r = 0.532, N = 11), which was statistically significant according to the one-tailed test (p = 0.046). Thus, higher numerical age-group ranks tended to correspond to higher suicide mortality values within the study-specific coding structure.

A simple linear regression model was fitted to examine the relationship between age-group rank and suicide mortality. The model yielded R = 0.532 and R^2 = 0.283, indicating that 28.3% of the observed variance in suicide mortality was explained by age-group rank. The adjusted R^2 was 0.203, and the standard error of the estimate was 2.922. However, the overall regression model did not reach conventional statistical significance, $F(1, 9) = 3.546$, p = 0.092. The regression coefficient for age-group rank was

Table 7. Regression Analysis of Age-Specific Suicide Mortality in the Russian Federation.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations		
	B	Std. Error	Beta			Zero-order	Partial	Part
(Constant)	13.729	5.491		2.500	0.034			
AGE Groups	2.846	0.810	0.761	3.515	0.007	0.761	0.761	0.761

a. Dependent Variable: Suicide mortality rate of age groups in Russian Federation

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Table 8. Age-Specific Suicide Mortality Patterns in Uzbekistan

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations		
	B	Std. Error	Beta			Zero-order	Partial	Part
(Constant)	12.042	1.987		6.059	.000			
AGE Groups	-0.177	0.280	-0.218	-0.632	0.545	-0.218	-0.218	-0.218

a. Dependent Variable: Suicide mortality rate of age groups in Uzbekistan

Table 9. Age-Specific Suicide Mortality Patterns in Yemen

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations		
	B	Std. Error	Beta			Zero-order	Partial	Part
(Constant)	6.542	1.889		3.462	0.007			
AGE Groups	0.525	0.279	0.532	1.883	0.092	0.532	0.532	0.532

a. Dependent Variable: Suicide mortality rate of age groups in Yemen

positive (B = 0.525, SE = 0.279; standardized β = 0.532), but it was not statistically significant according to the regression test (t = 1.883, p = 0.092). The intercept was 6.542 (SE = 1.889; t = 3.462, p = 0.007). The zero-order, partial, and part correlations were all 0.532, while tolerance and VIF were both 1.000, indicating no multicollinearity concerns in the single-predictor model.

The model diagnostics showed predicted suicide mortality values ranging from 7.067 to 12.313 per 100,000 population (*mean* = 9.690; SD = 1.740). Residuals ranged from -3.879 to 6.207, with a mean of zero and an SD of 2.772. Standardized predicted values ranged from -1.508 to 1.508, whereas standardized residuals ranged from -1.327 to 2.124. No standardized residual exceeded ±3. Collinearity diagnostics yielded eigenvalues of 1.885 and 0.115 and a maximum condition index of 4.042. Together with tolerance and VIF values of 1.000, these results indicated no evidence of problematic collinearity. The Durbin-Watson statistic was 0.785.

Overall, the results indicate a moderate positive association between age-group rank and suicide mortality (r = 0.532, one-tailed p = 0.046), although the corresponding regression model was not statistically significant under the conventional two-tailed test. Accordingly, the findings suggest a descriptive tendency toward higher suicide mortality across progressively higher-ranked age-group categories, but they do not provide sufficient evidence of a statistically significant linear predictive relationship under the regression model's inferential framework. This distinction should be interpreted in light of the small sample size (N = 11) and the use of a one-tailed test for the correlation and a conventional two-tailed test for the regression coefficient.

Moreover, age-group rank represents an ordinal coding scheme rather than continuous chronological age, and the categories are neither uniformly spaced nor mutually exclusive. In particular, the intervals overlap for categories such as 15 to 19, 15 to 24, and 15 to 29 years. Consequently, the observed association should be interpreted as a statistical pattern within the study-specific age-group structure rather than as evidence of an independent or causal effect of increasing chronological age on suicide mortality (Table 9).

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Discussion

Overall Interpretation and International Heterogeneity

The present cross-national analysis demonstrates substantial heterogeneity in suicide mortality across the 25 countries examined, particularly across Central Asia, Eastern Europe, South Asia, the Middle East, and the Gulf region. These findings are consistent with evidence from the Global Burden of Disease (GBD) studies, which indicates that suicide mortality varies according to demographic structure, socioeconomic conditions, cultural context, sex, and the quality of mortality registration systems (15, 16). Accordingly, international differences should not be interpreted solely as reflecting variations in suicidal behavior, because suicide deaths may be underregistered or misclassified as accidental or undetermined deaths (17). The comparatively high mortality rates observed in Kazakhstan, the Russian Federation, and India are broadly consistent with previous evidence identifying Eastern Europe, Central Asia, and South Asia as important regions for suicide prevention (15, 18-20).

Age-Related Patterns and the Importance of Life-Course Differences

The observed correlations indicate that some countries share similar age-specific suicide mortality profiles, whereas others exhibit distinct patterns. These findings underscore the importance of age-stratified surveillance, given that the contribution of different age groups to overall suicide mortality varies considerably across populations (15-21). Similar age-specific profiles may reflect shared demographic, socioeconomic, historical, and cultural circumstances, including unemployment, migration, social disruption, substance use, and access to mental health services (22). However, correlations between country-level age-specific profiles indicate epidemiological resemblance rather than a causal relationship between the factors underlying these patterns. The substantial burden of suicide among adolescents and young adults warrants particular attention, as suicide remains a major cause of death among individuals aged 15 to 29 years (21, 23). Prevention strategies should therefore incorporate early psychological support, educational and employment interventions, measures to strengthen social support, and restrictions on access to lethal means (21, 23).

Regional Similarities and Differences in the Middle East

Iran exhibited a distinctive correlation structure, with greater similarity to selected Gulf and Levantine countries than to some geographically closer populations. This finding is consistent with evidence indicating substantial heterogeneity in suicidal behavior across the Eastern Mediterranean Region (EMR) (24). Underreporting may be considerable because stigma and cultural, religious, and legal barriers can influence the reporting and registration of suicide deaths (24, 25). In Iran, suicide is associated with interacting demographic and socioeconomic factors, including male sex, older age, lower educational attainment, employment problems, urban residence, psychiatric history, previous suicide attempts, and substance use (26). Similarly, suicide surveillance in Gulf countries may be affected by stigma, migrant populations, socioeconomic transformation, and incomplete reporting (27). Consequently, lower recorded mortality rates should be interpreted cautiously, alongside efforts to strengthen mortality registration and self-harm surveillance systems (17, 27).

Interpretation of the Correlation Structure

Strong positive correlations among several national age-specific profiles suggest that countries may exhibit comparable age-related distributions of suicide mortality despite differences in their absolute mortality levels. Distinguishing between the overall magnitude of mortality and its age-specific distribution

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is important for international epidemiological surveillance. Conversely, weaker associations involving countries such as Iran, Oman, Uzbekistan, and the United Arab Emirates may reflect genuinely different epidemiological patterns, but they could also arise from small sample sizes, measurement variability, or incomplete data (15, 16). Therefore, the observed correlation coefficients should be interpreted as descriptive indicators of similarity between age-specific profiles rather than as evidence of causal relationships or common underlying determinants.

Implications for Suicide Prevention

The findings support the development of geographically targeted and age-sensitive suicide prevention strategies. Countries with higher recorded mortality rates may require intensified prevention efforts, whereas countries with lower recorded rates should strengthen surveillance to determine whether these estimates reflect genuinely lower mortality or incomplete case ascertainment. The WHO recommends multisectoral approaches that integrate mental health services, crisis intervention, community support, responsible media practices, and restrictions on access to lethal means (17, 28). Prevention strategies should also be tailored to age-specific needs by addressing psychological distress, social isolation, bullying, substance use, and academic or occupational stress among younger populations, while addressing bereavement, loneliness, disability, and social disconnection among older adults (21, 29). Strengthening civil registration systems, death certification procedures, International Classification of Diseases (ICD) coding, and the linkage of mortality records with health service databases is essential to improving surveillance and informing effective prevention policies (17, 30).

Strengths and Limitations

The principal strength of this study is its comparative assessment of overall and age-specific suicide mortality across 25 countries. Nevertheless, its ecological design precludes individual-level inference. The small number of observations per country, generally 10 to 11, limits statistical power and the stability of the estimated correlations. Furthermore, the use of overlapping age-group categories and the representation of age through ordinal rankings rather than continuous chronological age restrict the interpretation of age-related regression coefficients. The nonnormal distributions observed in several countries also warrant caution when interpreting parametric analyses. In addition, the use of data from a single year precludes the assessment of temporal trends, while differences in registration completeness, death certification, stigma, legal contexts, and cause-of-death misclassification may introduce systematic measurement bias (17, 24, 25).

Recommendations for Future Research

Future studies should use longitudinal, age-standardized, and sex-specific mortality data covering multiple years. Age-period-cohort models, joinpoint regression, generalized linear models, and spatial analyses could provide a more comprehensive characterization of temporal and geographical variation in suicide mortality. Future datasets should employ mutually exclusive age categories and incorporate relevant socioeconomic and contextual variables, including socioeconomic status, urbanization, unemployment, migration, psychiatric morbidity, substance use, conflict exposure, and access to healthcare. In Iran and neighboring countries, priority should be given to improving suicide registration and establishing linkages among mortality records, emergency department records, hospital databases, forensic records, and self-harm surveillance systems. Community-based studies are also needed to quantify the extent of underreporting and identify populations that may be missed by official statistics, thereby supporting the development of more targeted

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interventions addressing modifiable risk factors (17, 26, 27).

Conclusion

Overall, the findings indicate that suicide mortality across the studied countries is characterized by substantial geographical and age-specific heterogeneity. The observed similarities among several national age-specific profiles suggest potentially shared epidemiological contexts, whereas divergent patterns, particularly those involving Iran and selected Gulf countries, underscore the importance of country-specific determinants and surveillance practices. These findings are consistent with the broader literature demonstrating that suicide is a multifactorial public health problem shaped by demographic, socioeconomic, cultural, psychological, and health system factors. Accordingly, effective suicide prevention requires a coordinated approach incorporating reliable mortality surveillance, age-specific and country-specific risk assessment, improved access to mental health services, targeted interventions for vulnerable populations, and integrated multisectoral prevention strategies.

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Conflict of Interest

The authors declare that they have no conflicts of interest regarding this study.

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Ethical Considerations

Because this study used aggregated, nonidentifiable secondary data and involved neither direct participant recruitment nor individual-level records, informed consent was not applicable. The applicability of formal ethical review requirements should be determined in accordance with the policies of the relevant institutional ethics committee.

Code of Ethics

IR.ASMT.REC.1405.010

Authors' Contributions

All authors contributed to the conception and design of the study, the analysis and interpretation of the results, and the preparation of the manuscript. All authors read and approved the final version of the manuscript.

Data Availability Statement

The datasets analyzed in the current study are available from publicly accessible databases. Country-level suicide mortality data were obtained from the World Health Organization (WHO) Global Health Estimates. Additional data supporting the findings of this study are available from the corresponding author upon reasonable request.

Artificial Intelligence (AI) Disclosure

Artificial intelligence (AI) tools were used during the preparation of this manuscript to assist with language editing, grammatical correction, and improvements in the clarity and readability of the English text. The authors reviewed and verified all AI-assisted text and remain fully responsible for the accuracy, integrity, and originality of the manuscript and its scientific content.

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