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How Epidemic Emergency affects Health Resource Allocation: An Example of Covid-19 In Guangdong, China

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There is significant differences in health-resource allocation, utilisation, and annual change in utilisation in 2020 compared with 2019, whilst the health-resource utilisation clearly decreased under COVID-19. Building health management networks and standardizing the "medical + Internet" model are necessary to allocate health resources scientifically and dynamically





Figure 1 Violin plot of factors on health resource allocation and utilisation in Guangdong Province from 2017 to 2020.



**Figure 2** Violin plot and percentage accumulation bar chart of various indicators related to health resource allocation and utilisation in Guangdong Province from 2017 to 2020.

The per capita GDP, population density, natural growth rate, whether 2020, COVID-19 level, proportion of expenditure on public health and resident population would influence health-resource allocation and utilization, thus resulting in a change in inequality indices, particularly from 2019 to 2020. Further government intervention and direct government regulation are required to promote the equitable operation of health-resource markets and improve the efficient use of health resources by the general public.

Figure 3 Violin plot of comprehensive health indicators in Guangdong Province from 2017 to 2020.

The health-resource-utilisation inequality indices and the majority of inequality indices of annual change in health-resource allocation were the lowest in 2020, with the former clearly decreasing compared with 2019, but the health-resource-allocation inequality indices were the highest. Consequently, we need a flexible public health emergency warning and response system to prepare for public health emergencies.

Table 3: The RIF-I-OLS analytical results of influencing factors of the HRS and HRUS's inequality indices from 2018 to 2020 (β-Value)

|                                                                                                                                        | From 2019        | 9 to 2020:        |                |                 | From 2018 to 2019: |                   |                |                 |  |  |
|----------------------------------------------------------------------------------------------------------------------------------------|------------------|-------------------|----------------|-----------------|--------------------|-------------------|----------------|-----------------|--|--|
| HRS                                                                                                                                    | Model1<br>(Gini) | Model2(<br>AGini) | Model<br>3(CI) | Model<br>4(ACI) | Model1(<br>Gini)   | Model2(A<br>Gini) | Model3(<br>CI) | Model4<br>(ACI) |  |  |
| The proportion of expenditure on public health (%)                                                                                     | 0.445            | 19.193            | -2.147         | 9.243           | 0.589              | 10.736            | 2.288          | 10.572          |  |  |
| •••                                                                                                                                    |                  |                   |                |                 |                    |                   |                |                 |  |  |
| COVID-19 level                                                                                                                         | -0.036           | -0.083a           | -0.042         | -0.068a         | 0                  | 0                 | 0              | 0               |  |  |
| Note: a $P < 0.1$ b $P < 0.05$ c $P < 0.01$ d $P < 0.001$ . More details about the related results from 2017 to 2018 would be found in |                  |                   |                |                 |                    |                   |                |                 |  |  |

Note: a P<0.1, b P< 0.05, c P< 0.01, d P< 0.001; More details about the related results from 2017 to 2018 would be found in supplemental Table 4.

Table 4: The RIF-I-OLS analytical results of influencing factors of the HRSC and HRUSC's inequality indices from 2018 to 2020 (β-Value)

|                                                    | From 2019 to 2020: |                    |                    |                     | From 2018 to 2019: |                   |                |                 |  |
|----------------------------------------------------|--------------------|--------------------|--------------------|---------------------|--------------------|-------------------|----------------|-----------------|--|
| HRSC                                               | Model1<br>(Gini)   | Model2(<br>AGini)  | Model3(<br>CI)     | Model4(<br>ACI)     | Model1(G<br>ini)   | Model2(A<br>Gini) | Model3(<br>CI) | Model4(<br>ACI) |  |
| The proportion of expenditure on public health (%) | -8.844             | 44.188             | 17.651             | 44.277              | 1205.17            | -6.127            | 235.08         | 0.069           |  |
| •••                                                |                    |                    |                    |                     |                    |                   |                |                 |  |
| COVID-19 level                                     | -0.046             | 0.096 <sup>d</sup> | 0.176 <sup>b</sup> | -0.057 <sup>b</sup> | 0                  | 0                 | 0              | 0               |  |
| Constant term                                      | -1.436°            | -0.321b            | -1.877°            | 0.578°              | -94.996            | -0.45             | 1.969          | 0.208           |  |
| Note: a P<0.1, b P< 0.05, c P< 0.01, d P< 0.001.   |                    |                    |                    |                     |                    |                   |                |                 |  |



CONCLUSION

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The use of health resources was higher in regions with higher economic development than in regions with lower economic development, but it tended to be consistent in each region year after year,



particularly under COVID-19. The COVID-19 pandemic increased the degree of inequality in healthresource allocation, whilst simultaneously decreasing the inequality of annual change in healthresource utilisation. Decision-makers must adjust health resource allocation flexibly in response to the development trend of public health emergencies by utilizing emerging technologies.

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Pearl River Delta region Eastern Guangdong region Western Guangdong region