UNDER–FIVE MORTALITY: A GLOBAL CRISIS

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MORTALITY RATE, UNDER-5 (PER 1,000)

- **Current health expenditure (% of GDP)**
- **Out-of-pocket expenditure (% of current health expenditure)**
- **Physicians (per 1,000 people)**
- **Public spending on education, total (% of GDP)**
- **Literacy rate, adult female (% of females ages 15 and above)**
- **People practicing open defecation (% of population)**
- **People using safely managed drinking water services (% of population).**

Data Source: The World Bank

- When the resources are limited, what should be prioritized, education or health care?

- How important is mother's education?

- What is the role of sanitary practices and having access to clean water?

- How important is universal health care?

- How do continents differ with respect to these parameters?

World Bank Global Mortality Rate Dataset (1950 – 2022)

Columns

– Response value: Mortality Rate

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1488 entries, 0 to 1487
Data columns (total 10 columns):
 #    Column                  Non-Null Count    Dtype
---   ------                  --------------    -----
 0    country_name            1488 non-null     object
 1    year                    1488 non-null     int64
 2    Health expenditure      1488 non-null     float64
 3    Out-pocket expenditure  1488 non-null     float64
 4    Education expenditure   1488 non-null     float64
 5    Number physicians       1488 non-null     float64
 6    Mortality rate          1488 non-null     float64
 7    Female literacy         1488 non-null     float64
 8     Open defecation        1488 non-null     float64
 9    Manage water            1488 non-null     float64
dtypes: float64(8), int64(1), object(1)
memory usage: 116.4+ KB
```

DATASET OVERVIEW

```
Count of unique values in every column:
country_name : 149
year : 19
Health Expenditure : 1320
Out-pocket expenditure : 1320
Education expenditure : 1315
Number physicians : 1279
Mortality rate : 244
Female Literacy : 361
Open defecation : 275
Manage water : 341
```

DATASET OVERVIEW

Summary

	year	Health Expenditure	Out-pocket expenditure	Education expenditure	Number physicians	Mortality rate	Female Literacy	Open defecation	Manage water
count	1488.000000	1319.000000	1319.000000	1319.000000	1319.000000	364.000000	364.000000	364.000000	364.000000
mean	2009.506048	6.526258	33.325889	4.597884	2.098869	28.995879	81.820424	8.380214	57.418069
std	5.304573	2.295184	18.228449	1.730710	1.496356	34.454095	21.556203	14.397393	30.497241
min	2000.000000	1.027951	3.307494	0.787440	0.000800	1.000000	1.000000	0.001201	1.000000
25%	2005.000000	4.781093	18.532766	3.382515	0.720300	8.100000	71.768749	1.000000	36.956913
50%	2010.000000	6.554466	29.510948	4.539660	2.171700	17.750000	91.874619	1.903311	60.290884
75%	2014.000000	8.253400	44.741283	5.546300	3.297950	31.900000	96.239740	7.762895	81.964214
max	2018.000000	13.281340	84.348076	14.059080	7.777800	185.100000	99.995873	73.252478	100.000003

EXPLORATORY DATA ANALYSIS

Heat map demonstrating missing values
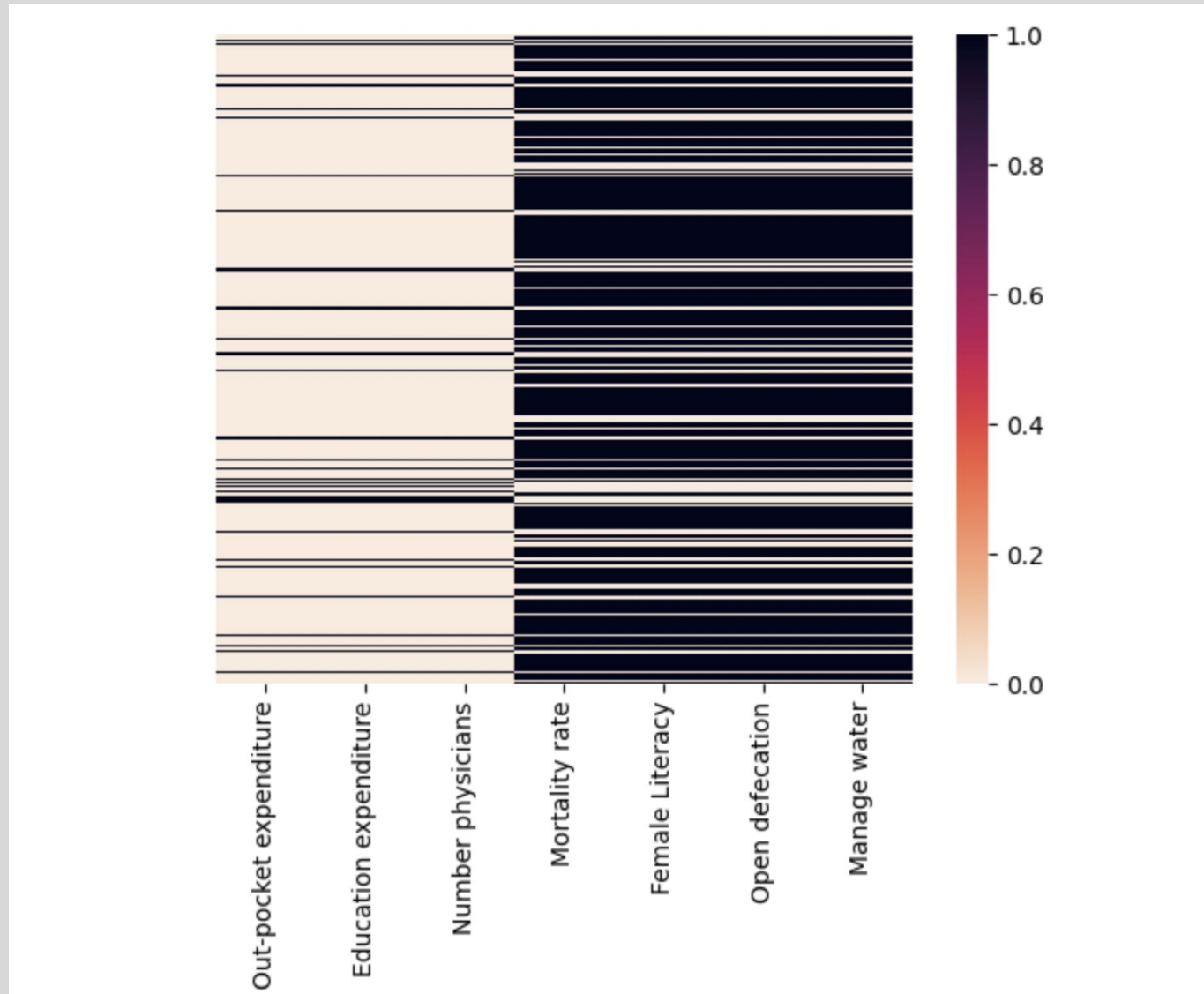
EXPLORATORY DATA ANALYSIS

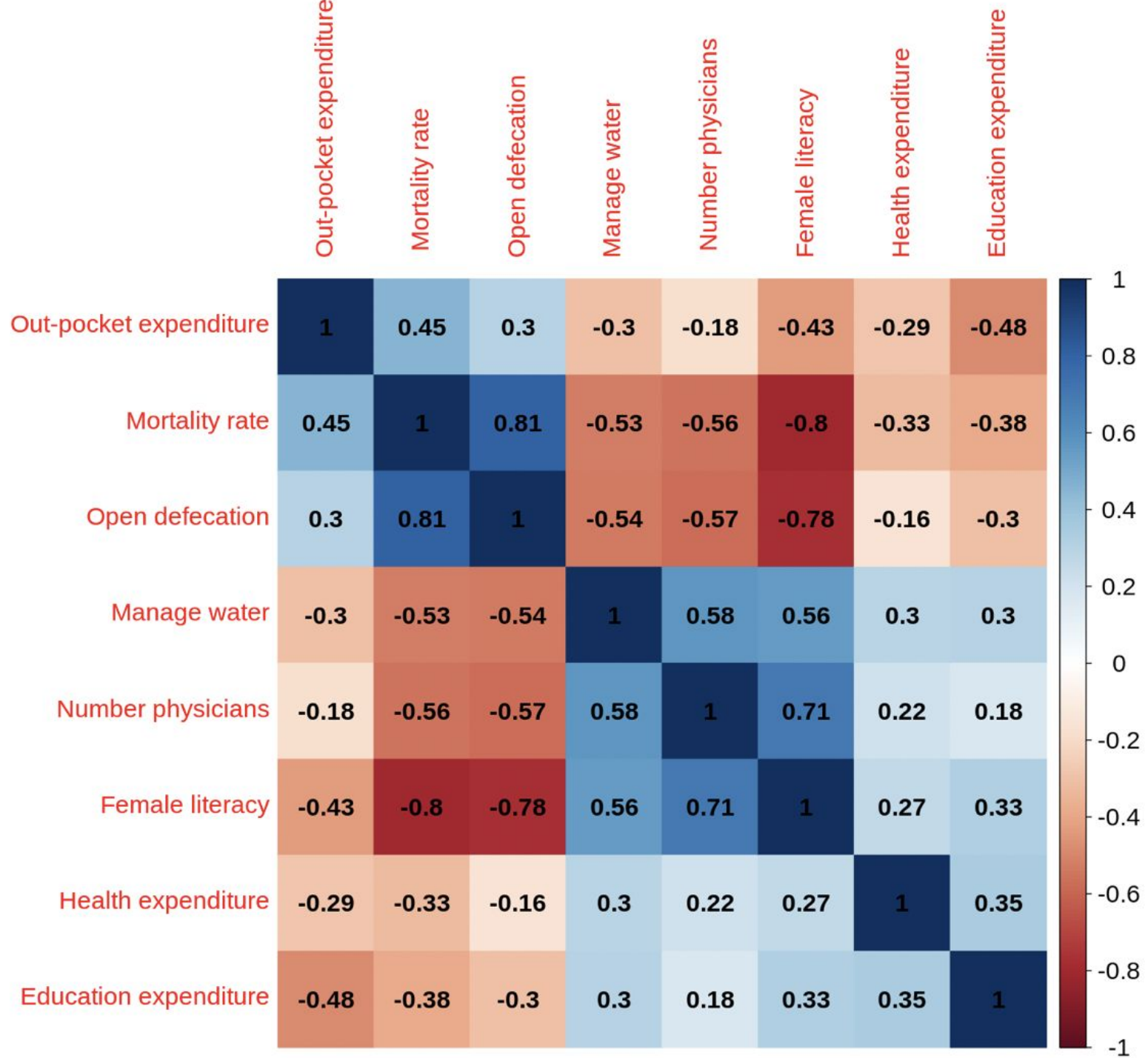## Country wise record count (Top and bottom)

Italy : 19
Czech Republic : 19
Ireland : 19
Norway : 19
Israel : 19
Spain : 19
Iceland : 19
Austria : 18
Azerbaijan : 18
Singapore : 18
Lithuania : 18
United Kingdom : 18

Turkmenistan : 2
Mauritania : 2
Montenegro : 2
Dominica : 1
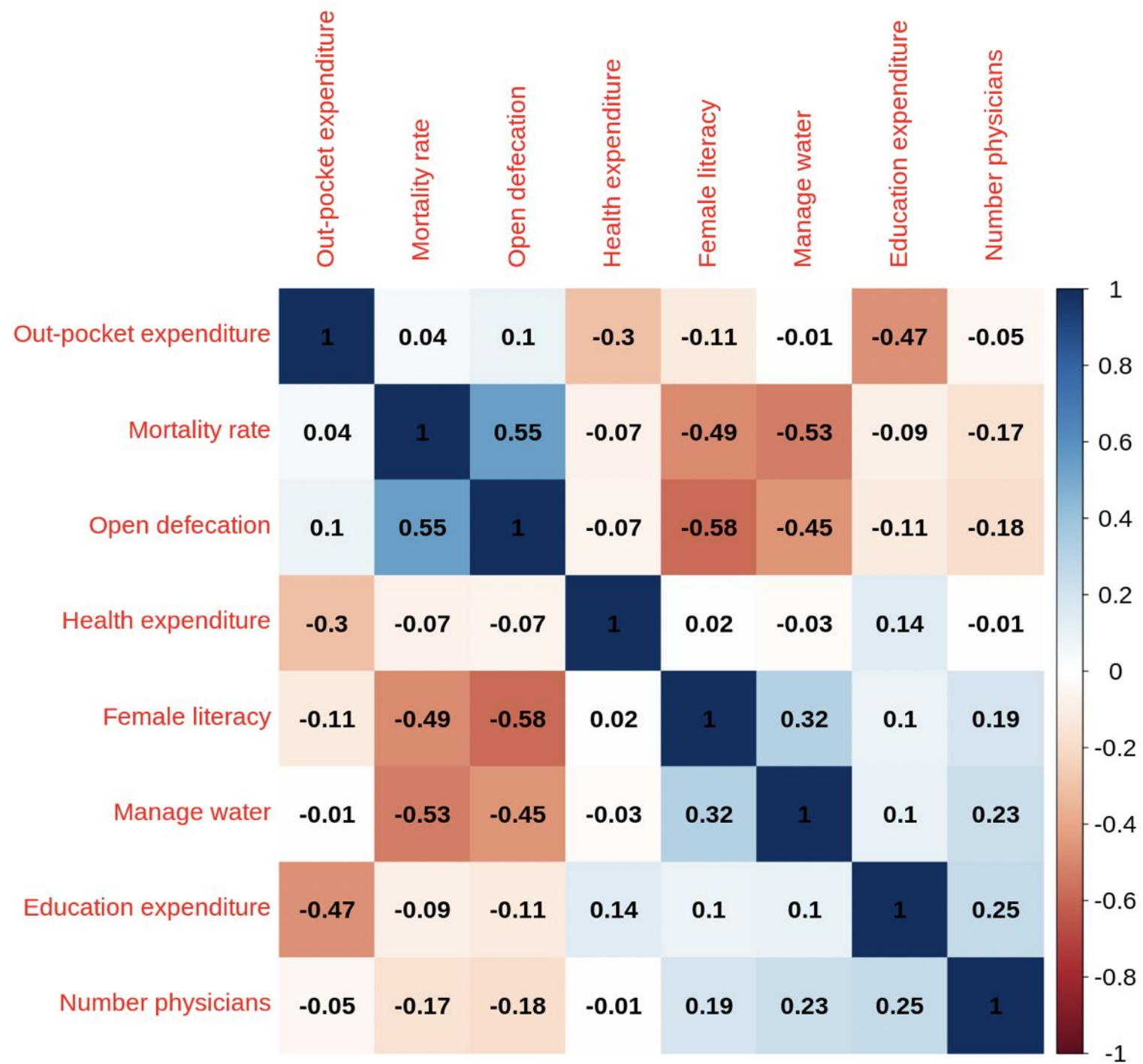Eritrea : 1
Antigua and Barbuda : 1
Angola : 1

Top 5 countries with maximum records
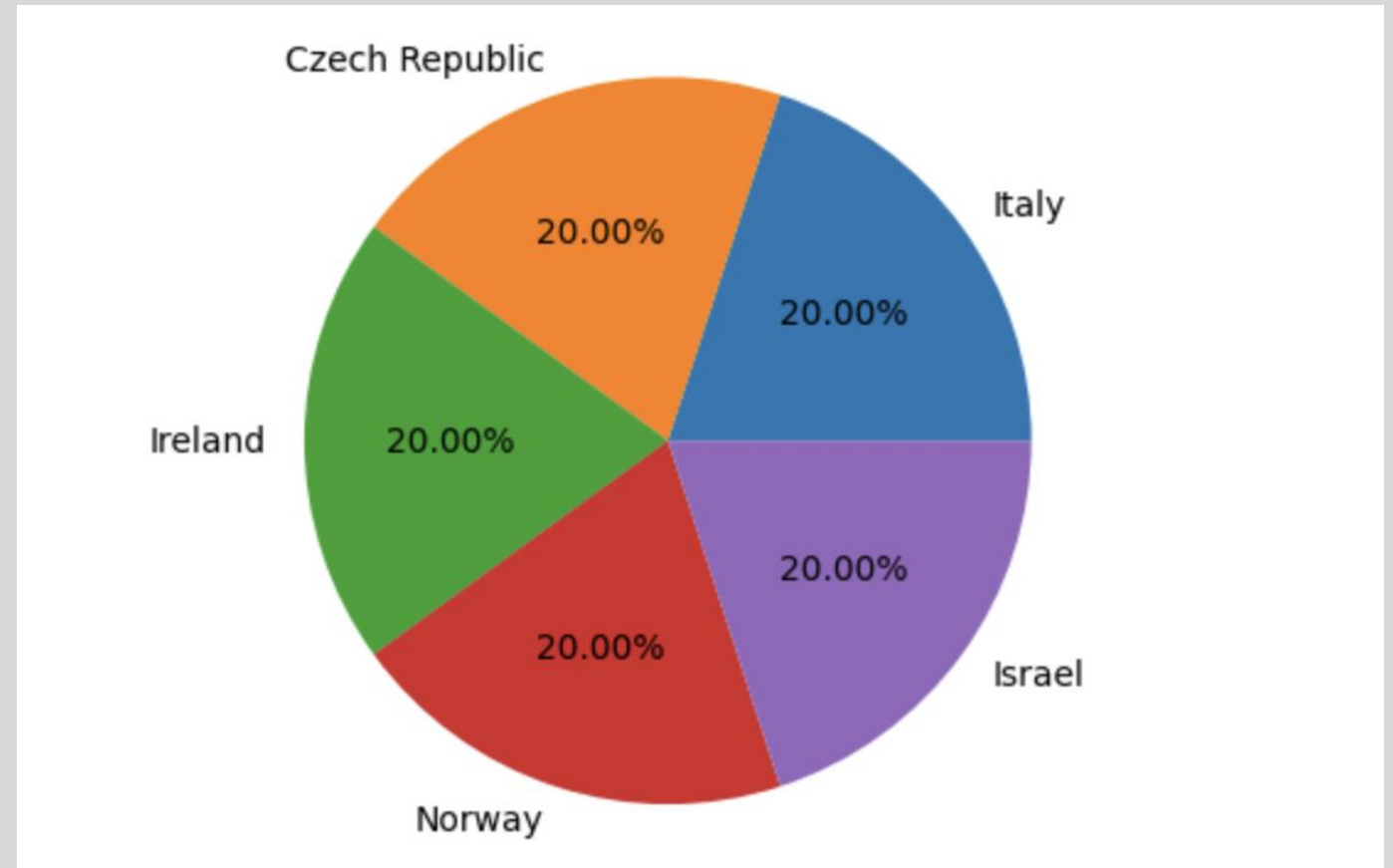
Correlation Matrix (All Data)

Continent: Asia
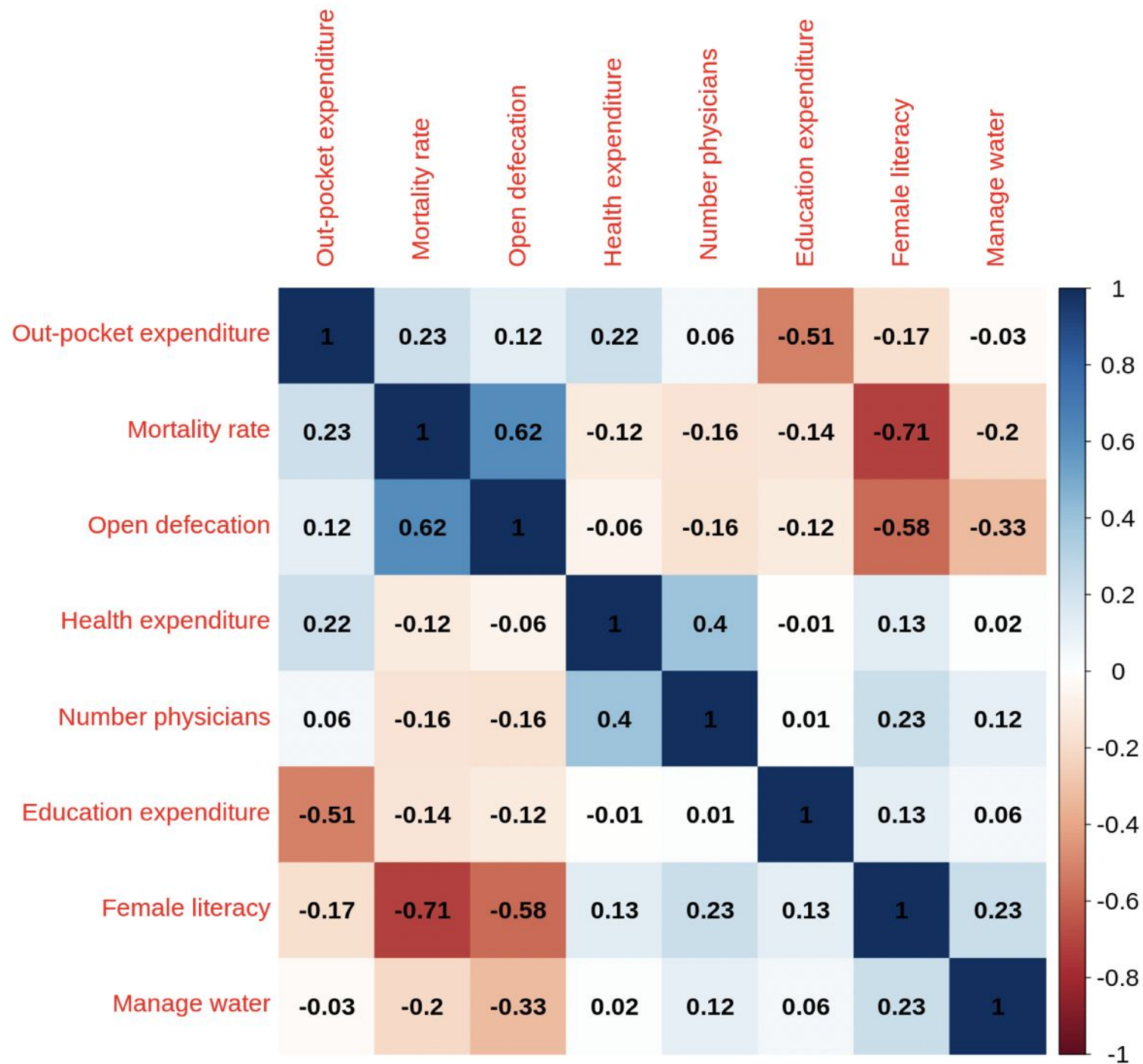
Continent: Africa

Continent: Europe
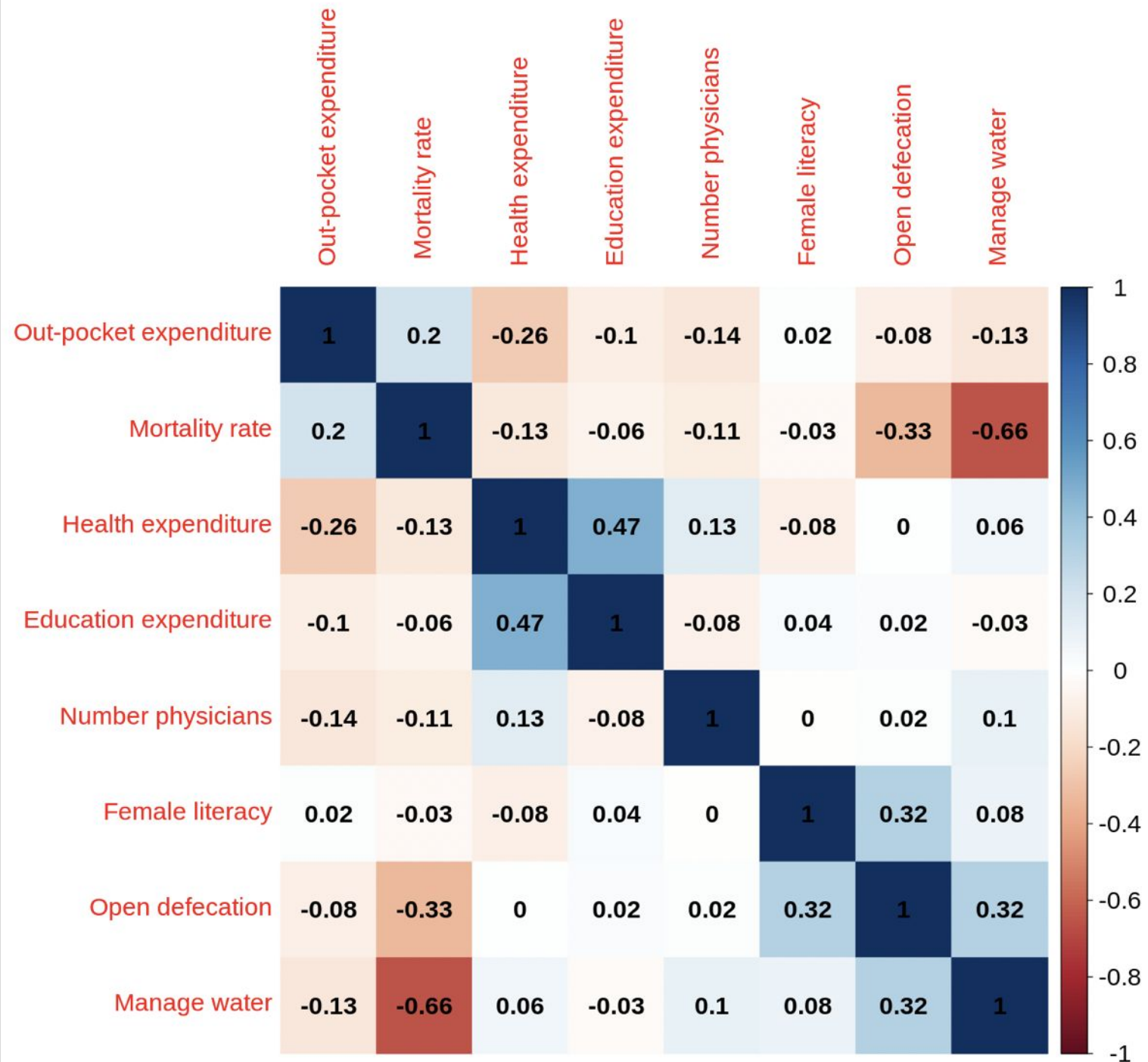
Americas (North & South)
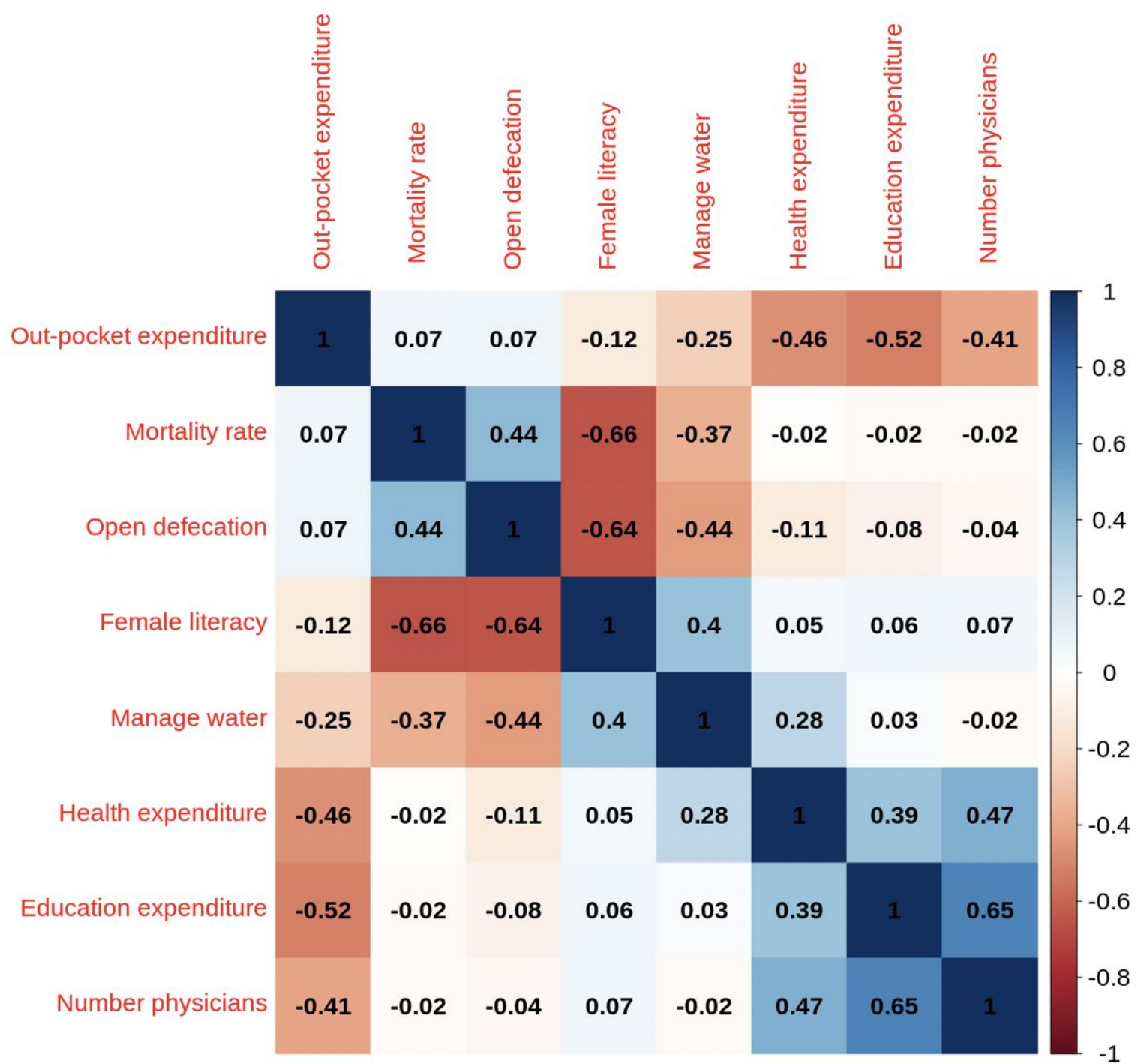
EXPLORATORY DATA ANALYSIS–change labels

Relationship between Literacy Rate among adult females and percentage of people practicing open defecation
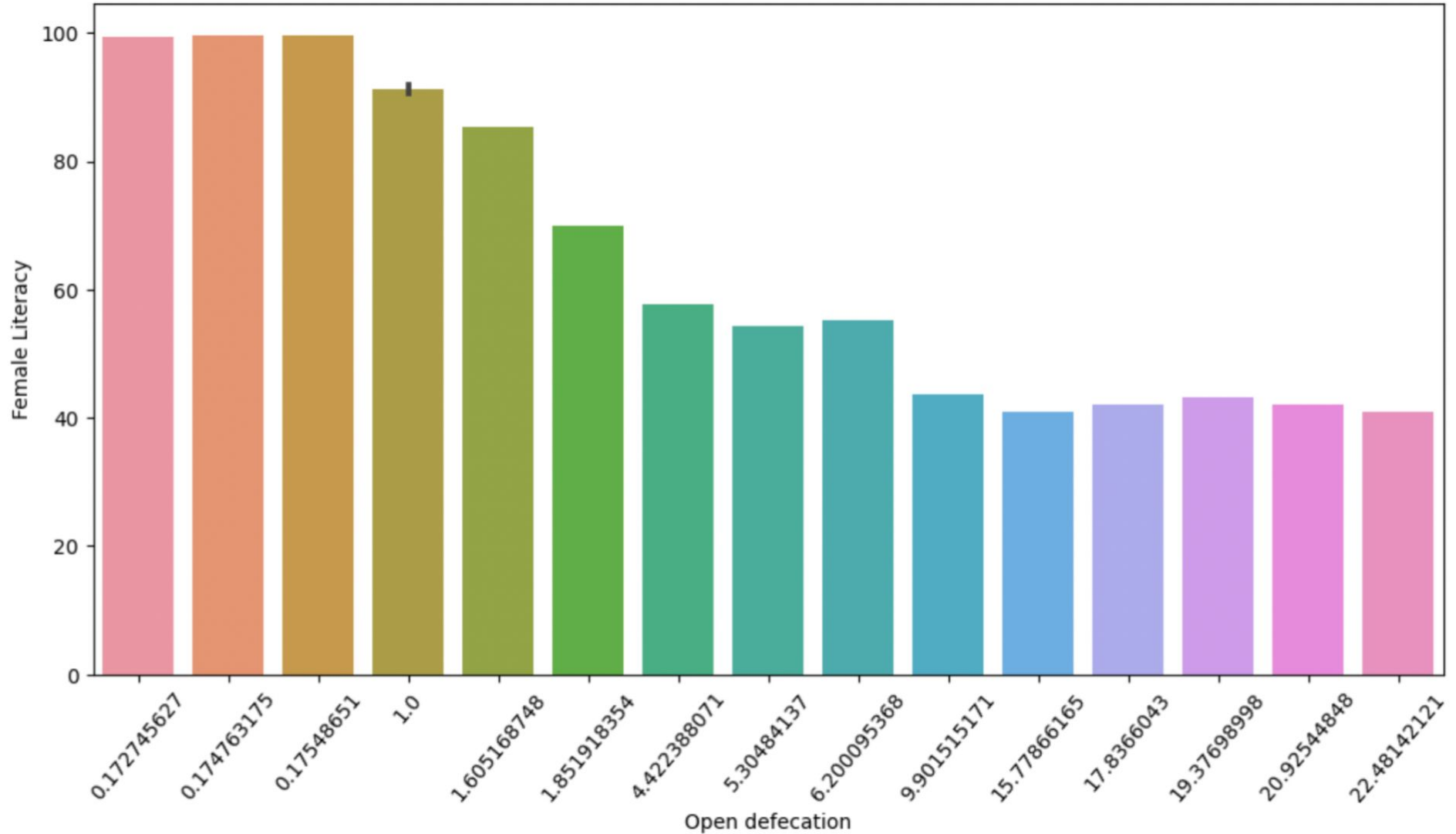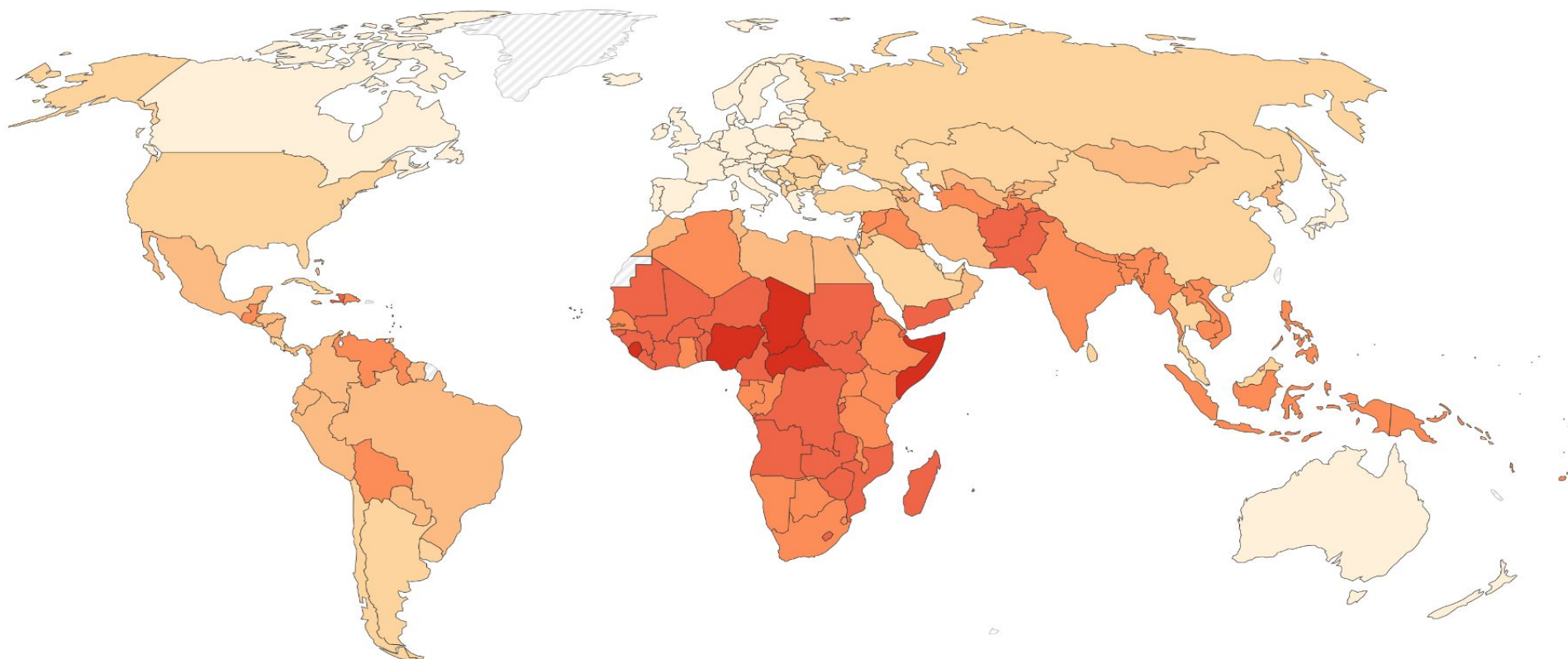
EXPLORATORY DATA ANALYSIS

Relationship between Mortality Rate and percentage of people practicing open defecation
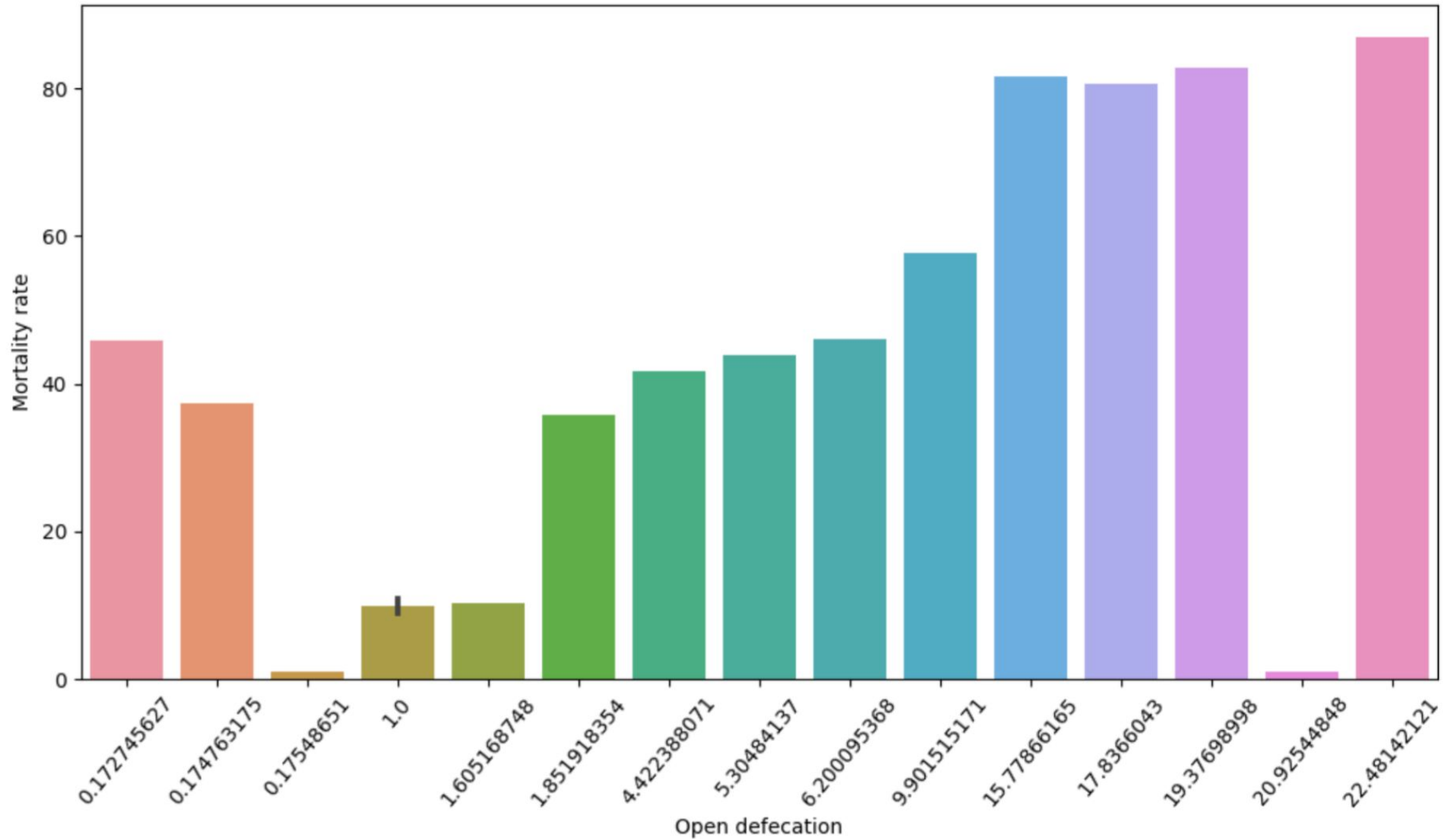
Child mortality rate, 2020

The share of newborns who die before reaching the age of five.

Our World in Data

No data   0%   0.5%   1%   2%   5%   10%   20%   50%

Methods

1. Multiple Linear Regression

2. Random Forest Regression

3. Support Vector Regression

Methods

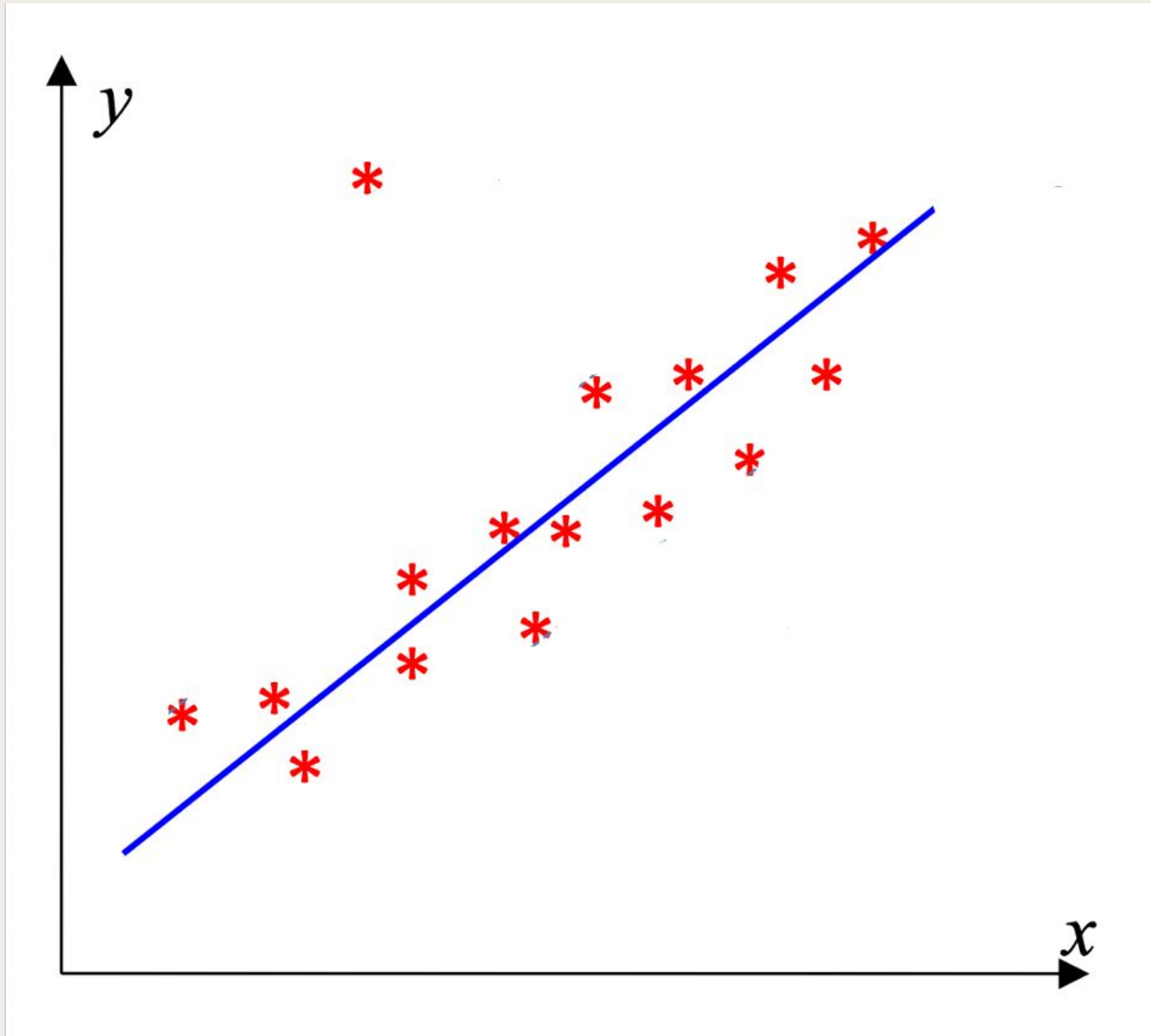1. **Multiple Linear Regression**

2. Random Forest Regression

3. Support Vector Machine

Minimize

$$\frac{1}{N}\sum_{i=1}^{N}(y_i - \widehat{y_i}^2)$$
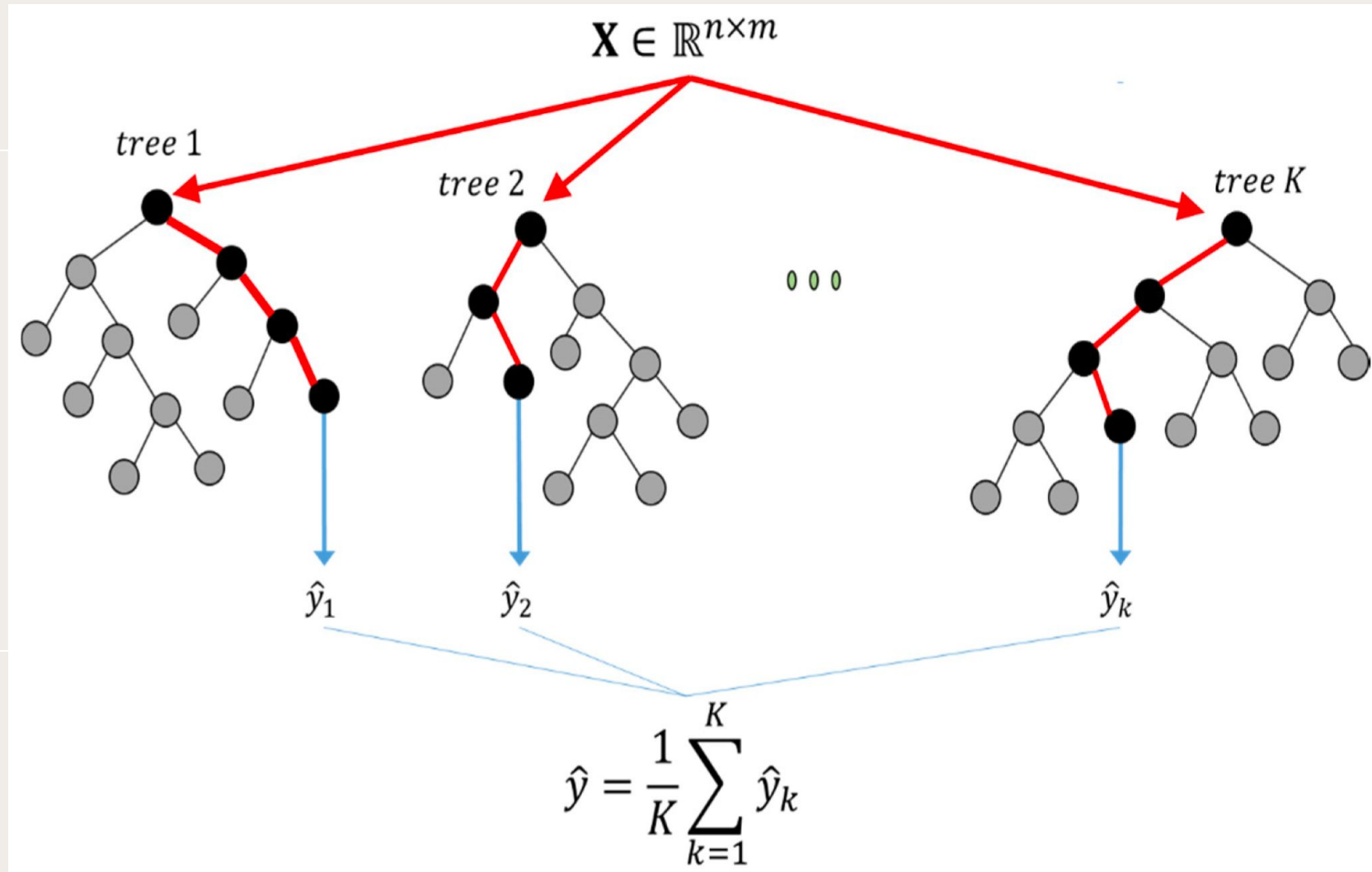
where,

$$y_i = \beta_0 + \beta_1 x_{i1} + \cdots + \beta_p x_{ip} + \epsilon$$

and

$$\widehat{y_i} = \hat{\beta}_0 + \hat{\beta}_1 x_{i1} + \cdots + \hat{\beta}_p x_{ip}$$

Methods

1. Multiple Linear Regression

2. **Random Forest Regression**

3. Support Vector Machine
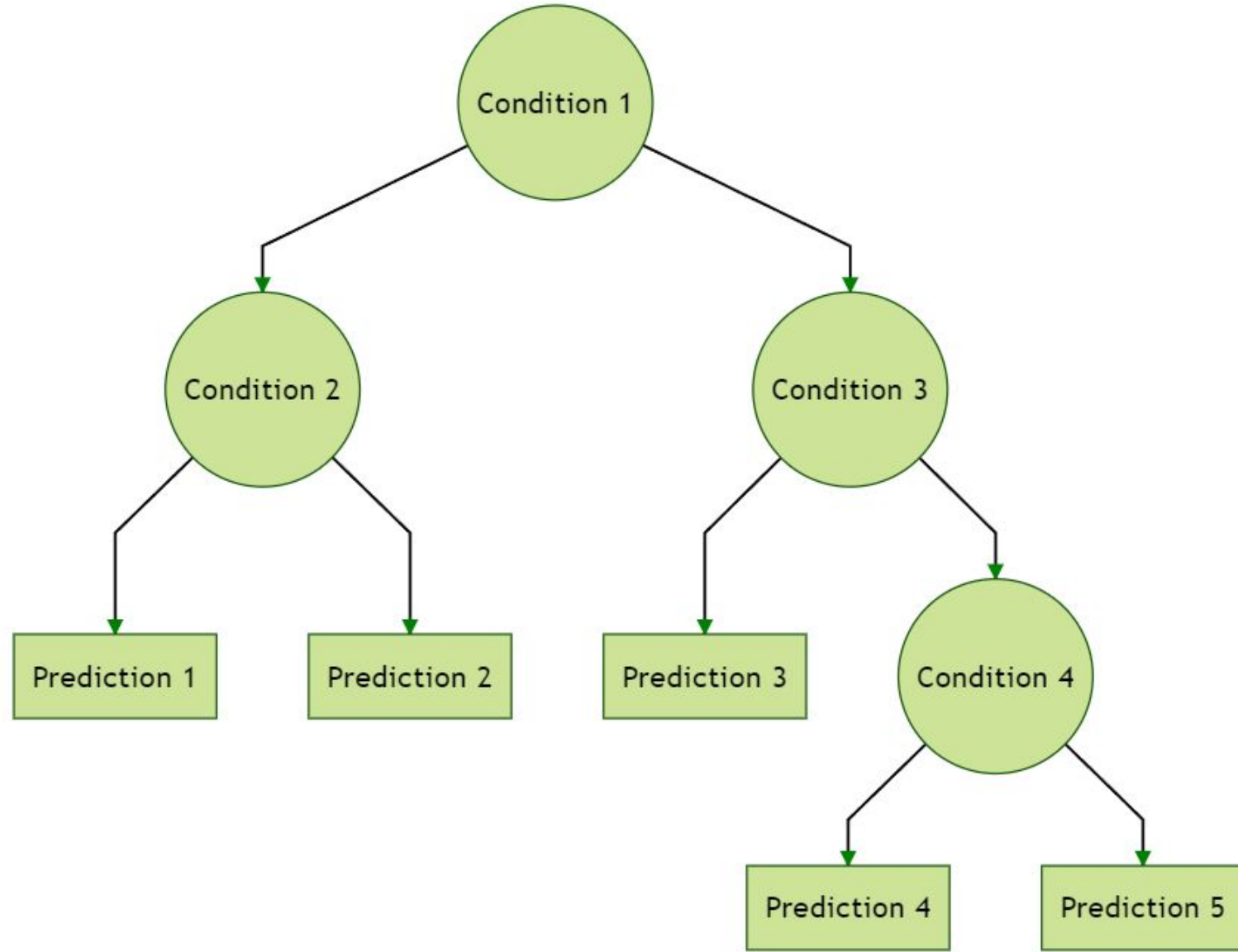
Methods

1. Multiple Linear Regression

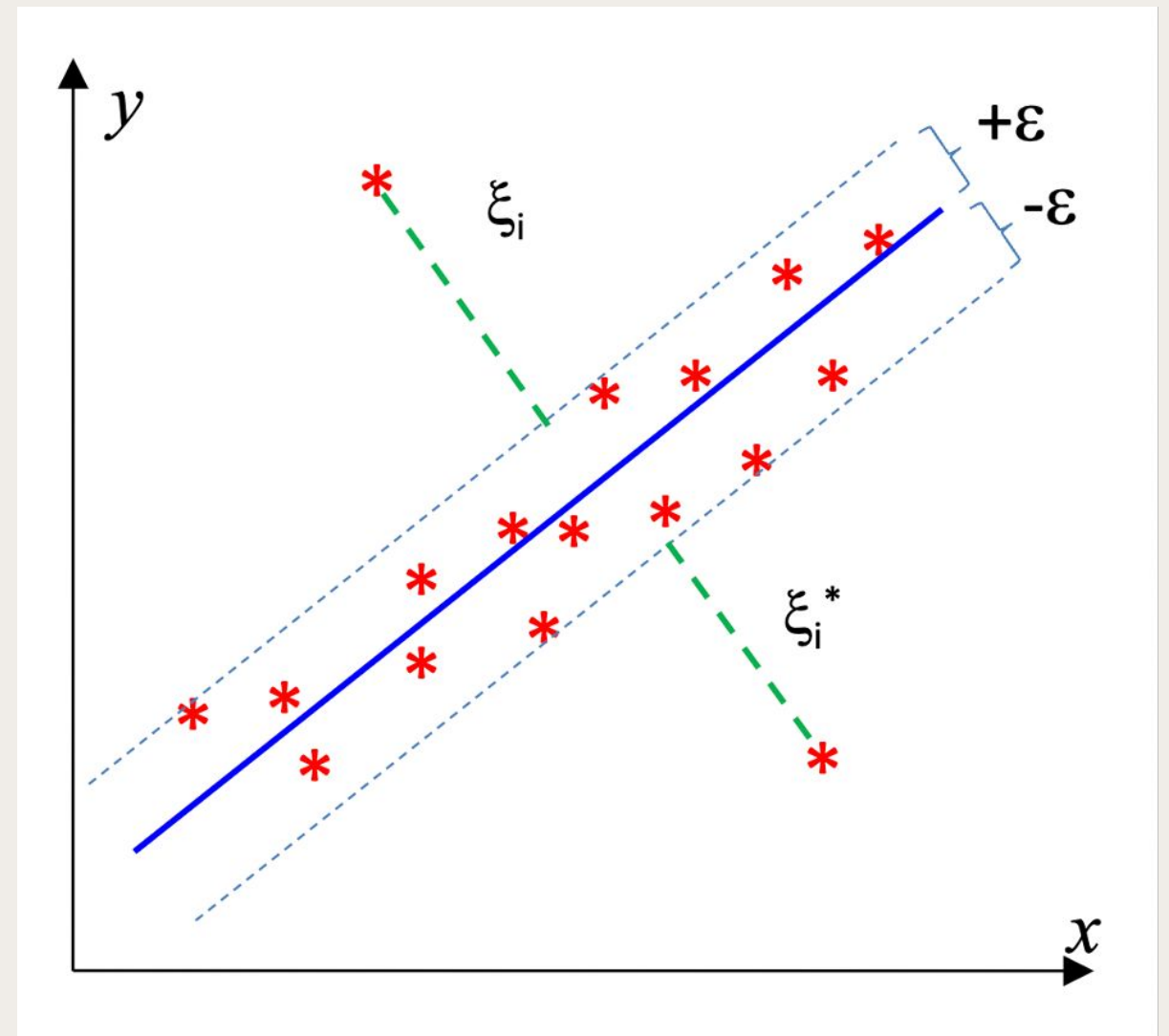2. **Random Forest Regression**

3. Support Vector Machine

Methods

1. Multiple Linear Regression

2. Random Forest Regression

3. **Support Vector Regression**

Min

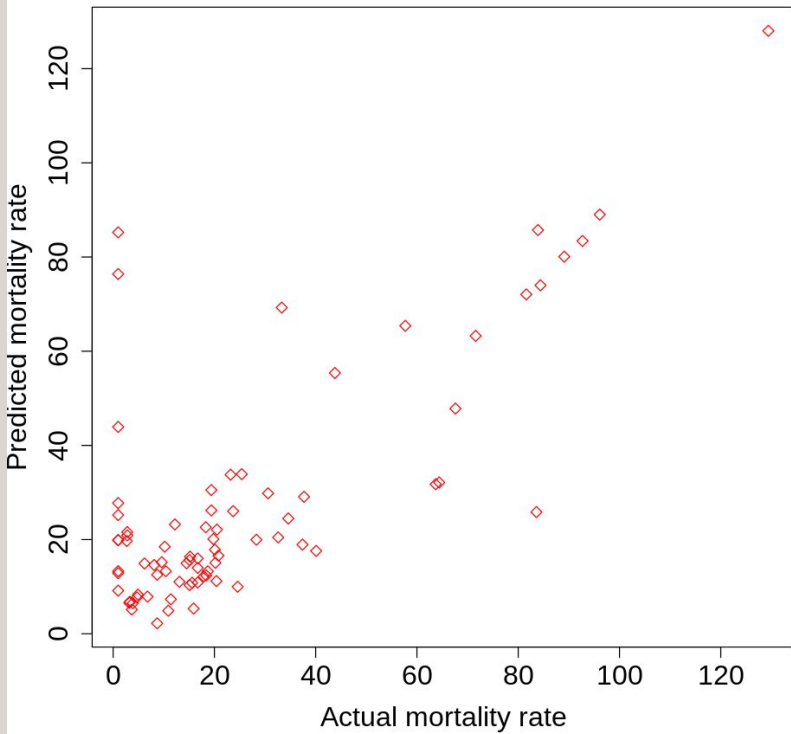$$\frac{1}{2} ||\boldsymbol{w}||^2 + C \sum_i (\xi_i + \xi_i^*)$$

Subject to:

$$y_i - \boldsymbol{w}^T \boldsymbol{x} - b \leq \epsilon + \xi_i$$
$$y_i - \boldsymbol{w}^T \boldsymbol{x} - b \geq -\epsilon - \xi_i^*$$
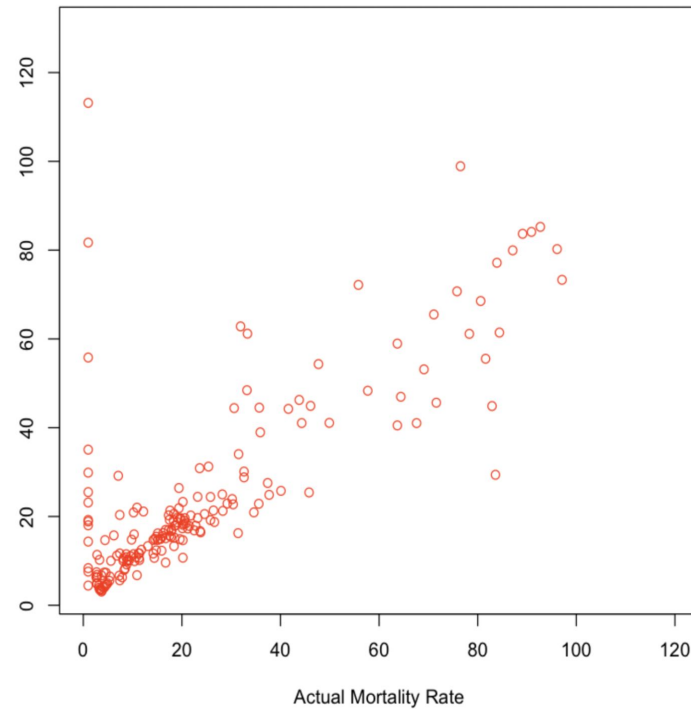$$\xi_i, \xi_i^* \geq 0$$

Results by Methods

Multiple Linear Regression

RMSE: 19.12 and R^2: 0.87

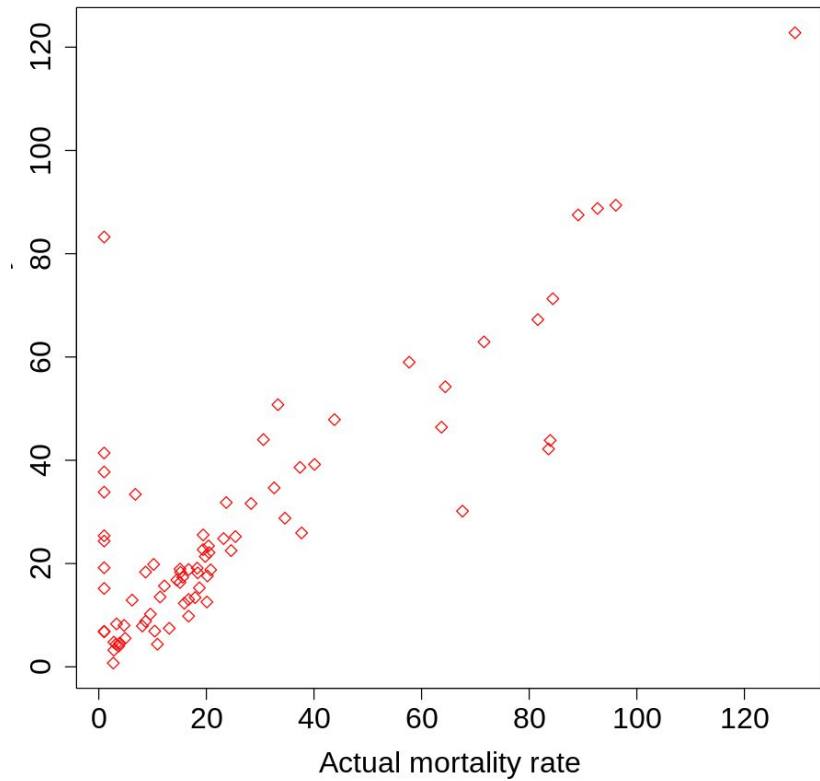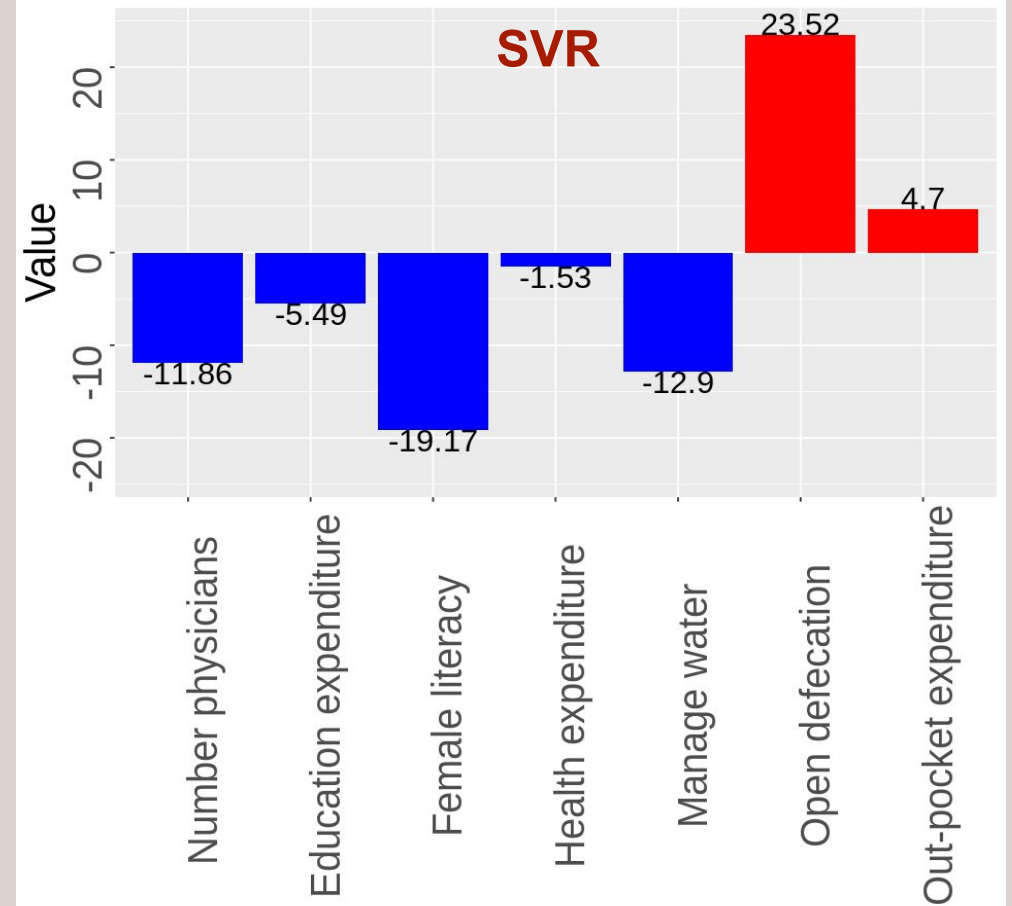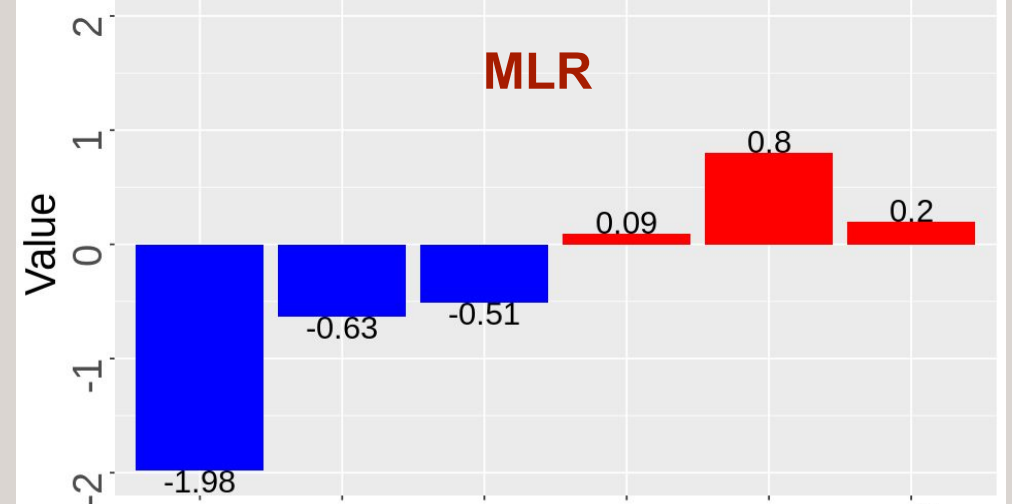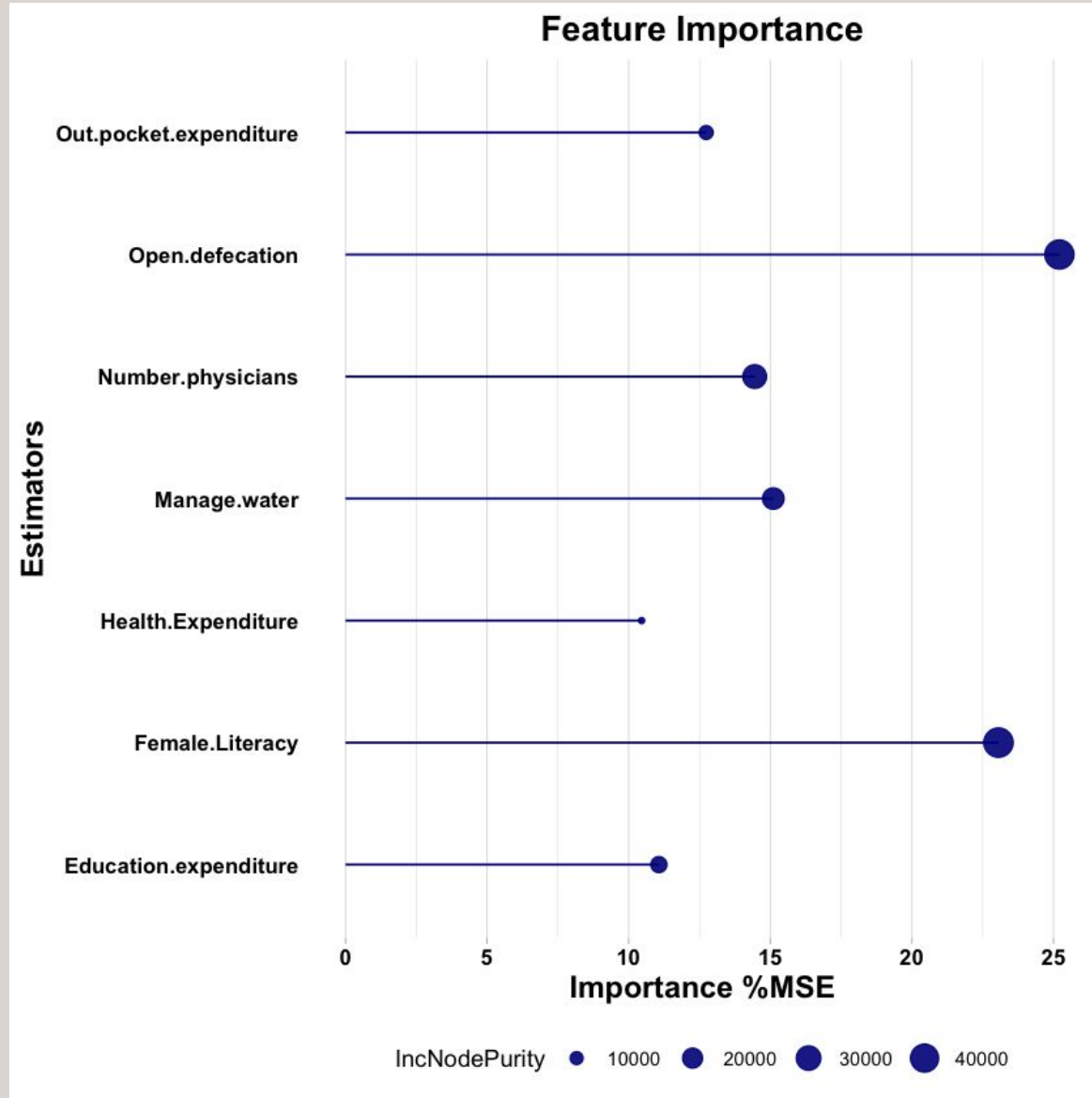## Random Forest
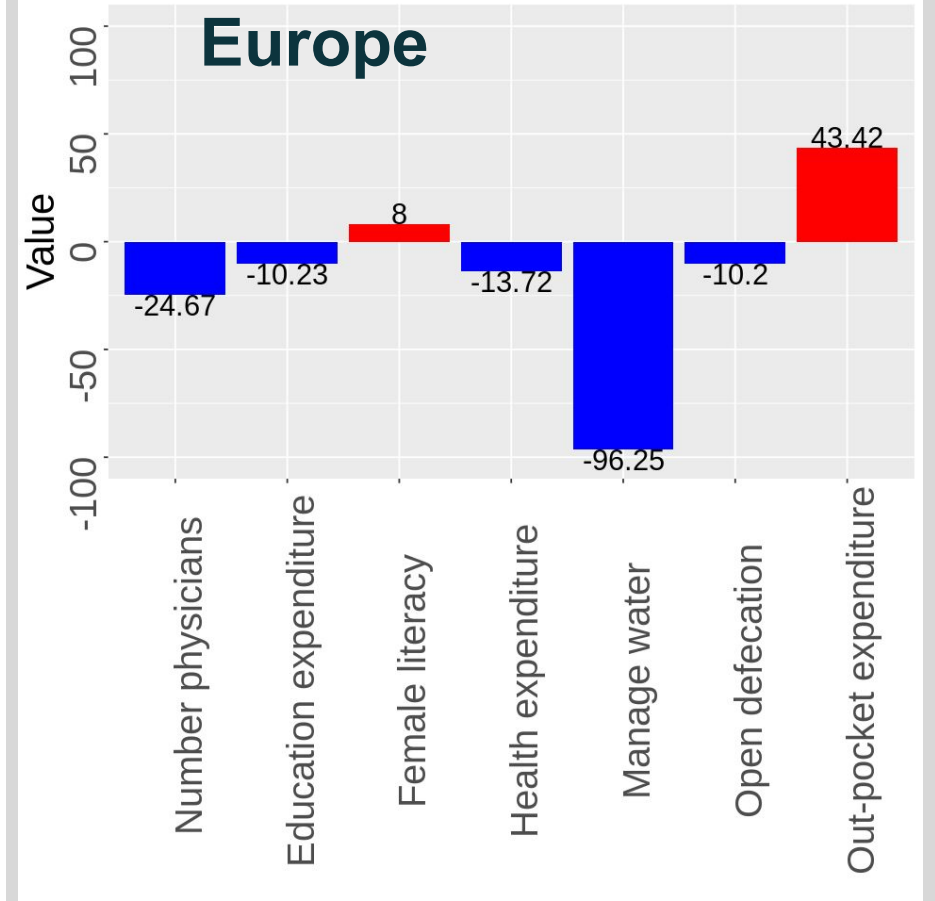
RMSE: 16.30

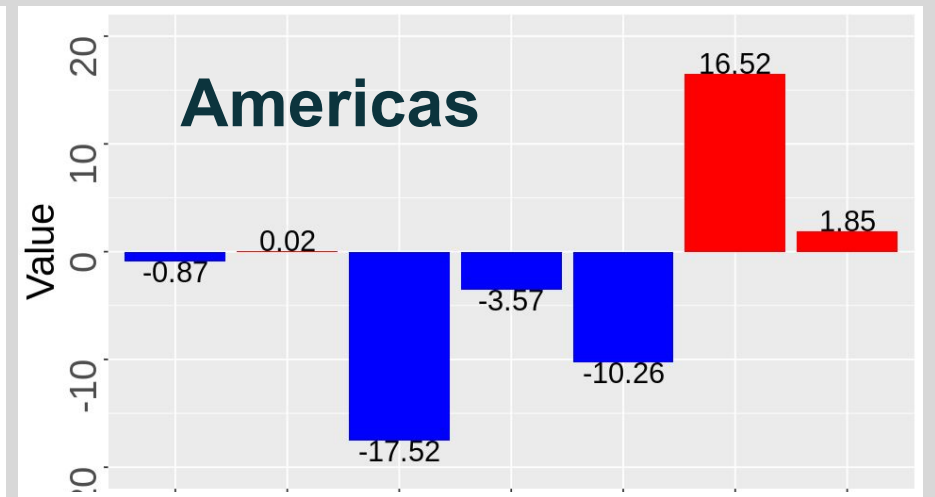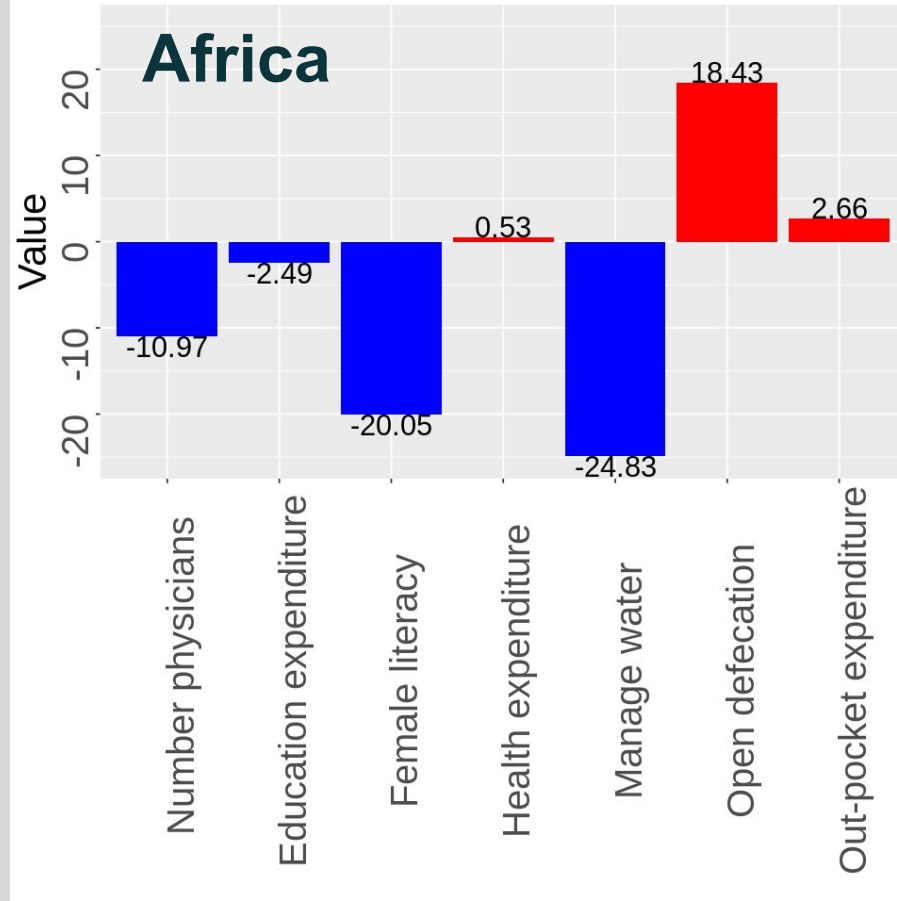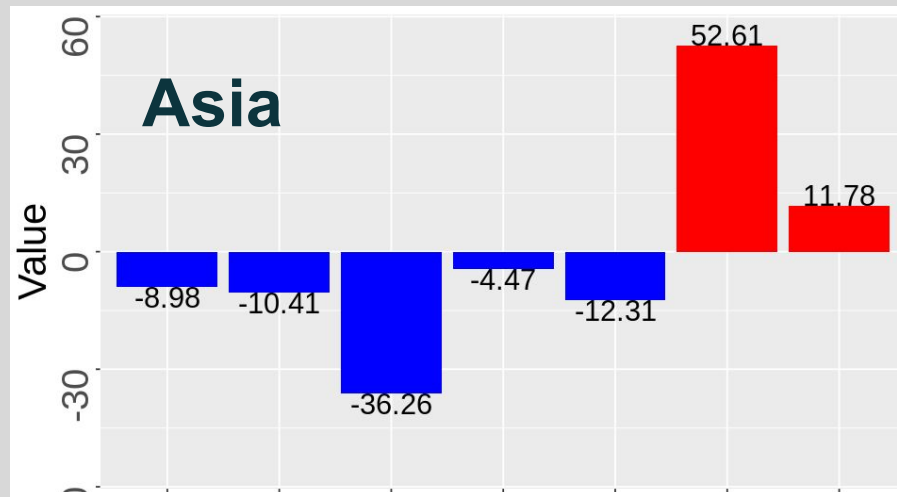## Support Vector Regressor

RMSE: 16.16

Results by Methods

Random Forest

Comparison of Continents

Summary

- Influence of different factors on child mortality rate **varies** in different continents.
- Mortality rate under five years old is strongly (positively) correlated with **literacy rate** of adult females.
- Mortality rate under five years old is highly negatively affected by **open defecation**.
- Since healthcare is privatized, largely over the continents, the analysis suggests that **investment in education** (to increasing awareness) can help curb mortality rate better as compared to direct **investment in the healthcare**.
- Given the data and the results from the findings, appropriate **nutrition** and **access to clean water** are also pivotal factors affecting the mortality rate in certain continents.
- Child mortality is a vital indicator of child health and overall national development. Our analysis suggests that **educational programs** and **public health interventions** focused on birth spacing may turn out to be the most effective.

Thank you!