

The Effect of Alcohol in Life Expectancy

Florencia Irene

Department of Statistics,

California State University East Bay

firene@horizon.csueastbay.edu

INTRODUCTION

The relationship between alcohol consumption and life expectancy has been a topic of considerable debate in scientific literature. While some studies suggest that moderate alcohol intake may confer health benefits and lead to increased longevity, others caution against its potential negative impacts on overall health and mortality rates.¹ For instance, research conducted by the University of California Irvine's Institute for Memory Impairments and Neurological Disorders indicates that moderate drinking, defined as no more than two glasses of wine or beer per day, may reduce the risk of premature death by approximately 18%. ²Conversely, the American Society of Clinical Oncology has issued warnings regarding the association between alcohol consumption and an increased risk of at least seven different types of cancer. Additionally, alcohol consumption has been linked to obesity, a known risk factor for cardiovascular disease and diabetes.

Given the contradictory findings and significant public health implications, this paper seeks to investigate the potential association between alcohol consumption and life expectancy. Building upon existing research and assumptions, it hypothesizes that alcohol consumption may indeed be associated with a shorter life expectancy. By focusing on this hypothesis, the paper aims to contribute to a better understanding of the complex relationship between alcohol consumption and health outcomes using observational studies. These insights may inform public health interventions and policy decisions.

METHOD

Data Collection: Data pertaining to life expectancy, health factors, and economic indicators for 193 nations from 2000 to 2005 were obtained from reputable sources. Specifically, the dataset was acquired from the World Health Organization (WHO) data repository website, while economic data were sourced from the United Nations website. This comprehensive dataset encompasses 22 variables, including Country, Status (developed or developing), Life Expectancy, Alcohol Consumption, Body Mass Index (BMI), Gross Domestic Product (GDP), and Education indicators.

A. Sampling Method

Stratified sampling was employed to ensure representative coverage of the adult population (aged 15 years and above) across the 193 countries included in the dataset. This method involves dividing the population into distinct strata based on predefined criteria, such as geographical region or socio-economic status, and then selecting a proportional sample from each stratum. In this study, a representative sample of the adult population from each country was surveyed to collect data on relevant health and socio-economic indicators.

B. Statistical Modeling

The relationship between life expectancy and alcohol consumption was modeled using a linear regression approach. The model is represented as:

$$Life\ Expectancy_i = \beta_0 + \beta_1 Alcohol\ Consumption_i + \epsilon_i$$

¹ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5460586/>

² <https://www.cancer.org/cancer/risk-prevention/diet-physical-activity/alcohol-use-and-cancer.html>

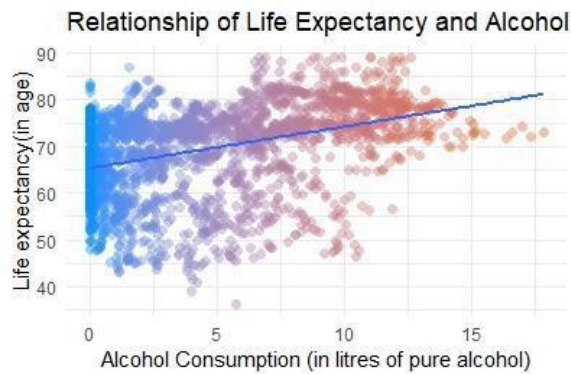
where β_0 represents the intercept term, β_1 denotes the coefficient for alcohol consumption, and ϵ_i represents the error term for each observation. The error term is assumed to follow a normal distribution with a mean of zero and constant variance. According to the model, the average life expectancy when alcohol consumption is zero is equal to β_0 , and the average difference in life expectancy for every one-unit change in alcohol consumption is equal to β_1 . The relationship between alcohol consumption and life expectancy can be examined using this statistical model while controlling for other potential confounding variables present in the dataset.

RESULT

Globally, the average life expectancy stands at 69.34 years, while alcohol consumption averages 4.54 liters per capita in countries with a population aged 15 years and older. The table below presents summary statistics for these key variables along with relevant confounding factors.

Variable	Mean(sd) or n(n%)
Life expectancy	69.34(8.79)
Alcohol	4.54(4.03)
Status	Developed: 242(14.68%) Developing: 1407(85.32%)
Income composition of resources	0.63(0.21)
Education	12.12 (3.25)
BMI	38.13(19.77)

Additionally, the relationship between life expectancy and alcohol consumption is depicted in the scatter plot below.



The scatter plot illustrates a moderate linear relationship between life expectancy and alcohol consumption. This indicates that as alcohol consumption increases, life expectancy tends to increase as well. It is notable that the majority of observed countries exhibit alcohol consumption levels ranging between 0 and 10 liters per year. Conversely, countries with alcohol consumption exceeding 15 liters per year are relatively rare occurrences.

To address the research question, it is important to examine four conditions of regression analysis. These conditions, namely linearity, independence, normality of the residuals, and equality of variance, have all been verified and met, as detailed in the Appendix 1. Utilizing R-Studio for the regression analysis between the two primary variables, the following results have been obtained:

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Call:
lm(formula = y ~ x, data = life)

Residuals:
    Min       1Q   Median       3Q      Max
-34.127  -4.206   1.680   6.366  20.312

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  65.31121    0.25891   252.26  <2e-16 ***
x            0.88815    0.04275   20.78  <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 8.691 on 2567 degrees of freedom
Multiple R-squared:  0.144,    Adjusted R-squared:  0.1436
F-statistic: 431.7 on 1 and 2567 DF,  p-value: < 2.2e-16

(Intercept)      x
0.000000e+00 9.418124e-89
[1] 1

2.5 %      97.5 %
(Intercept) 64.8035215 65.8188969
x           0.8043268 0.9719691
[1] 0.379419

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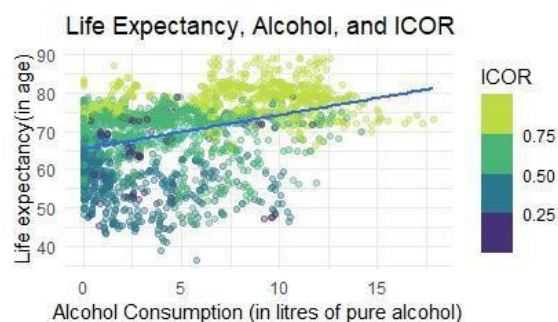
Upon inspection of R output above, the estimate model to describe the relationship of alcohol consumption and life expectancy is:

$$\text{Life Expectancy}_i = 65.31 + 0.8882 \text{Alcohol Consumption}_i$$

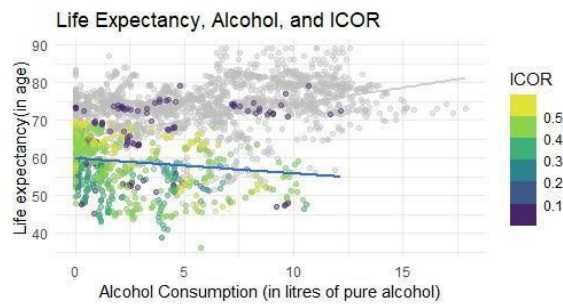
This equation predicts that the average life expectancy of countries with 0 alcohol consumption is 65.31. On the other hand, the average difference in life expectancy when Alcohol consumption differs by one unit is 0.8882. The confidence interval on the output shows: we are 95% confident that with each liter increase in alcohol consumption, the life expectancy is predicted to increase on average by 0.8043 to 0.9720 years.

Finally, by evaluating the p-value to the hypothesis model, we can derive a decision to not reject the null hypothesis. This means, we do not have enough evidence that higher alcohol consumption leads to lower life expectancy, on the other hand it suggests that higher alcohol consumption leads to higher life expectancy.

Understanding the positive relationship between alcohol consumption and life expectancy should not be perceived as the conclusion. To delve deeper into the analysis, a new variable is introduced: income composition of resources (ICOR), as it is believed to potentially act as a confounding factor. The scatter plot below illustrates the relationship between alcohol consumption, life expectancy, and ICOR.



The scatter plot reveals that countries with high ICOR (depicted in yellow and green) tend to exhibit both higher alcohol consumption and higher life expectancy. However, upon closer examination, countries with ICOR values less than 0.5 are highlighted, as shown in the plot below. Interestingly, the scatter plot demonstrates that, in contrast to countries with high ICOR, those with low ICOR exhibit a negative relationship between alcohol consumption and life expectancy.



To further strengthen the assumption, the summary statistics of alcohol consumption and life expectancy between high and low ICOR countries are examined. This additional analysis provides insights into how income composition of resources may influence the relationship between alcohol consumption and life expectancy.

To reinforce the assumption, the summary statistics of alcohol consumption and life expectancy between high and low ICOR countries are examined below.

	Mean(sd)	
	Low ICOR (< 0.550)	High ICOR (≥ 0.550)
Life expectancy (intercept)	2.3(2.6)	5.5(4.1)
Alcohol consumption	58.96(7.42)	73.89(5.9)

According to the summary statistics, alcohol consumption and life expectancy are observed to be higher in high ICOR countries compared to those in lower ones.

CONCLUSION

After thorough analysis, it becomes evident that the assumption of a negative relationship between alcohol consumption and life expectancy lacks sufficient evidence. Conversely, the findings indicate a moderate positive relationship between these two variables. However, it is important to note that this result should not be solely relied upon to justify increased alcohol consumption as a means to prolong life. Numerous confounding variables, including ICOR and others such as the type of alcohol consumed, body mass index, education level, a country's GDP, and healthcare system quality, influence the relationship between life expectancy and alcohol consumption.

In conclusion, while the analysis suggests a link between higher alcohol consumption and increased life expectancy, it is not definitive enough to advocate for increased alcohol consumption for longevity. Given the intricate interplay of various factors influencing life expectancy, it is essential to exercise caution when formulating conclusions. Additionally, it is imperative to consider broader aspects of individual health and well-being to ensure comprehensive understanding and informed decision-making.

REFERENCES

American Cancer Society. (n.d.). Alcohol use and cancer. Retrieved from <https://www.cancer.org/cancer/risk-prevention/diet-physical-activity/alcohol-use-and-cancer.html>

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APPENDIX

Appendix 1

