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| --- |
| **TableS1. The correlation matrix of 12 metal(loid)s in whole blood of COVID-19 patients.** |
|  | **Mg** |  |  |  |  |  |  |  |  |  |  |
| **Ca** | -0.21  |  |  |  |  |  |  |  |  |  |  |
|  | 0.0002  | **Ca** |  |  |  |  |  |  |
| **Cr** | -0.06  | 0.30  |  |  |  | 　 | < -0.4 | 　 | 0 ~ 0.2 |  |  |
|  | 0.3173  | <0.0001 | **Cr** |  |  | 　 | -0.4 ~ -0.2 | 　 | 0.2 ~ 0.4 |  |  |
| **Mn** | 0.32  | -0.25  | -0.15  |  |  | 　 | -0.2 ~ 0 | 　 | 0.4 ~ 0.6 |  |  |
|  | <0.0001 | <0.0001 | 0.0081  | **Mn** |  |  |  | 　 | > 0.6 |  |  |
| **Fe** | 0.55  | -0.59  | -0.35  | 0.51  |  |  |  |  |  |  |  |
|  | <0.0001 | <0.0001 | <0.0001 | <0.0001 | **Fe** |  |  |  |  |  |  |
| **Cu** | -0.06  | 0.35  | 0.19  | -0.08  | -0.22  |  |  |  |  |  |  |
|  | 0.3194  | <0.0001 | 0.0007  | 0.1811  | 0.0001  | **Cu** |  |  |  |  |  |
| **Zn** | 0.36  | -0.52  | -0.09  | 0.32  | 0.64  | -0.08  |  |  |  |  |  |
|  | <0.0001 | <0.0001 | 0.1304  | <0.0001 | <0.0001 | 0.1432  | **Zn** |  |  |  |  |
| **As** | 0.24  | -0.30  | -0.30  | 0.37  | 0.50  | -0.20  | 0.30  |  |  |  |  |
|  | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | 0.0003  | <0.0001 | **As** |  |  |  |
| **Cd** | -0.09  | -0.01  | -0.05  | 0.13  | 0.01  | 0.11  | 0.08  | 0.01  |  |  |  |
|  | 0.1312  | 0.8109  | 0.4083  | 0.0230  | 0.8718  | 0.0600  | 0.1757  | 0.9105  | **Cd** |  |  |
| **Hg** | 0.15  | -0.22  | -0.05  | 0.19  | 0.31  | 0.00  | 0.27  | 0.23  | -0.04  |  |  |
|  | 0.0071  | 0.0002  | 0.3820  | 0.0010  | <0.0001 | 0.9753  | <0.0001 | <0.0001 | 0.4855  | **Hg** |  |
| **Tl** | 0.01  | -0.14  | -0.21  | 0.18  | 0.27  | -0.06  | 0.12  | 0.43  | 0.10  | 0.12  |  |
|  | 0.8112  | 0.0159  | 0.0002  | 0.0018  | <0.0001 | 0.3329  | 0.0397  | <0.0001 | 0.0741  | 0.0386  | **Tl** |
| **Pb** | 0.22  | -0.15  | -0.14  | 0.17  | 0.32  | 0.13  | 0.26  | 0.21  | 0.32  | 0.09  | 0.12  |
|  | 0.0001  | 0.0083  | 0.0131  | 0.0031  | <0.0001 | 0.0195  | <0.0001 | 0.0002  | <0.0001 | 0.1278  | 0.0415  |
|  |  |  |  |  |  |  |  |  |  |  |  |
| **Notes:** correlation coefficients (CC, above) and p values (below). Abbreviations: Mg, magnesium; Ca, calcium; Cr, chromium; Mn, manganese; Fe, iron; Cu, copper; Zn, Zinc; As, arsenic; Cd, cadmium; Hg, mercury; Tl, thallium; Pb, lead. |

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| --- | --- | --- | --- |
| **Table S2. The Cut-off points of laboratory findings in COVID-19 patients by applying ROC** |  |  |  |
| Parameter | Disease status | 　 | Outcome |
| Cut-off | Sensitivity | Specificity | AUC (95% CI) | *P* | 　 | Cut-off | Sensitivity | Specificity | AUC (95% CI) | *P* |
| Mg | 40.52  | 0.45  | 0.78  | 0.61 (0.54 - 0.67) | **0.002**  |  | 35.95  | 0.87  | 0.33  | 0.53 (0.39 - 0.68) | 0.681  |
| Ca | 68.00  | 0.53  | 0.80  | 0.66 (0.59 - 0.72) | **< 0.001** |  | 62.91  | 0.73  | 0.47  | 0.56 (0.37 - 0.74) | 0.491  |
| Cr | 1.03  | 0.51  | 0.82  | 0.68 (0.62 - 0.74) | **< 0.001** |  | 1.32  | 0.67  | 0.83  | 0.77 (0.64 - 0.9) | **0.001**  |
| Mn | 10.98  | 0.72  | 0.58  | 0.68 (0.61 - 0.74) | **< 0.001** |  | 10.90  | 0.48  | 0.67  | 0.53 (0.38 - 0.69) | 0.687  |
| Fe | 376.67  | 0.81  | 0.55  | 0.73 (0.67 - 0.79) | **< 0.001** |  | 343.25  | 0.69  | 0.53  | 0.56 (0.39 - 0.74) | 0.424  |
| Cu | 823.98  | 0.78  | 0.47  | 0.65 (0.59 - 0.72) | **< 0.001** |  | 1090.65  | 0.40  | 0.81  | 0.57 (0.4 - 0.74) | 0.392  |
| Zn | 6.54  | 0.53  | 0.67  | 0.61 (0.55 - 0.68) | **0.001**  |  | 5.46  | 1.00  | 0.22  | 0.55 (0.41 - 0.7) | 0.508  |
| As | 1.24  | 0.76  | 0.63  | 0.74 (0.68 - 0.8) | **< 0.001** |  | 0.96  | 0.70  | 0.80  | 0.75 (0.61 - 0.89) | **0.002**  |
| Cd | 0.61  | 0.65  | 0.42  | 0.52 (0.45 - 0.58) | 0.654  |  | 0.68  | 0.93  | 0.55  | 0.75 (0.63 - 0.87) | **0.002**  |
| Hg | 1.70  | 0.50  | 0.64  | 0.55 (0.48 - 0.62) | 0.122  |  | 1.62  | 0.60  | 0.64  | 0.61 (0.43 - 0.78) | 0.194  |
| Tl | 0.05  | 0.52  | 0.82  | 0.67 (0.61 - 0.73) | **< 0.001** |  | 0.06  | 0.15  | 0.93  | 0.53 (0.38 - 0.68) | 0.708  |
| Pb | 11.24  | 0.59  | 0.61  | 0.59 (0.52 - 0.66) | **0.012**  | 　 | 7.21  | 0.92  | 0.40  | 0.54 (0.33 - 0.74) | 0.647  |
|  |  |  |  |  |  |  |  |  |  |  |  |
| Abbreviations: Mg, magnesium; Ca, calcium; Cr, chromium; Mn, manganese; Fe, iron; Cu, copper; Zn, Zinc; As, arsenic; Cd, cadmium; Hg, mercury; Tl, thallium; Pb, lead. |

**Supplementary Figures**

**Figure S1. Whole blood levels of 12 metal(loid)s in 306 COVID-19 patients between non-severe and severe group.** Difference between non-severe and severe group were tested by using Mann-Whitney U test. Data are shown as median and interquartile range and were tested for significance at \* *p* < 0.05. Gray dotted line and dashed line represented normal lower and upper limit, respectively. Abbreviations: Mg, magnesium; Ca, calcium; Cr, chromium; Mn, manganese; Fe, iron; Cu, copper; Zn, zinc; As, arsenic; Cd, cadmium; Hg, mercury; Tl, thallium; Pb, lead.

**Figure S2. Whole blood levels of 12 metal(loid)s in the severe patients with COVID-19 between deceased and recovered group.** Difference between deceased and recovered group were tested by using Mann-Whitney U test. Data are shown as median and interquartile range and were tested for significance at \* *p* < 0.05. Gray dotted line and dashed line represented normal lower and upper limit, respectively. Abbreviations: Mg, magnesium; Ca, calcium; Cr, chromium; Mn, manganese; Fe, iron; Cu, copper; Zn, zinc; As, arsenic; Cd, cadmium; Hg, mercury; Tl, thallium; Pb, lead.

**Figure S1**



**Figure S2**

