# Supplementary Material



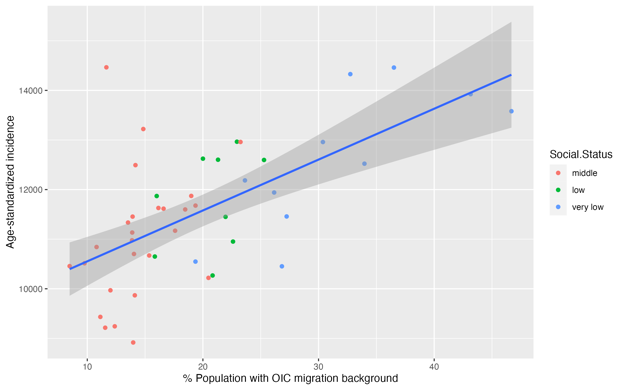
**Supplementary Figure S1.** Spatial description of selected explanatory variables.

A screenshot of a graph

Description automatically generated

**Supplementary Figure S2.** Correlation matrix of selected predictors.

Figure 8 shows the association between the age-standardized incidence (cases per 100,000 inhabitants) and the percentage of the population with an OIC migrant background across all PLRs with different social status levels. The social status level of each PLR was evaluated using the Berlin Monitoring Soziale Stadtentwicklung program (Senatsverwaltung für Stadtentwicklung und Wohnen Berlin, 2021). After the effects of the other strong predictor—age—were adjusted, an obvious correlation remained between COVID-19 incidence and the OIC migrant minority groups. We also found that the PLRs with the lowest social status were more likely to have a higher proportion of OIC



**Figure S3.** Age-standardized incidence (cases per 100,000 inhabitants) for the all- periods versus the percentage of the population with OIC migrant backgrounds (RR:1.009, 95% CI [1.002,1.012]). PLRs are categorized by social status level, according to the Monitoring Soziale Stadtentwicklung 2021(Senatsverwaltung für Stadtentwicklung und Wohnen Berlin, 2021). The social status levels ranged from middle to very low, with the high social status absent from the PLRs in Neukölln.

**Table S1.** Posterior estimates for the RR (95% CI) of the model including all pandemic periods from the final global model. Only the significant predictors are shown.

| **Variables** | **All-period** | **Wave1** | **Summer1** | **Wave2** | **Wave3** | **Summer2** | **Wave4** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| (Intercept) | 10.32 | 5.387 | 5.612 | 8.245 | 7.558 | 5.181 | 8.477 |
|  | [10.305, 10.330] | [-5.059, -4.835] | [5.471, 5.740] | [8.209, 8.278] | [7.512, 7.604] | [5.042, 5.320] | [8.452, 8.503] |
| PCT\_65 | 0.938 |  | 0.746 |  | 0.920 | 0.732 |  |
|  | [0.916, 0.961] |  | [0.526, 0.965] |  | [0.864, 0.976] | [0.597, 0.867] |  |
| PCT\_15 | 1.029 |  |  | 1.059 |  |  |  |
|  | [1.013, 1.045] |  |  | [1.020, 1.098] |  |  |  |
| PCT\_POP\_MB | 1.029 |  | 1.270 | 1.086 |  |  | 1.127 |
|  | [1.006 , 1.053] |  | [1.046, 1.270] | [1.020, 1.140] |  |  | [1.098, 1.156] |
| PCT\_Beneficiaries |  |  |  |  | 1.105 |  |  |
|  |  |  |  |  | [1.052, 1.159] |  |  |
| mean\_dist\_greenspace |  | 0.864 |  |  |  |  |  |
|  |  | [0.747, 0.980] |  |  |  |  |  |
| mean\_dist\_transport | 1.025 |  | 0.779 |  |  |  |  |
|  | [1.011, 1.039] |  | [0.627, 0.932] |  |  |  |  |
| noise\_mean | 0.970 |  |  |  |  |  | 0.968 |
|  | [0.956, 0.984] |  |  |  |  |  | [0.941, 0.995] |
| mean\_hotdays |  |  |  |  |  |  | 1.042 |
|  |  |  |  |  |  |  | [1.016, 1.069] |
| share\_ph | 1.033 |  |  |  |  |  |  |
|  | [1.018 , 1.047] |  |  |  |  |  |  |
| Effective number of parameters | 10.64 | 2.97 | 4.92 | 4.55 | 4.24 | 2.93 | 5.98 |
| DIC | 796.31 | 537.90 | 582.82 | 696.89 | 658.88 | 536.81 | 691.17 |
| All continuous predictors are mean-centered and scaled by 1 standard deviation. [ ] represents 95% credible interval. Only significant variables (95% credible interval of coefficient estimate does not overlap with zero) were remained in the model | | | | | | | |

**Table S2.** Prediction accuracies (RMSE values) of the regression models’ estimates

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **RMSE** | **Fixed** | **Random** | **BYM** | **MLE** | | **RF** |
| All-periods model | 1,457 | 1,479 | 1,376 | | 1,484 | 1,738 |
| Wave 1 | 98 | 92 | 84 | | 99 | 114 |
| Summer 1 | 136 | 127 | 121 | | 133 | 141 |
| Wave 2 | 440 | 449 | 438 | | 443 | 460 |
| Wave 3 | 255 | 251 | 248 | | 260 | 269 |
| Summer 2 | 93 | 91 | 90 | | 94 | 120 |
| Wave 4 | 433 | 413 | 395 | | 438 | 427 |

MLE: a maximum-likelihood generalized linear model; RF: a random forest machine-learning model