**Table 1: Factors associated with COVID-19 deaths using NB regression model (key variables)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Variables** | **Estimate** | **IRR** | **95% CI** | **P-value** |
| Malaria Cases/M | -0.25 | 0.78 | 0.60 – 1.13 | 0.168 |
| The percentage of people aged 65 and above | 0.18 | 1.20 | 1.02 - 1.42 | 0.008\*\* |
| Total test/M | -0.07 | 0.93 | 0.38 – 2.54 | 0.866 |

*Note. IRR = incidence rate ratios; CI = confidence interval.*

*\*p < 0.1. \*\*p < .05. \*\*\*p < .01.*

|  |  |
| --- | --- |
|  | **VIF** |
| Malaria Cases/M | 1.38 |
| The percentage of people aged 65 and above | 2.59 |
| Total test/M | 1.79 |
| Vaccination/100 | 2.48 |
| GHSI | 2.35 |
| Obesity (%) | 1.98 |
| GDP | 2.18 |
| Population density | 1.25 |
| Stringency index | 1.11 |
| Longitude | 1.48 |
| Latitude | 1.81 |

* *Removed* ***WGI*** *for higher VIF*

**Table 2: Factors associated with COVID-19 deaths using NB regression model (All variables)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Variables** | **IRR** | **95% CI** | **P-value** |
| Malaria Cases/M | 0.83 | 0.74 – 0.96 | 0.007 \*\* |
| The percentage of people aged 65 and above | 1.07 | 1.02 - 1.12 | 0.002 \*\* |
| Total test/M | 0.96 | 0.86 – 1.09 | 0.400 |
| Vaccination/100 | 0.99 | 0.99 - 1.01 | 0.449 |
| GHSI | 1.01 | 0.98 - 1.03 | 0.670 |
| Obesity (%) | 1.06 | 1.02 - 1.10 | <0.001 \*\*\* |
| GDP | 0.99 | 0.99 – 1.00 | 0.393 |
| Population density | 0.99 | 0.99 – 1.00 | 0.521 |
| Stringency index | 1.01 | 0.99 – 1.02 | 0.134 |
| Longitude | 0.99 | 0.98 – 0.99 | 0.022\* |
| Latitude | 0.99 | 0.99 – 1.00 | 0.422 |

*Note. IRR = incidence rate ratios; CI = confidence interval.*

*\*p < 0.1. \*\*p < .05. \*\*\*p < .01.*

> #All variables

> model.3nb <- glm.nb(fdata$total\_deaths\_per\_million ~ fdata$Case\_Value\_m

+ +fdata$aged\_65\_older

+ + fdata$total\_tests\_per\_thousand\_m

+ + fdata$total\_vaccinations\_per\_hundred

+ + fdata$GHSI

+ + fdata$Obesity\_rate

+ + fdata$GDP

+ + fdata$population\_density

+ + fdata$stringency\_index

+ + fdata$longitude

+ + fdata$latitude

+ ,data = fdata)

There were 50 or more warnings (use warnings() to see the first 50)

> vif(model.3nb)

fdata$Case\_Value\_m fdata$aged\_65\_older

1.379119 2.593958

fdata$total\_tests\_per\_thousand\_m fdata$total\_vaccinations\_per\_hundred

1.791882 2.480571

fdata$GHSI fdata$Obesity\_rate

2.345954 1.975445

fdata$GDP fdata$population\_density

2.182074 1.251506

fdata$stringency\_index fdata$longitude

1.110626 1.479150

fdata$latitude

1.812929

> summary(model.3nb)

Call:

glm.nb(formula = fdata$total\_deaths\_per\_million ~ fdata$Case\_Value\_m +

fdata$aged\_65\_older + fdata$total\_tests\_per\_thousand\_m +

fdata$total\_vaccinations\_per\_hundred + fdata$GHSI + fdata$Obesity\_rate +

fdata$GDP + fdata$population\_density + fdata$stringency\_index +

fdata$longitude + fdata$latitude, data = fdata, init.theta = 1.910021487,

link = log)

Deviance Residuals:

Min 1Q Median 3Q Max

-3.3281 -0.8444 -0.1866 0.5318 2.0718

Coefficients:

Estimate Std. Error z value Pr(>|z|)

(Intercept) 4.938969672 0.542375967 9.106 < 0.0000000000000002 \*\*\*

fdata$Case\_Value\_m -0.183675618 0.068385705 -2.686 0.00723 \*\*

fdata$aged\_65\_older 0.068011122 0.021726754 3.130 0.00175 \*\*

fdata$total\_tests\_per\_thousand\_m -0.044997591 0.053513607 -0.841 0.40042

fdata$total\_vaccinations\_per\_hundred -0.001850026 0.002444289 -0.757 0.44912

fdata$GHSI 0.004714405 0.011058757 0.426 0.66989

fdata$Obesity\_rate 0.059205882 0.014965370 3.956 0.0000762 \*\*\*

fdata$GDP -0.000004764 0.000005573 -0.855 0.39264

fdata$population\_density -0.000065030 0.000101267 -0.642 0.52077

fdata$stringency\_index 0.009432718 0.006288365 1.500 0.13361

fdata$longitude -0.004338051 0.001899427 -2.284 0.02238 \*

fdata$latitude -0.003887220 0.004843245 -0.803 0.42220

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Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for Negative Binomial(1.91) family taken to be 1)

Null deviance: 139.826 on 61 degrees of freedom

Residual deviance: 67.538 on 50 degrees of freedom

(103 observations deleted due to missingness)

AIC: 986.41

Number of Fisher Scoring iterations: 1

Theta: 1.910

Std. Err.: 0.322

2 x log-likelihood: -960.411

> exp(model.3nb$coefficients)

(Intercept) fdata$Case\_Value\_m

139.6263145 0.8322057

fdata$aged\_65\_older fdata$total\_tests\_per\_thousand\_m

1.0703772 0.9559998

fdata$total\_vaccinations\_per\_hundred fdata$GHSI

0.9981517 1.0047255

fdata$Obesity\_rate fdata$GDP

1.0609937 0.9999952

fdata$population\_density fdata$stringency\_index

0.9999350 1.0094773

fdata$longitude fdata$latitude

0.9956713 0.9961203

> exp(confint(model.3nb))

Waiting for profiling to be done...

2.5 % 97.5 %

(Intercept) 44.0680255 467.1099354

fdata$Case\_Value\_m 0.7419432 0.9592079

fdata$aged\_65\_older 1.0225466 1.1214427

fdata$total\_tests\_per\_thousand\_m 0.8615282 1.0879235

fdata$total\_vaccinations\_per\_hundred 0.9932258 1.0030418

fdata$GHSI 0.9816903 1.0280004

fdata$Obesity\_rate 1.0235726 1.1011064

fdata$GDP 0.9999859 1.0000056

fdata$population\_density 0.9997555 1.0001735

fdata$stringency\_index 0.9965390 1.0226870

fdata$longitude 0.9911381 1.0001895

fdata$latitude 0.9843920 1.0071369

Table 1: Correlation coefficient of Malaria cases/M, Malaria deaths/M, COVID-19 cases/M and COVID-19 deaths/M, respectively

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Malaria Cases/M | Malaria Deaths/M | COVID-19 cases/M | COVID-19 Deaths/M |
| Malaria Cases/M | 1 | 0.59\* | -0.28\* | -0.25\* |
| Malaria Deaths/M | 0.59\* | 1 | -0.28\*\* | -0.24\*\* |
| COVID-19 cases/M | -0.28\* | -0.28\*\* | 1 | 0.67\* |
| COVID-19 Deaths/M | -0.25\*\* | -0.24\*\* | 0.67\* | 1 |

\*Significant P<0.001, \*\* Significant P<0.01

Figure 1: Map for total Covid-19 cases as of 5th January 2022 vs Malaria cases of 2017

|  |
| --- |
| Malaria Case Vs COVID-19 Case |
| Map |
| Malaria Deaths Vs COVID-19 Cases |
| E:\ResearchProject\Jamal Sir\COVID_Malaria\MapMDeathCcase.tiff |
| Malaria Deaths Vs COVID-19 Deaths |
| E:\ResearchProject\Jamal Sir\COVID_Malaria\MapDeath.tiff |
| Malaria Case Vs COVID-19 Deaths |
| E:\ResearchProject\Jamal Sir\COVID_Malaria\MapMCaseCdeath.tiff |