Life Expectancy: Prioritizing WHO Efforts

DATA-DRIVEN ANALYSIS OF DEVELOPMENT STATUS AND LIFE EXPECTANCY

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Objective

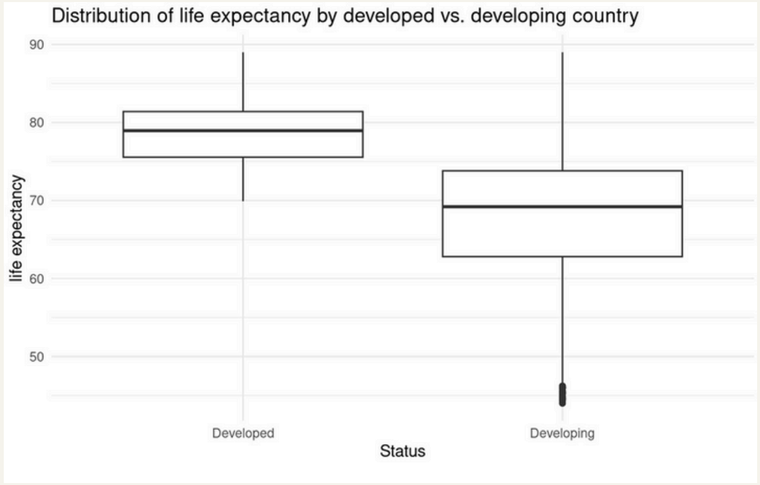
Which factors most significantly impact life expectancy in developing vs. developed countries?

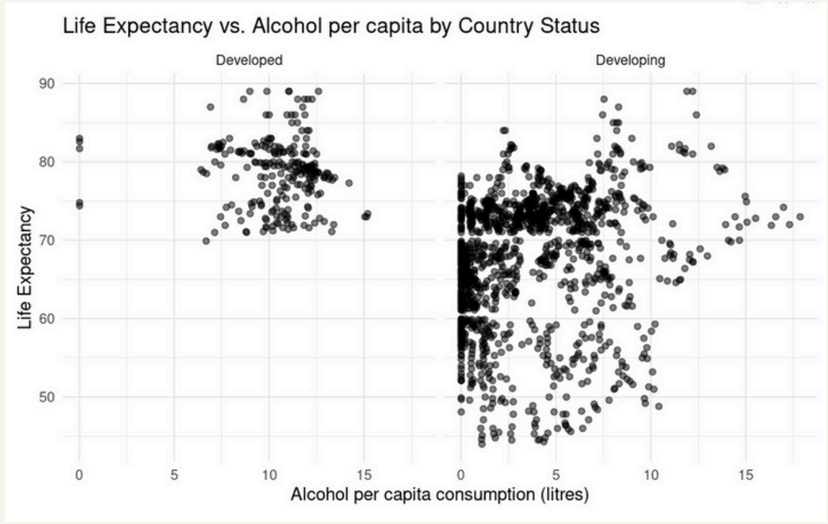
Goal: Develop recommendations for the WHO to focus its efforts and maximize improvements in life expectancy.

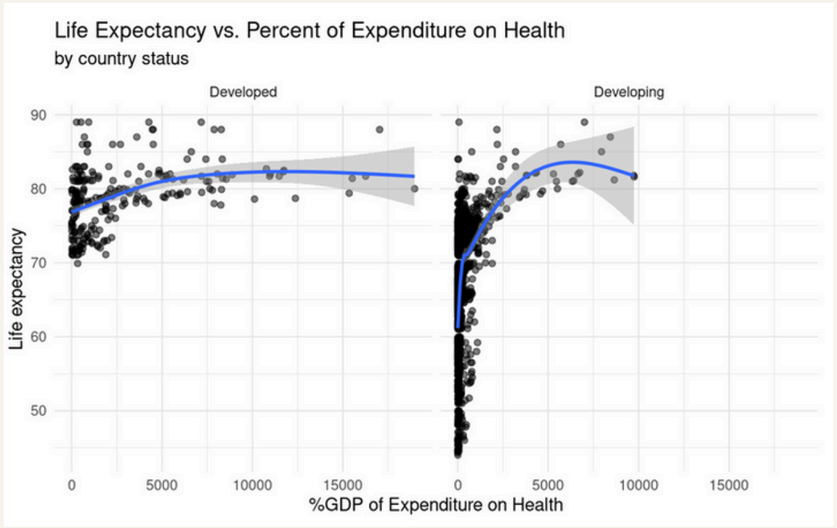
Methodology

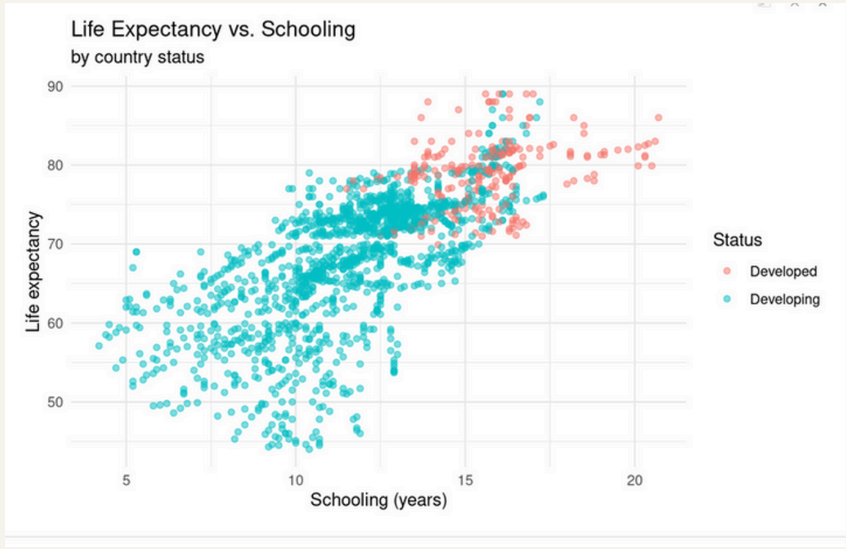
1. Exploratory Data Analysis
2. Comparative Correlation Analysis
3. Life Expectancy Regression Models by Status

Key Insights









Correlation Analysis

Overall Top Variables of Interest

Strongest positive relationship: **Schooling, Income Composition index, BMI**
Strongest negative relationship: **Adult Mortality, HIV/AIDS**
No relationship: **Population, Measles**

However, when separated by country status:

Variable <chr>	Correlation_Developed <dbl>
Income_composition_of_reso...	0.72130222
percentage_expenditure	0.39196186
GDP	0.38692033
Schooling	0.35708291
Total_expenditure	0.17915943
Population	0.12289764
Polio	0.05977494
BMI	0.01079434
Diphtheria	-0.01533129
under_five_deaths	-0.03157185

1–10 of 18 rows

Variable <chr>	Correlation_Developing <dbl>
Schooling	0.67046982
Income_composition_of_reso...	0.64976109
BMI	0.52365968
GDP	0.41598176
percentage_expenditure	0.37469966
Diphtheria	0.29627078
Polio	0.27750283
Alcohol	0.20378770
Hepatitis_B	0.17114370
Total_expenditure	0.09724281

1–10 of 18 rows

Key Findings

Developing countries had a strong, positive correlation between life expectancy and BMI, whereas developed countries had a correlation coefficient close to 0.

- Thus, **BMI is a crucial factor that plays a role in life expectancy**, but this **correlation decreases significantly as a country becomes a developed country**.

Increased years in schooling were strongly associated with higher life expectancy in developing countries, but only moderately so in developed countries.

Percentage of government expenditure on health had a weak correlation with life expectancy in developing countries;

- Infectious diseases and alcohol had a moderate correlation.
- Other factors (poverty, malnutrition, sanitation, etc.) may have a stronger impact on life expectancy.
- Healthcare expenditure may not be evenly distributed across the country.
- Current government focus is on addressing infectious diseases/emergency healthcare.

Regression Analysis Results

What factors predict life expectancy in developed and developing countries?

Built linear regression models* by country status to predict life expectancy from all variables provided (excl. Year), tested interaction effects using drop-in deviance

Significant Factors (p-val < 0.05)

Developed:

- Schooling, Adult mortality, diphtheria, income composition index

Developing:

- Schooling, Adult mortality, diphtheria, income composition index, **GDP, BMI, Alcohol**

Interaction Effect

- The interaction effect between Alcohol and BMI was not significant in developed countries, but **significant in developing countries**.
- Suggests the relationship between alcohol consumption and BMI in relation to life expectancy differs by country status

*Model Evaluation:

- both R^2 ~ 0.73
- VIFs + GVIFs indicated no multicollinearity

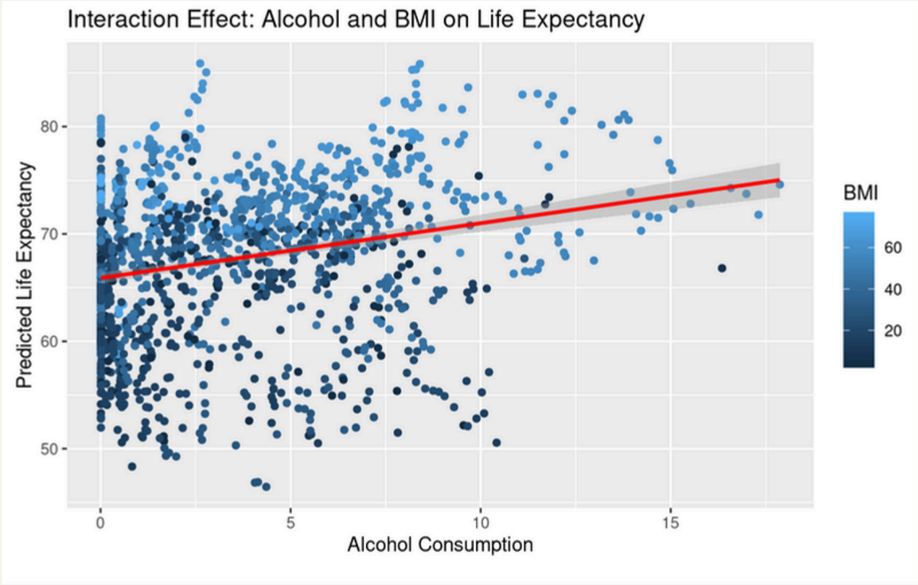
Significant Factors

Developed Countries

- Primary Focus: Education, maintaining current level of expenditure on Health

Developing Countries

- Primary Focus: Education, Health and Lifestyle (BMI, Alcohol), Economic Development (GDP)
- Secondary Focus: Infectious Diseases (Diphtheria, Polio)



As countries become more developed, **certain general factors lose their impact** (e.g., lifestyle, economic growth, infectious disease), while others, like **education and health expenditure specifically, remain critical**.

- Developing countries with lower avg BMI experience less negative impact of alcohol consumption on life expectancy, whereas those with higher BMI may experience a greater reduction in life expectancy at similar levels of alcohol consumption.

Recommendations

Developing Countries

Increased funding for education and public health in developing countries

Programs addressing diet, health education, and lifestyle (i.e. alcohol consumption)

GDP + Economic Development: Improving economic conditions will indirectly improve access to healthcare, infrastructure, and general living conditions.

Developed Countries

Addressing inequalities in health, education, and standard of living

Adult mortality & healthcare: non-communicable diseases, improving healthcare for aging populations

Health expenditure and efficiency

Main Takeaways

Education Programs

Investments in education

- Teacher training programs
- Collaboration w/ national education ministries
- Better education results in improved public health awareness, lifestyle choices, and access to resources.

Health Education Programs

- Rural/underserved focus
- Health expenditure monitoring program to fairly distribute resources

Economic Development

Develop **Global Income Composition Index and GDP Goals** that countries have incentive to meet

- Promote health-sensitive economic policies, health financing models
- Support mobilization of resources through taxation policy, international health funding
- Investments aimed at economic growth and resource allocation would significantly impact life expectancy

Health System Infrastructure

Strengthening weak correlations between total health expenditure and life expectancy

- Make sure health spending directly benefits the population through efficient healthcare delivery
- Address inequalities in health system and target vulnerable populations

Supporting disease prevention programs

- Increasing vaccination support and infectious disease research for diphtheria, polio, etc.

Limitations

Data Cleaning:

- Omitted observations with NAs for modeling purposes

Assumption of Independence of Observations:

- Not fully met for models, however:
  - Model built with control for observable characteristics (e.g. GDP, population) to account for country-specific differences
  - Reduces risk of bias due to country-specific interdependencies
  - Temporal autocorrelation (correlation across years within a country) is minimal; use of relevant covariates can account for this

Future Analysis

- **Inclusion of fixed effects** (year-level) in linear regression to control for time-invariant characteristics that could affect the relationship between the variables
- Comparison between results with NAs and without NAs
- **Time-Series Analysis** w/ ARIMA to determine if there are any trends over time