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Efficient Method for COVID-19 Vaccine Allocation

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Abstract:

The number of deaths from COVID-190 is still increasing (WHO, 2022). The fastest way to form herd immunity is to provide a balanced supply of vaccines. To this end, vaccine supply should be made in considering the number of consumers. This study attempted to present the most efficient vaccine supply method and designated areas for Seoul vaccination hospitals.

First, by setting hospital doctors and population as suppliers and consumers, respectively, we tried to set the vaccine supply amount for each hospital according to the number of consumers so that vaccinations can be performed in the shortest period of time. To this end, the vaccination service area for each hospital was established to enable vaccination in the shortest time by applying the shortest distance and least cost allocation technique from individual consumers' residences to vaccination hospitals (Dijkstra, 1959; Boeing, 2017). Based on this, the daily vaccine demand for each hospital was calculated to be used in the vaccine supply plan.

Second, if an additional vaccination hospital can be designated, the vaccination period can be reduced, so we tried to analyze the accessibility of vaccination by administrative dong to determine which region should be designated additionally. As an analysis of vaccination accessibility, the 2SFCA technique was used to derive and compare vaccine accessibility by administrative district as an index (Luo and Wang, 2003).

The analysis results are as follows. First, in the analysis of the shortest distance and least cost with hospitals for each building to carry out vaccine supply in the shortest period of time, it was confirmed that vaccination could be completed faster when the least cost method was applied. Based on this, it was possible to set the number of daily vaccine distributions per hospital and the vaccination area for each hospital. Second, through accessibility analysis, areas with high and low accessibility to vaccination hospitals were identified. Through this, priorities for each administrative district for the additional designation of vaccination hospitals were derived.

The results of this study are expected to help establish an efficient vaccine distribution plan so that herd immunity can be formed in a short period of time through vaccination and establish a plan for designating and securing vaccination hospitals.

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