

Statistical Analysis of Suicide Rates Across WHO Regions

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Abstract

Original Research Article

Suicide remains a major global public health challenge, claiming approximately 800,000 lives annually and representing the leading cause of death among adolescents and young adults worldwide. This study conducts a statistical analysis of suicide rates across six World Health Organization (WHO) regions—Africa, America, Eastern Mediterranean, Europe, South-East Asia, and Western Pacific—over a period spanning from 1978 to 2009. The aim is to identify significant regional differences in suicide rates and evaluate gender disparities in suicide prevalence. Using secondary data sourced from the International Journal of Environmental Research (2012), the study applies descriptive statistics, One-Way Analysis of Variance (ANOVA), post hoc Tukey HSD tests, and independent samples t-tests to examine patterns and test hypotheses. Findings reveal that the Western Pacific and European regions exhibit significantly higher suicide rates compared to other regions, while the Eastern Mediterranean region reports the lowest. Gender analysis confirms that males are disproportionately affected, with a significantly higher mean suicide rate than females across all regions. Assumption tests validate the robustness of the statistical methods used. The study concludes that both geographical location and gender are critical determinants in suicide incidence, calling for region-specific and gender-sensitive prevention strategies. Recommendations include expanding mental health infrastructure, improving data collection practices, restricting access to lethal means, and integrating suicide prevention into national health policies. The research contributes to the global dialogue on mental health and supports the WHO's objective to reduce suicide rates by one-third under the Sustainable Development Goals.

Keywords: Suicide rates, WHO regions, gender disparity, ANOVA, mental health, public health.

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1. INTRODUCTION

Suicide is a deeply complex and troubling public health concern that spans across countries, cultures, and socioeconomic boundaries. It is defined by the World Health Organization (WHO) as "the act of deliberately killing oneself, initiated and performed by the individual in full knowledge of its fatal outcome." While definitions may vary slightly, the core concept remains the same: suicide is an intentional act of ending one's life, often arising from an overwhelming sense of despair, psychological distress, or social disconnection.

Globally, suicide is among the leading causes of death, particularly in the youth population. It is the third leading cause of death among individuals aged 15 to 44 years, and second among adolescents aged 15 to 19 years. WHO estimates that nearly 1 million people die from suicide annually, equating to one suicide every 40 seconds. In addition, suicide attempts are estimated to

occur 25 times more frequently than completed suicides. These figures place suicide as the most prominent form of violent death, ahead of homicide and deaths from conflict or war.

The psychological and social repercussions of suicide are significant, affecting not only the individuals who die by suicide but also at least six people on average who are emotionally and socially connected to them. The tragedy reverberates through families, communities, and nations, resulting in grief, stigma, economic loss, and emotional trauma. Despite its prevalence and impact, suicide is not a disease in itself; rather, it is typically linked to underlying mental disorders, with depression being the most common. Other contributing factors include alcohol and substance abuse, chronic illness, and personality disorders.

One of the major challenges in studying and preventing suicide is the difficulty in accurately

diagnosing and reporting it. Suicide involves not only determining cause of death but also inferring intent, which complicates data collection, especially in less-resourced settings. For instance, deaths categorized under injury mortality (accidents, suicides, homicides, etc.) may not always reveal the true cause or motive, particularly in regions where cultural and legal factors discourage full disclosure.

Significantly, suicide is not confined to any particular income group or geographic region. While high-income countries often have detailed surveillance systems, 80% of global suicides occur in low- and middle-income countries where access to mental health services is limited, and social stigma is high. These countries bear the greatest burden and are frequently underrepresented in global statistics.

In recognition of the growing concern, international bodies such as WHO and the United Nations have adopted strategic goals to reduce suicide rates. For example, the WHO's Mental Health Action Plan set a target of 10% reduction by 2020, while the UN Sustainable Development Goals aim for a 33% reduction by 2030. Currently, over 40 countries have implemented national suicide prevention strategies, and countries like China, England, Denmark, South Korea, and Switzerland have reported measurable reductions in suicide rates due to targeted interventions.

In the United States, suicide was declared a public health crisis in 1999. Among the factors influencing the high rates are social isolation, mental health illiteracy, and a fragmented healthcare system. In response, legislation such as the Mental Health Parity and Addiction Equity Act (2008) was enacted to mandate equal treatment coverage for mental and physical health conditions. However, enforcement and access to care remain inadequate in many areas.

Risk Factors of Suicide

Suicidal behavior is influenced by a range of interlinked individual, socio-cultural, and situational factors:

- Individual factors: mental disorders, previous suicide attempts, substance abuse.
- Socio-cultural factors: stigma around mental illness, lack of access to mental health services, media portrayal of suicide.
- Situational factors: financial hardship, emotional loss, and exposure to suicidal behaviors in others.

Biological and genetic components are also being increasingly recognized. Studies suggest low serotonin levels and family history of suicide can predispose individuals to suicidal behavior. Suicide attempts, especially among women, may manifest through self-harm methods like poisoning or cutting, while completed suicides are more common among men and often involve more lethal methods. According to

WHO (2021), approximately 703,000 people die by suicide each year, with countless more attempting it. The ripple effects span families, communities, and nations, making suicide a pressing global issue. It remains a leading cause of death across age groups, especially the youth, necessitating urgent attention from governments, policymakers, and healthcare systems to reduce its occurrence. This study is designed to explore the distribution and dynamics of suicide globally through the lens of WHO regional classifications, determine if there is a statistically significant difference in suicide rates among the six WHO regions and identify the gender with the highest suicide rate across regions.

The study covers suicide rates per 100,000 inhabitants across six WHO regions: Africa, Americas, Eastern Mediterranean, Europe, South-East Asia, and Western Pacific. The dataset spans 1978 to 2009, although some years were not reported.

2. LITERATURE REVIEW

2.1 Historical Background of Suicide

Suicide is one of the leading causes of unnatural death worldwide and represents a major global health concern. Historical data reveal that the incidence of suicide has steadily increased over the past four decades. It is now regarded as the second leading cause of death among individuals aged 15–29, placing an immense burden on families, communities, and public health systems.

According to Gould, M. S *et al* (2006) “Youth suicide is a complex and multifaceted phenomenon influenced by an interplay of psychiatric, psychological, social, and environmental factors. Epidemiological studies consistently show that mental health disorders, particularly depression and substance abuse, are the most significant predictors of suicide risk among adolescents. However, broader societal influences such as media exposure, family dynamics, and community support systems also play critical roles in either mitigating or amplifying vulnerability. Understanding these layers is essential for designing effective prevention strategies tailored to at-risk youth populations.”

The reporting of suicide varies considerably across countries, influenced by legal, cultural, and religious contexts. In developed nations, suicide is no longer treated as a criminal offense, allowing for more transparent documentation and public health discourse. However, in many developing countries, including Nigeria, suicide remains criminalized. This legal status deters families from reporting the true nature of a loved one's death, often disguising it as an accident or natural cause to avoid legal consequences and social stigma.

Range, L. M., Hibberd, J., & Klowden, A. (1999) Adolescent suicide is closely linked to a range of psychological factors such as depression, hopelessness, and low self-esteem, as well as family dynamics

including poor communication, lack of emotional support, and high levels of conflict. The interplay between individual vulnerability and dysfunctional family environments can significantly elevate suicide risk. Effective prevention must therefore address both the intrapersonal and familial contexts in which suicidal behavior develops.

Available data in these countries are typically derived from hospital records or police reports, which are prone to underreporting and misclassification. This inconsistency in data limits the ability of researchers and policymakers to develop effective, evidence-based prevention strategies. James (2004) emphasizes that in Africa and many developing nations, the limited attention given to mental health exacerbates the already meagre understanding and visibility of suicide as a public health crisis.

2.2 Causes of Suicide

Suicide rarely arises from a single cause. It is most often the result of a complex interaction of psychological, biological, social, and environmental factors. Understanding these causes is crucial for designing effective interventions.

a. Mental Illness

Among the most common contributors to suicide are mental health disorders, particularly depression, bipolar disorder, and schizophrenia. Depression, in particular, is reported to be associated with over 90% of suicide cases. However, many individuals suffering from mental illnesses remain undiagnosed or untreated, especially in regions with poor mental health infrastructure.

Asha Beder (2021), a clinical psychologist, emphasized in a newspaper interview that undiagnosed and untreated mental illnesses are often responsible for increasing suicide rates among youth populations. Mental health conditions are often exacerbated by environmental stressors, which in turn heighten the risk of suicidal ideation and behaviour.

Turecki, G., & Brent, D. A. (2016) Suicide is the result of a complex interaction between genetic, biological, psychological, and environmental factors. While psychiatric disorders, particularly mood disorders, are strongly associated with suicide risk, adverse life events, early-life trauma, and impaired stress responses also significantly contribute. Prevention efforts must therefore adopt a multifactorial approach, integrating clinical, social, and public health strategies to identify at-risk individuals and reduce suicide incidence across populations.

b. Academic and Social Pressure

Among adolescents and young adults, academic stress and failure in examinations are frequently cited as major triggers for suicide. The competitive atmosphere

of educational institutions, combined with high expectations from parents and teachers, can create overwhelming psychological pressure. Students from low-income families often face financial burdens and social disparities, further amplifying their distress.

c. Family and Domestic Issues

Another significant cause of suicide is family conflict or breakdown, which can include abuse, neglect, rejection in romantic relationships, and domestic violence. A toxic or rigid home environment can generate emotional isolation, especially among youth. Victims of such environments may suffer in silence due to fear or shame, pushing them toward suicide as an escape.

d. Violence and Trauma

Prolonged exposure to bullying, physical abuse, sexual assault, and cybercrime (e.g., blackmail) has been found to increase the likelihood of suicide. The rise of social media and digital platforms has unfortunately added a layer of psychological vulnerability, particularly among adolescents, who are more impressionable and likely to suffer silently.

e. Substance Abuse

Alcohol and drug abuse often act as both a symptom and a trigger for suicidal behavior. Substance use can lower inhibitions and impair judgment, making individuals more prone to acting on suicidal thoughts.

2.3 Common Methods of Suicide

The means of committing suicide often vary by age, gender, and cultural context. However, certain patterns are consistent across regions.

a. Poisoning and Overdose

This is the most common method of suicide attempt, particularly among females. It includes ingestion of medications (prescription and over-the-counter), cleaning agents, pesticides, and other household chemicals. Youths may resort to any accessible substance, highlighting the need for secure storage of medications and toxic materials.

b. Self-Harm with Sharp Objects

Self-inflicted injuries using knives, blades, razors, or other sharp instruments are prevalent, especially among individuals dealing with emotional distress. This form of suicide attempt may not always be intended to cause death but can escalate into fatal outcomes.

c. Strangulation and Hanging

These methods are common and do not require complex setups — even a bedsheet or belt can serve the purpose. The accessibility of materials for hanging increases the risk, especially in unsupervised settings.

d. Firearms

In countries where firearms are easily accessible, such as the United States, gun-related suicides account for a significant percentage of overall suicide deaths. This method has the highest fatality rate among all means, with over 85% of firearm suicide attempts resulting in death, compared to 1–2% for overdoses or cutting.

2.4 Prevention Strategies and Safe Practices

Preventing suicide requires a multi-pronged approach involving government policy, healthcare infrastructure, family engagement, and public education. Suggested safety measures include:

- Restricting access to lethal means (e.g., locking firearms and toxic substances).
- Monitoring emotional well-being of high-risk individuals, especially adolescents.
- Ensuring mental health services are accessible, affordable, and destigmatized.
- Training teachers, parents, and healthcare professionals to recognize warning signs.

A critical component of suicide prevention is fostering an open and supportive environment, where individuals feel safe discussing their struggles without fear of judgment or punishment.

3. METHODOLOGY

This study employs a quantitative research design, utilizing secondary data to conduct a statistical analysis of suicide rates across six WHO regions. The design is descriptive and comparative, focusing on identifying significant differences in suicide rates across geographical locations and gender. The goal is to determine whether suicide rates vary significantly between regions and whether gender is a significant factor in these rates.

Data Source and Scope

The data used in this research was extracted from the International Journal of Environmental Research (2012). Nwafor *et al* (2025), the selection of statistical techniques is based on the characteristics of the collected data and questionnaire design, as well as the goal of the scientific inquiry. It consists of suicide rates per 100,000 inhabitants across the six WHO regions: Africa, Americas, Eastern Mediterranean, Europe, South-East Asia, and Western Pacific. The dataset spans a period of 31 years (1978–2009). However, not all years within this timeframe had complete data due to gaps in international reporting, with missing entries for several years, including 1979–1984, 1986, 1988–1989, 1992, 1994, 1996–1997, and 2000.

Analytical Tools and Techniques

The statistical analysis was performed using IBM SPSS software. Several tools and techniques were employed, including descriptive statistics, line graphs

and box plots for visualization, One-Way Analysis of Variance (ANOVA), Tukey HSD Post Hoc Test, and Independent Samples T-test.

4. RESULTS AND DISCUSSION

The study analysed suicide rate data across six WHO regions—Africa, Americas, Eastern Mediterranean, Europe, South-East Asia, and Western Pacific—over the period from 1978 to 2009, comprising a total of 198 observations disaggregated by gender and region. The statistical tools used include descriptive statistics, graphical methods (line graphs and box plots), one-way ANOVA, post hoc tests, and independent samples t-tests. A summary of suicide rates per 100,000 inhabitants across the six WHO regions shows marked regional disparities. According to the findings:

- Western Pacific had the highest mean suicide rate (12.26), followed closely by Europe (12.05).
- South-East Asia also had a moderately high average (6.22).
- The Americas, Africa, and particularly the Eastern Mediterranean had significantly lower rates (means of 5.40, 4.20, and 1.00, respectively).
When disaggregated by gender:
- The male mean suicide rate was 13.32, more than three times the female mean rate of 3.89.
- This stark gender disparity suggests that men are substantially more affected by suicide across all regions.

Visualizations reinforced the statistical findings:

- Line plots revealed that more than 50% of suicide cases occurred in the Western Pacific and European regions, confirming their higher burden.
- Box plots illustrated greater variability and the presence of outliers in Europe and Western Pacific, indicating a wider spread of suicide rates across countries within these regions.
- When paneled by gender, males consistently showed higher medians and more outliers, indicating both a higher baseline rate and more extreme suicide figures.

The key hypothesis tested was:

- H_0 : The mean suicide rates per 100,000 inhabitants are equal across the six WHO regions.
- H_1 : At least one region has a significantly different mean suicide rate.

The ANOVA test yielded $F = 7.976$ with $p < 0.001$, indicating strong evidence to reject the null hypothesis. Therefore, we conclude that suicide rates vary significantly by WHO region.

Assumption Checks

- Levene's Test for homogeneity of variances yielded a p-value of 0.210, indicating that the assumption of equal variance across groups was not violated.
- Normality tests using Kolmogorov-Smirnov ($p = 0.150$) and Shapiro-Wilk ($p = 0.204$) showed

that residuals followed a normal distribution, satisfying another core assumption of ANOVA.

Robustness Checks: Welch and Brown-Forsythe Tests

To validate the ANOVA results further, Welch and Brown-Forsythe tests were conducted. Both tests confirmed statistically significant differences in suicide rates across the regions:

- Welch Test: $F = 21.394$, $p < 0.001$
- Brown-Forsythe Test: $F = 13.533$, $p < 0.001$

These results reinforce the conclusion that mean suicide rates are not uniform across WHO regions.

Post Hoc Analysis (Tukey HSD Test)

To pinpoint which regions differ significantly, a Tukey HSD test was performed. The test grouped WHO regions into two subsets:

- Subset 1: Eastern Mediterranean, Africa, Americas, and South-East Asia — these regions showed statistically similar lower suicide rates.
- Subset 2: Europe and Western Pacific — both regions had significantly higher rates, distinguishing them from other regions.

This provides useful insight for public health agencies and international organizations: Europe and the Western Pacific require more focused suicide prevention efforts.

Gender Differences: Independent Samples T-Test

To test gender differences in suicide rates:

- H_0 : There is no difference in suicide rates between males and females.
- H_1 : There is a significant difference in suicide rates between males and females.

The independent samples t-test yielded $t = 8.402$, $p < 0.001$, strongly rejecting the null hypothesis. The analysis confirms that males had significantly higher suicide rates than females across all regions. This result was consistent under both equal and unequal variance assumptions (Levene's test for gender: $F = 79.926$, $p < 0.001$).

Interpretation of Findings

The statistical analysis revealed a clear and consistent pattern:

1. Suicide rates vary significantly across regions, with Europe and Western Pacific being disproportionately affected.
2. Males are at a much higher risk than females, both in terms of mean rate and variance.
3. Eastern Mediterranean countries report notably low rates, which could be attributed to either actual differences or underreporting due to cultural and religious stigma.

These results highlight the importance of region-specific and gender-specific mental health

interventions. While global strategies are essential, tailoring efforts to local realities—including access to healthcare, societal norms, and means of suicide—is critical for effective prevention.

CONCLUSION AND RECOMMENDATIONS

This study set out to analyse suicide rates across six World Health Organization (WHO) regions—Africa, America, Eastern Mediterranean, Europe, South-East Asia, and the Western Pacific—based on data spanning from 1978 to 2009. Through the application of descriptive statistics, graphical analysis, One-Way ANOVA, post hoc tests, and independent samples t-tests, a series of significant findings emerged that not only shed light on the global burden of suicide but also underscore critical disparities across geographical regions and gender.

The results confirmed that suicide rates differ significantly between regions, with Europe and the Western Pacific exhibiting the highest average suicide rates per 100,000 inhabitants. These regions also displayed greater variability and extreme values, suggesting a broader distribution of suicide prevalence among their respective countries. In contrast, Eastern Mediterranean countries consistently showed the lowest reported rates, although this may reflect cultural taboos and underreporting rather than an absence of suicidal behaviour.

Furthermore, the gender-based analysis revealed that males are significantly more likely to die by suicide than females across all regions. The independent samples t-test substantiated this difference with a high degree of statistical significance. The greater incidence and variability of male suicides may be influenced by factors such as social expectations, reluctance to seek mental health support, access to more lethal means, and underdiagnosed depression in men.

The findings of this study validate the necessity for regionally nuanced and gender-sensitive suicide prevention strategies. They also reinforce the importance of continued international collaboration, accurate data reporting, and targeted mental health interventions.

RECOMMENDATIONS

In light of the above findings, the following recommendations are proposed:

1. Intensify Suicide Prevention Programs in High-Risk Regions

Special attention should be given to Europe and Western Pacific where suicide rates are highest. WHO and regional health authorities should invest in expanded mental health infrastructure, early intervention systems, and community-based support networks in these regions.

2. Develop Gender-Specific Mental Health Interventions

Given the consistently higher suicide rates among males, tailored interventions targeting men should be developed. These should address:

- Social stigma around expressing emotional vulnerability
- Access to mental health services in male-dominated spaces (e.g., workplaces, correctional institutions, military)
- Education campaigns to promote help-seeking behaviors

3. Improve Data Collection and Reporting

Countries, especially in the Eastern Mediterranean and parts of Africa, must strengthen their capacity for collecting reliable suicide data. Governments should decriminalize suicide and work to eliminate cultural taboos that prevent accurate reporting. Investment in vital registration systems, mental health surveillance, and training of medical personnel is essential.

4. Promote Mental Health Awareness and Literacy

Public education campaigns should be conducted to:

- Raise awareness of mental illness and suicide risk factors
- Encourage families and communities to engage in prevention efforts
- Train gatekeepers such as teachers, religious leaders, and youth mentors to recognize warning signs

5. Restrict Access to Lethal Means

Legislation and practical efforts should be made to reduce access to common means of suicide, especially firearms, pesticides, and toxic household chemicals. Safe storage laws and buyback programs can significantly lower suicide rates, as evidenced in several countries.

6. Integrate Suicide Prevention into National Health Policies

Suicide prevention should be an explicit priority within national mental health plans, aligned with the UN Sustainable Development Goal 3.4, which aims to reduce premature mortality from non-communicable diseases, including suicide, by one-third by 2030. This comprehensive evaluation not only provides insight into

regional and gender-based disparities in suicide but also serves as a call to action. Suicide is preventable, and with strategic investment in public health infrastructure, awareness, and policy, global suicide rates can be significantly reduced.

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