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Policy-influencing psychological factors in national-level suicide risk indicators

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Abstract

In this study, the authors relate the socio-economic structure, the existing policy measures, and the national suicide rate. It finds factors influencing suicide rates such as per capita GDP, alcohol consumption, and the existence of National Suicide Prevention Strategy (NSPS) using cross-country data. A multiple regression analysis is performed in this study to compare such variables between different nations, revealing that wealthier people, as demonstrated by high per capita GDP, have lower tendencies to commit suicide, thus economic prosperity is a protective trait. On the other hand, higher alcohol use leads to high plight with an increase in the rate of suicide cases in a nation, with nations such as Russia being a perfect example of this trend. The study provides an almost paradoxical observation: the safer the country is for its citizens, and the more committed resources to NSPS, the higher the suicide rates. It often focuses on adopting such NSPS with the aim of tackling the current prevailing problem rather than averting a similar situation. The case studies of Zimbabwe and Russia illustrate how the lack level of economic prosperity combined with drinking poses a significant threat as far as the suicide rate in the two states is concerned. The paper presents ideas to strengthen the national policy, principally in terms of the economic security and alcohol policy, if the main limitations, such as lack of data and its time perspective, are eliminated. These insights aim to inform more effective suicide prevention strategies globally.

Keywords: Suicide risk, socio-economic factors, alcohol use, suicide prevention

1. Introduction

The relationship between socio-economic factors and public health outcomes, particularly mental health, has garnered significant attention in recent years. Among these outcomes, suicide rates are a critical indicator of societal well-being, reflecting the complex interplay between economic stability, social support systems, and mental health infrastructure. Suicide ranks as the 15th leading cause of death globally, with over 75% of cases occurring in low- and middle-income countries^[8]. Economic hardships, including low income, reduced wealth, and unemployment, are commonly linked to suicide^[8]. Poverty is often defined by deprivation across multiple dimensions, such as education, healthcare, and housing^[7]. Both prolonged poverty and sudden economic crises, like crop failures, can serve as significant risk factors for suicidal thoughts and behaviors^[7].

Factors such as poverty, unemployment, lack of education, insufficient civic amenities, poor access to healthcare, and the absence of health insurance or welfare systems negatively impact the mental well-being of populations^[3]. In developing nations, the critical period between the onset of suicidal thoughts and the act of suicide is often overlooked, due to both lack of awareness and uncertainty about where to seek help. Even when the problem is recognized, many lack the necessary resources to access support^[3].

While numerous studies have identified correlations between economic indicators and suicide rates, there is a lack of comprehensive models that integrate multiple socio-economic and policy variables to quantify their collective impact. Most existing research tends to focus on single variables, such as income or alcohol consumption, without considering the potential interactions between these factors and their cumulative effect on suicide rates. Furthermore, there is limited empirical evidence on the effectiveness of national suicide prevention strategies in diverse socio-economic contexts. This gap in the literature is particularly concerning given the increasing emphasis on evidence-based policymaking.

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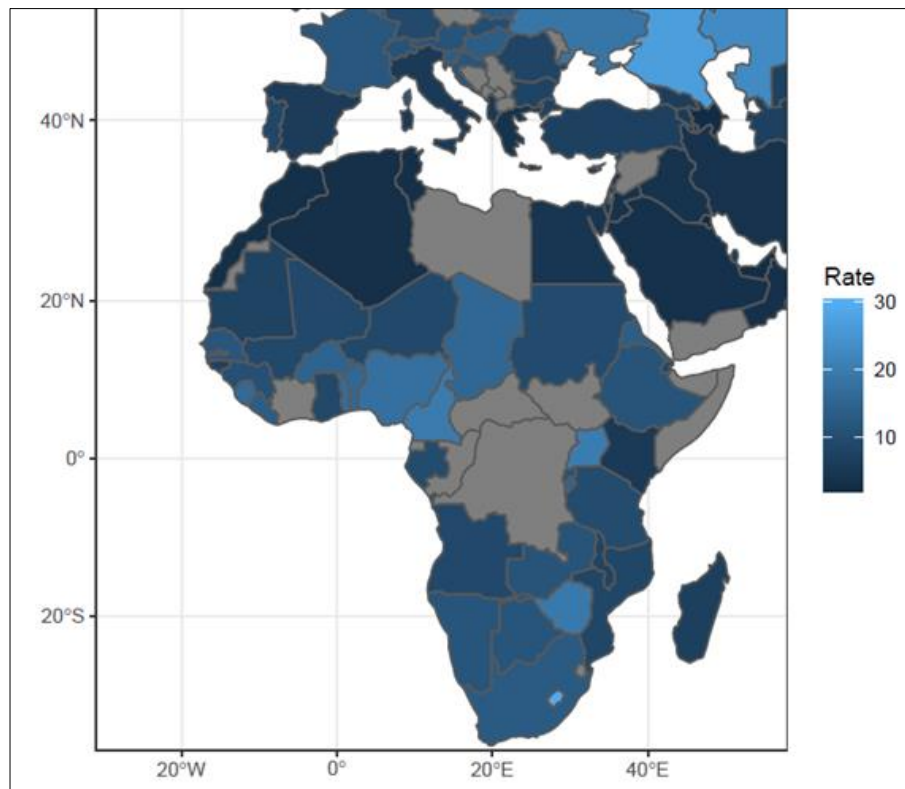
The need for this study is underscored by the rising global suicide rates, particularly in low and middle-income countries where economic instability is more pronounced. Understanding the relationship between economic indicators and suicide rates is essential for developing targeted interventions that can mitigate the risk of suicide.

To underscore the complex nature of the suicide problem and to show how the causes of suicide can vary between countries, this paper examines the situations in Zimbabwe and Russia. Zimbabwe has suffered endemic poverty, hyperinflation, and high unemployment for years. On the other hand, Russia's levels of alcohol consumption are among the highest in the world. Though their underlying conditions appear to be markedly different, both nations suffer from high rates of suicide.

1.2 Case Study: Economics - Zimbabwe

Endemic poverty, hyperinflation, and extreme unemployment^[4] are among the economic and social problems plaguing Zimbabwe, where political crisis coupled with failed economic policy has led to its decline. Zimbabwe's economic woes are often attributed to the policies of former dictator Robert Mugabe. Post Mugabe, Zimbabwe continues to deal with debt issues, difficulty attracting foreign investment, and currency instability.

The *WHO* estimates that 19 persons per 100,000 take their own life deliberately in Zimbabwe per annum (2019). Of the 166 countries in this study, Zimbabwe ranks 13th in the world for suicides per capita, and has one of the highest rates in Africa as visualized below:



Sourced from the World Health Organization report: "Suicide: Key Facts, 2019" and the World Economic Profile of the Country of Zimbabwe

Fig 1: Suicide Rate in Africa (annual persons per 100k population)

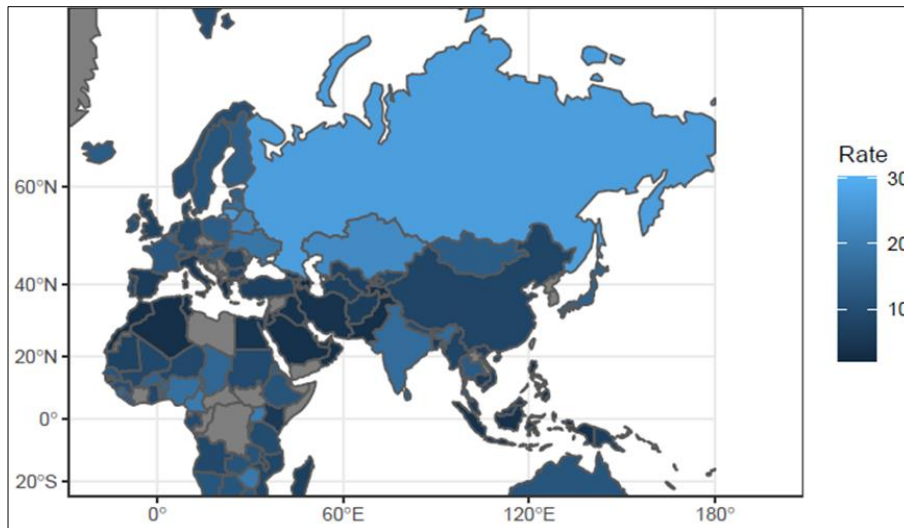
1.3 Case Study: Alcohol Abuse - Russia

Harmful use of alcohol is often cited as a major risk factor for suicide. A study published in *The Lancet* found that global alcohol consumption saw an increase of about 70% from 1990 to 2017, going from about 21 billion liters of pure alcohol to 35.7 billion liters of pure alcohol^[14]. Countries that have higher rates of alcohol use generally also have higher rates of suicide. Current evidence indicates an association between alcohol dependence and impulsive suicide attempts^[6].

Alcohol Use Disorder (AUD), as defined in the World Health Organization's International Classification of Diseases (ICD-11), is a chronic disease characterized by compulsive alcohol consumption, loss of control of alcohol intake, and a negative emotional state when not consuming alcohol^[16]. Alcohol intoxication can heighten feelings of

dysphoria, impair cognitive function, increase impulsivity, and trigger suicidal thoughts. Shortly after consuming alcohol, individuals face nearly a sevenfold higher risk of attempting suicide, with this risk skyrocketing to 37 times higher following heavy alcohol consumption^[10]. Risk of suicidal ideation, suicidal attempts, and completed suicide are each increased by 2-3 times among those with AUD in comparison with the general population^[10].

In Russia, the prevalence of AUD is approximately 5%, meaning that almost 1-in-20 suffer from alcohol dependence^[9]. The *WHO* estimates that 27 persons per 100k take their own life deliberately in Russia per annum (2019). Of the 166 countries in this study, Russia ranks 3rd in the world for suicides per capita, and has higher rates than many of its global neighbors as visualized below:



Sourced from the World Health Organization report: Suicide: Key Facts, 2019

Fig 2: Suicide Rate in Russia (Annual persons per 100k population)

2. Variables & Data Sources

This study identifies key factors influencing suicide rates at the country level, focusing on those actionable through policy interventions. Variables were selected from lifestyle, medical/mental health, economic, and policy domains to capture potential causes or mitigators of suicide.

The core dataset comes from the World Health Organization (WHO) [13], with the main variable being the age-standardized suicide rate per 100,000 people, based on the most recent available data.

Additional data was gathered to complement the suicide statistics. Health expenditures [17] reflect resources available for mental health, and GDP per capita indicates economic well-being. Alcohol consumption per capita accounts for cultural influences, while the number of psychiatrists, mental hospitals, and suicide prevention strategies reflect mental health resource allocation. The female/male labor participation ratio was included to control for gender-related cultural factors. Data was available for 166 countries.

Key variables include:

- **Health Expenditure (% of GDP):** WHO
- **Female/Male Labor Participation Ratio:** UNDP
- **GDP per capita (PPP):** World Bank
- **Alcohol Consumption per capita:** World Bank
- **Suicide Prevention Strategy:** WHO
- **Psychiatrists and Mental Hospitals per 100,000:** WHO

Note that more detailed descriptions of the data and the source links can be found in the Appendix.

3. Modelling and Assumptions

A multiple linear regression model was used to examine the relationships between socio-economic factors and suicide rates. This method was chosen to quantify how key variables like GDP per capita, alcohol consumption, and the presence of a national suicide prevention strategy influence national suicide rates. The goal was to explore these associations based on existing data, not to predict future suicide rates.

The study focused on key variables: the female-male labor participation ratio, GDP per capita, alcohol consumption per capita, and the presence of a suicide prevention strategy. Variables excluded from the final model included health

expenditure, psychiatrists per 100,000, and mental hospitals per 100,000.

Several assumptions were made: GDP per capita was used as a proxy for national wealth or individual income; the presence of a national suicide prevention strategy indicated a country's commitment to addressing suicide systematically; and alcohol consumption per capita reflected national drinking behaviors. The analysis relied on R's base functionality, with further technical details available in the appendix.

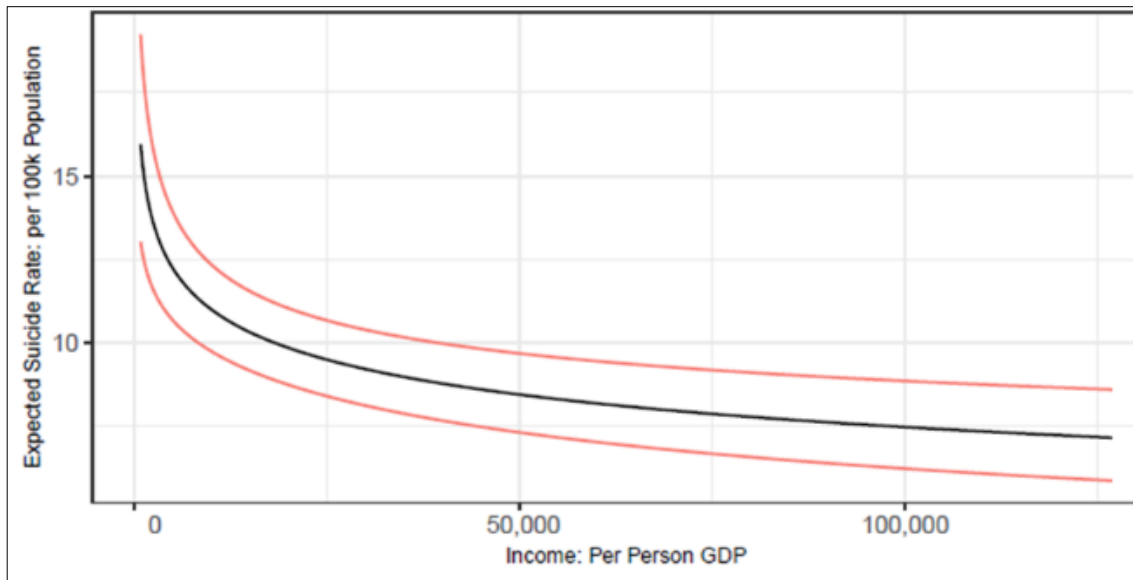
3.1 Quantifying Impact of Measures on Suicide

This model allows to describe the relationships between country level indicators and suicide rates globally. Decision-makers can quantify the relationships between these measures to support insight for their health related planning activities. However, data-driven insights derived from this model and the data sources highlighted in this report should be considered in the context of specific country-level impacts not considered in this report. To highlight the need for a holistic approach to gathering data-driven insights and incorporating domain knowledge of subject matter experts, this study describes a basic framework for potentially incorporating insights from this model into a policy decision-making process.

3.2 Quantifying Impact: Income, GDP per person

A key insight that surfaced during the modeling process was the presence of a significant relationship between a measure of income (here defined as the country-level GDP per person) and country-level suicide rates. Countries with lower per-person income tend to have a higher incidence of suicide. To explore this relationship further, this paper looks at the impact of income (her GDP per capita) on a country's suicide rate, controlling for the other key factors in this model, including alcohol consumption, the female-male labor participation rate, and the presence of a country-level suicide prevention strategy.

When controlling for these variables, it was found that an approximate 10% increase in income (or GDP per person) corresponded to a 2% decrease in suiciderate at the country level for the typical country. The following plot highlights the sensitivity of income to suicide rates based on results from this model:



Note: Expected rate with 95% confidence intervals for the typical country (i.e. holding other variables in the model identified fixed at the ‘sample mean’)

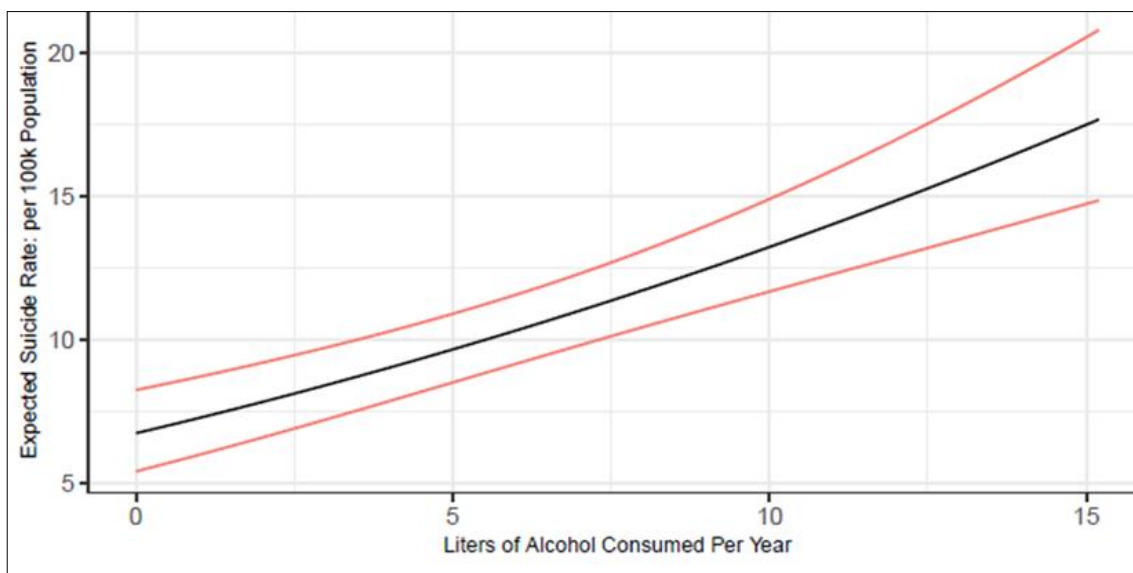
Fig 3: Expected Country-Level Suicide Rate vs. Income (GDP per-person)

3.3 Quantifying Impact: Alcohol Consumption

Another key insight that surfaced during the modeling process was the presence of a significant relationship between a measure of alcohol abuse, liters of consumption per year, and country-level suicide rates. Countries with higher levels of alcohol consumption in this data tended to have a higher incidence of suicide when controlling for other variables in this model. Based on the estimates, an approximate 4% increase in alcohol consumption

corresponded to an expected 2% increase in the suicide rate for countries where adults, on average, consume more than 4 liters of alcohol per year.

It is important to note that alcohol consumption was the most impactful and significant indicator of country-level suicide rate in this model. To illustrate the estimated impact; the following plot highlights the sensitivity of alcohol consumption to suicide rates based on results From this model:



Note: Expected rate with 95% confidence intervals for the typical country (i.e. holding other variables in the model identified fixed at the ‘Sample mean’).

Fig 4: Expected Country-Level Suicide Rate vs. Liters of Alcohol consumer per year (PP)

This sensitivity analysis highlights the strong relationship between these variables, which is not an entirely novel relationship that we discovered. The brief case study of suicide in Russia was meant to provide some discussion of the real impact of alcohol consumption.

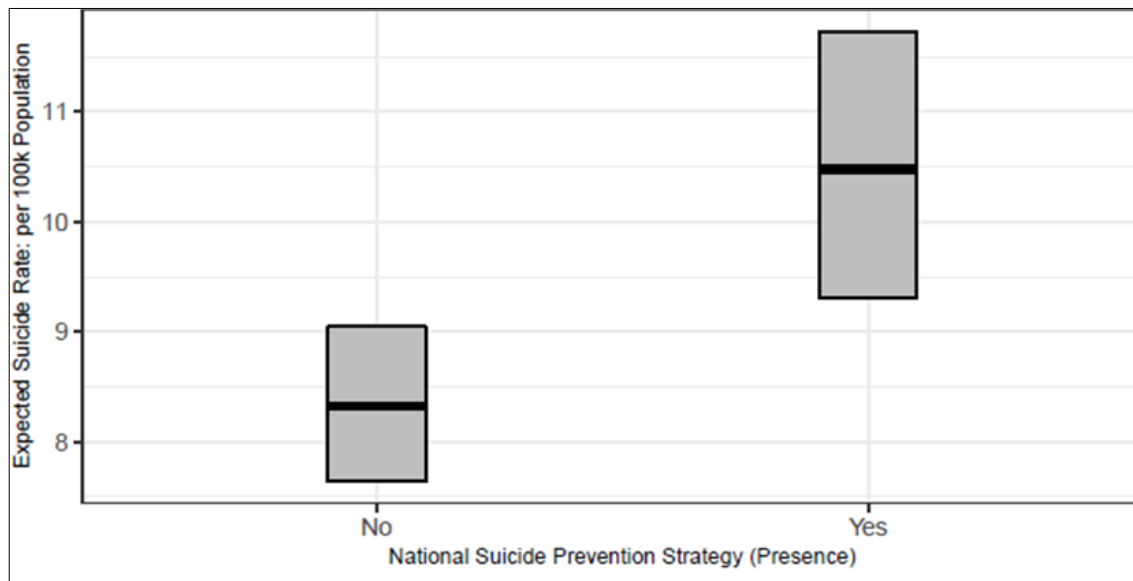
Quantifying Impact: The Presence of a National Suicide Strategy: Based on data criteria from the WHO, the impact

of having a stand-alone national suicide prevention strategy was measured. According to the who, the definite criterion for the presence of a national suicide strategy was that, in order to be considered, a country’s plan would have to be stand-alone and not be integrated into another plan.

Looking into the data, it was found that the presence of a suicide prevention strategy was more likely to be associated with countries struggling with suicide prevention overall.

Some of these countries included Guyana, Lithuania, Suriname, Belarus, and South Korea. Based on the estimates from this model, countries that have implemented a suicide

prevention strategy has a 26% higher incidence of suicide nationally, as shown below:



Note: Expected rate with 95% confidence intervals for the typical country (i.e. holding other variables in the model identified fixed at the 'sample mean').

Fig 5: Expected Country-Level Suicide Rate vs. the presence of a national suicide strategy

While it may seem unintuitive that countries with a suicide prevention strategy have higher rates, it should not be inferred or interpreted from this model that having a national suicide prevention strategy leads to the incidence of suicide overall. It may be understood that the establishment of this strategy may be a 'reactive' decision. The strategy may have been established as a result of high incidence. As a result, this variable in the model controls for estimating other effects and to provide context for countries with high rates of suicide otherwise, it was incorporated.

6.1 Suicide Prevention Strategy

National Suicide prevention strategies have been implemented in many countries to combat suicide. In 1993, the United Nations created a task force which teamed up with the WHO to put together a study on the causes, preventative, and rehabilitative measures of suicide, which culminated with the release of a report in 1996 called "Prevention of suicide: guidelines for the formulation and implementation of Policy Drivers of National Suicide Indicators and national strategies" [2]. Before this, Finland was the only nation that had a national program for suicide prevention.

These guidelines were followed to varying degrees by different countries or local municipalities. The 1996 study was followed up with another study in 2018 [12], which updated recommendations and findings since 1996. The 2018 study also contained a list of all countries with "a stand-alone national suicide prevention strategy (NSPS) adopted by the government" [12]. It was found that countries that have put a national suicide prevention strategy in place tend to have higher incidence of suicide rates overall. Since most National suicide programs have only been implemented in the last two decades, this may explain the counterintuitive trend observed. However, it is still advised to have a national strategy to address suicide.

Government policy to combat suicide allows for the "development and strengthening surveillance (of at-risk groups), and to provide and disseminate information" [12] on at-risk individuals to inform action. An implementation of an NSPS in Scotland called "Choose Live." decreased suicide rates by 20% over ten years. This sort of improvement in suicide rates after implementation is implied in the 2018 report and lends to the recommendation that national strategies should be implemented.

Developing countries are recommended to take advantage of online resources for policy planners like MiNDbank, a website created by the WHO with recommendations on mental health issues [15]. Countries still should consider establishing an authoritative agency tasked with the continued investigation, formulation, and implementation of a National Suicide Prevention Strategy. It should follow actions like those below from countries with success in reducing suicide [5].

1. Diminish admittance to means and strategies for self-destruction-Perspective self-destruction as a mental slip-up
2. Work on clinical, mental, and psychosocial drives
3. Disperse information about proof based techniques for decreasing self-destruction.
4. Raise ability levels among staff and other key people in the consideration administrations.
5. Perform "main driver" or occasion investigations after self-destruction backing deliberate associations.
6. Advance public mindfulness crusades featuring the pervasiveness of self-destruction.
7. Promote public awareness campaigns highlighting the prevalence of suicide.

National strategies should not replace existing frameworks already in place in local government, either. By changing public perceptions, reducing the stigmas associated with

seeking help and coming up with national strategies to combat suicide, the rate of suicide can be reduced.

6.2 Alcohol Intake

Alcohol abuse is among the major risk factors for suicide. Policymakers should consider implementing measures designed to mitigate the harmful use of alcohol as a means of reducing the rate of suicide. According to the WHO, the policy interventions that have proven effective at reducing the harmful use of alcohol are varied. One is to increase the price of alcohol via taxation, which is implemented successfully in states such as Utah. Another is to enact and enforce restrictions on alcohol advertising (across multiple types of media) - out of sight, out of mind. Finally, it may be helpful to enact and enforce restrictions on the physical availability of retail alcohol (Via reduced hours of sale); for example, many "dry states" do not serve alcohol on Sundays [10]. It is not recommended to remove access to alcohol completely, as seen in the disastrous US history lesson in the prohibition era. The increased violence may not have been worth the decrease in suicide [11].

6.3 GDP Per Capita

There is a negative correlation between GDP per capita (PPP) and suicide rates. While it is unknown why this is, it is believed that money should be spent to uncover more about the relationship between income and suicide. Countries with lower GDPs tend to have higher rates of suicide, which also tend to have lower quality infrastructure, health care, and a plethora of other associated industries [11]. Because of lower quality services in this area, at-risk individuals may have a higher likelihood of suicide. An analysis of income of specific income groups would shed more light as to whether low income correlates to higher suicide or not. As such, it is recommended to invest in research to understand better potential relationships between income instability, income protection, and suicide at the individual level. In addition, governments should pursue measures aimed at poverty reduction and unemployment benefits to support individual economic security.

7. Results

The analysis revealed several significant relationships between socio-economic indicators and suicide rates across the 166 countries studied. Key findings include the discovery of a negative correlation between GDP per capita and suicide rates, indicating that countries with higher income levels tend to have lower suicide rates. This suggests that economic stability may act as a protective factor against suicide, possibly due to better access to mental health resources, stronger social safety nets, and reduced stress linked to financial insecurity. Furthermore, alcohol consumption was found to have a positive correlation with suicide rates, meaning that higher levels of alcohol consumption per capita are associated with increased suicide rates. Interestingly, the presence of a National Suicide Prevention Strategy (NSPS), although intended to reduce suicide rates, was associated with higher reported suicide rates. This finding suggests that countries with an NSPS may already be struggling with high suicide rates, and the implementation of such strategies might be a reactive measure rather than preventive. Further investigation is needed to understand the timing and effectiveness of these strategies.

Table 1: Regression Model Summary

Variable	Coefficient	P-value
GDP per capita (log-transformed)	-0.404***	<0.01
Liters of alcohol consumed per capita	0.166***	<0.01
National suicide prevention strategy (NSPS)	0.562***	<0.01
Female-to-male labor participation ratio	1.031**	<0.05
Constant	5.420***	<0.01

The model's R-squared value is 0.62, indicating that 62% of the variance in suicide rates can be explained by the independent variables included in the model-namely GDP per capita, alcohol consumption, labor participation ratio, and the presence of a national suicide prevention strategy. These results highlight the complex relationships between socio-economic factors and suicide rates and provide valuable insights for policy interventions.

8. Discussion

The results of this study reveal important insights into the socio-economic and psychological factors that influence suicide rates at a national level. The findings indicate that economic stability, as reflected by GDP per capita, plays a critical role in mitigating suicide risk. This suggests that policies aimed at improving economic security, reducing unemployment, and providing better social safety nets could have a significant impact on lowering suicide rates. Conversely, the positive association between alcohol consumption and suicide rates underscores the need for effective alcohol regulation policies. Countries with higher alcohol consumption should consider implementing stricter measures, such as increasing taxes on alcohol, limiting advertising, and restricting the availability of alcohol, to reduce its harmful effects on public health, particularly in relation to suicide.

One of the more surprising findings is the positive correlation between the presence of a National Suicide Prevention Strategy (NSPS) and suicide rates. This counterintuitive result likely reflects the fact that countries implementing these strategies are already facing high suicide rates, leading to the establishment of such programs. It is essential to interpret this finding cautiously, as it does not imply that the NSPS is ineffective, but rather that these strategies may be implemented reactively in response to existing high suicide rates. Future research should focus on evaluating the long-term effectiveness of these strategies and identifying the best practices for their implementation.

Finally, the positive association between the female-to-male labor participation ratio and suicide rates suggests that gender disparities in labor markets could have complex impacts on mental health. This finding warrants further investigation to understand how gender equality in the workplace, access to employment opportunities, and societal gender roles may influence mental health outcomes.

These findings are consistent with previous research suggesting that economic factors play a significant role in suicide prevention. The negative correlation between GDP per capita and suicide rates aligns with studies indicating that financial stability can reduce suicide risk. Additionally, the positive correlation between alcohol consumption and suicide rates corroborates existing literature advocating for stricter alcohol control measures. However, the unexpected association between the implementation of NSPS and increased suicide rates suggests that further investigation is

warranted to understand the dynamics and effectiveness of these strategies in various contexts.

9. Limitations

While this study provides valuable insights into the correlates of suicide rates, several limitations must be acknowledged:

- **Data Limitations:** The study relies on existing data sources, which may contain inaccuracies or inconsistencies in reporting suicide rates and associated factors.
- **Cross-Sectional Design:** The cross-sectional nature of the analysis limits the ability to infer causality between the identified factors and suicide rates. Longitudinal studies are needed to establish causal relationships.
- **Cultural Differences:** The study encompasses countries with diverse cultural contexts, which may influence the effectiveness of NSPS and the relationship between socioeconomic indicators and suicide rates. Cultural factors may not be adequately captured in the analysis.
- **External Validity:** The findings may not be generalizable to all countries or regions, particularly those not included in the study. Further research is needed to explore these relationships in different cultural and socioeconomic contexts.

10. Conclusion

In summary, this study highlights the critical factors influencing suicide rates across diverse socioeconomic contexts. The unexpected association between the implementation of National Suicide Prevention Strategies (NSPS) and increased suicide rates suggests that further investigation is necessary to understand the complexities surrounding these strategies, particularly in relation to increased awareness and reporting of suicides.

While this research contributes to the growing body of literature on suicide prevention, it is essential to acknowledge the limitations of the study, including data reliability and the cross-sectional design. Future research should aim to explore these relationships longitudinally and in various cultural contexts to enhance the effectiveness of suicide prevention efforts globally. By addressing the socioeconomic factors and fostering a comprehensive understanding of the dynamics of suicide prevention strategies, policymakers and practitioners can work towards developing more effective interventions to reduce suicide rates and improve mental health outcomes.

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