The Study of Vaccination Priority in Thailand: An GWR Analysis

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ABSTRACT

The study, titled The study of VACCINATION PRIORITY in Thailand: An GWR Analysis, aimed to study the distribution of COVID-19 vaccine in Thailand by using data from Mahidol University's vaccine transport tracking system to analyze the spatial correlation of distribution of COVID-19 vaccine and covid-19 outbreak coefficient using geospatial programs. The results showed that the allocation of the COVID-19 vaccine in Thailand was reasonably distributed across areas with a high cumulative population, with a correlation coefficient of 79.03%. However, the central region in the provinces surrounding Bangkok and the eastern region are allocated relatively large compared to the remote areas.

1. INTRODUCTION

When the supply of vaccines for COVID-19 in the early stages of vaccine development success is limited. This raises the question of how countries should prioritize distribution of available vaccines. It is also necessary to act transparently and based on evidence of incidences related to knowledge and uncertainty of the epidemic, risk profiles, vaccine efficacy, and immunizations. The nature of the population exists to exemplify the priority allocation of vaccines. Bubar et al. (2020) studied and presented a model for vaccine distribution priorities. They assessed the impact of the established strategies, in order of importance, on cumulative epidemic incidence and mortality. Demographic factors such as age, exposure, and prevalence of contagious immunity were considered. Regarding vaccine factors, including imperfections of vaccine availability and efficacy caused by age differences.

A study by Bubar et al. (2020) found that epidemic vaccines should be given priority to adults aged 20-49 in order to reduce the cumulative incidence of epidemic and adult populations over 60 in order to reduce the death rate from infection of the epidemic. Examples of priorities were drawn from studies in the People's Republic of China, South Korea, Italy and the United States. In the People's Republic of China, vaccines are provided to essential workers, including health, law enforcement, safety, nursing homes, social welfare institutions, community services, energy, food and transportation, and employees/. International students (49.7 million). This information can be prioritized for vaccination to maintain essential services in the early stages of the vaccination program. Later, the elderly, people with underlying health conditions, and pregnant women (563.6 million) may be vaccinated to reduce the number of severe cases of COVID-19. This includes hospitalizations, intensive care, and death. Lately, the vaccination program could be extended to target adults without health conditions and children (784.8 million) to reduce symptomatic infection and/or stop the spread of the virus when given 10 million doses per day. The two-dose vaccination schedule will take 1 week to inoculate the necessary practitioners but will likely take up to 7 months to vaccinate 70% of the population.

In South Korea, effective vaccination strategies have been developed that will reduce the number of deaths and the incidence of infection. One characteristic of COVID-19 is that symptoms, severity, and mortality vary with age. When vaccination is limited, an age-based vaccination prioritization strategy should be used to reduce the incidence of epidemics and public mortality. Choi et al. (2021) developed an age-structured model to describe the dynamics of COVID-19 transmission, including vaccination. Using models and actual epidemiological data in Korea, infection probabilities were assessed for each age group under different levels of social distancing in Korea. and examine effective age-based vaccination strategies to reduce the number of confirmed cases and deaths from COVID-19. The study found that in areas with low levels of social distancing, vaccination was prioritized for the age group with the highest transmission rates to largely reduce the incidence. But in areas where social distancing is high, vaccination is prioritized for older age groups to reduce infection and reduce mortality. Vaccination for the elderly is the best strategy in all situations of social distancing that affects vaccine allocation and its effectiveness on reducing disease incidence and mortality.

In Italy, an automated decision-making system (ADM) has been introduced to determine the priorities of COVID-19 vaccination both by the Italian Federation of General Practitioners and by regional authorities in Lombardy, Valle d'Aosta, and Piedmont. The ADM system analyzed to find the right solution and found that all systems share a common ground. That is to maximize the efficiency of vaccine distribution. While the priority was given to the elderly and those at high risk due to co-morbidities, in which patients had more than one health condition and individualized overall medical history. Italy is not the only country where vaccine prioritization algorithms have been adopted, for example the "QCovid" algorithm deployed in the UK. This has led to inflated risk score claims due to missing data and general doubts about its reliability in the scientific community. Similar issues have been highlighted in Bavaria, Germany and in the United States.

In the United States, a dynamic model of transmission has been created using a parametric segmented model to capture current understanding of the epidemiological nature of COVID-19. This includes the main source of group differences. (sensitivity, severity, and contagion rate). It examines three alternative policy objectives: reducing infection, age at death, or mortality. A dynamic strategy model that evolves with the population's epidemiological status has been modeled, finding that this time resilience is critical to public health goals. Typically older key practitioners are targeted first. However, it depends on the purpose. Younger employees are prioritized for spreading control or older workers for direct mortality control. When the goal is to reduce deaths versus non-target approaches, prioritizing prevents deaths between 20,000 (when non-drug interventions are severe) and 300,000 (when non-drug interventions are severe). these interventions are weak). Study showed that proper prioritization is susceptible to a number of factors, especially the effectiveness and supply of vaccines, transmission rates, and the size of initial infections.

This research aims to study the distribution of the COVID-19 vaccine in Thailand by analyzing the spatial correlation of the COVID-19 vaccine distribution and the coefficient showing the spread of COVID-19. using geospatial program to display the results as a spatial description on the choropleth map

2. METHODOLOGY

2.1 Data Management

This research was based on information from the website "The researcher" located at https://covid-19.researcherth.co. This website collects domestic vaccination data in daily cumulative reports since the first vaccination date. The report began on March 24, 2021, showing cumulative data by province. The data analyzed herein is the cumulative number of people vaccinated as of July 18, 2021 by categorizing the vaccinated recipients into 2 groups: the elderly and the general public, as shown in Figure 1 below.

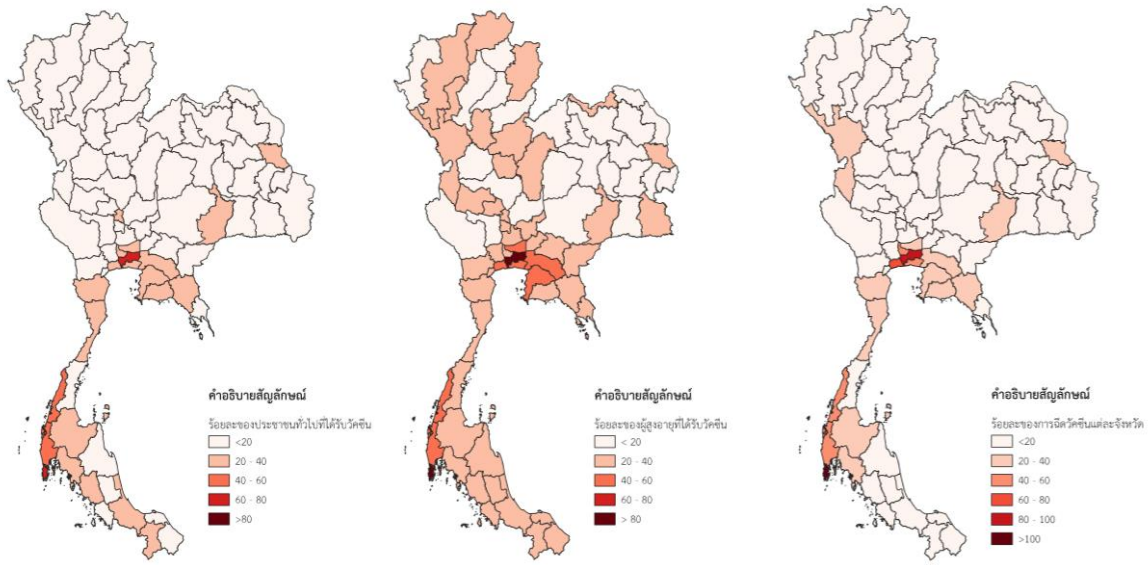

Figure 1. Vaccine distribution in different areas of Thailand

2.2 Method of Data Analysis

A spatial analysis of data to show the distribution of vaccine allocations to the entire population at risk, comprising the elderly and the general public, across all 77 provinces of the country. Descriptive statistics were used in the analysis to preliminarily show the distribution of the data. Geographically weighted regression analysis was performed on a geospatial program with Explanatory Variables and Dependent Variables by province in 77 provinces.

3. RESULT AND DISCUSSION

On average, people in each province of Thailand are vaccinated on average 18.95% of the total population. The elderly were vaccinated with an average of 27.74 percent of the entire provincial population. And the general public receives vaccination, an average of 19.21 percent of the population of the whole province with a standard deviation of 22.56, 14.17 and 12.29, respectively. The provinces with the highest proportion of vaccinated populations were Phuket and Bangkok, accounting for 174.4 percent and 87.79, while Kalasin Province Only 6.44 percent of people were vaccinated.

Table 1 .Vaccine Distribution in Thailand

	General Public	Elderly	Percentage of all vaccinated persons
AVG.	19.21428571	27.74415584	18.95
STD.	12.28845965	14.17100908	22.55581406
MAXIMUM	74.1	91.2	174.40
MINIMUM	7.9	11.3	6.44
MEDIAN	15.3	25.6	12.57
MODE	11.4	33.6	#N/A
SKEWNESS	2.79923333	2.080428963	4.968450401

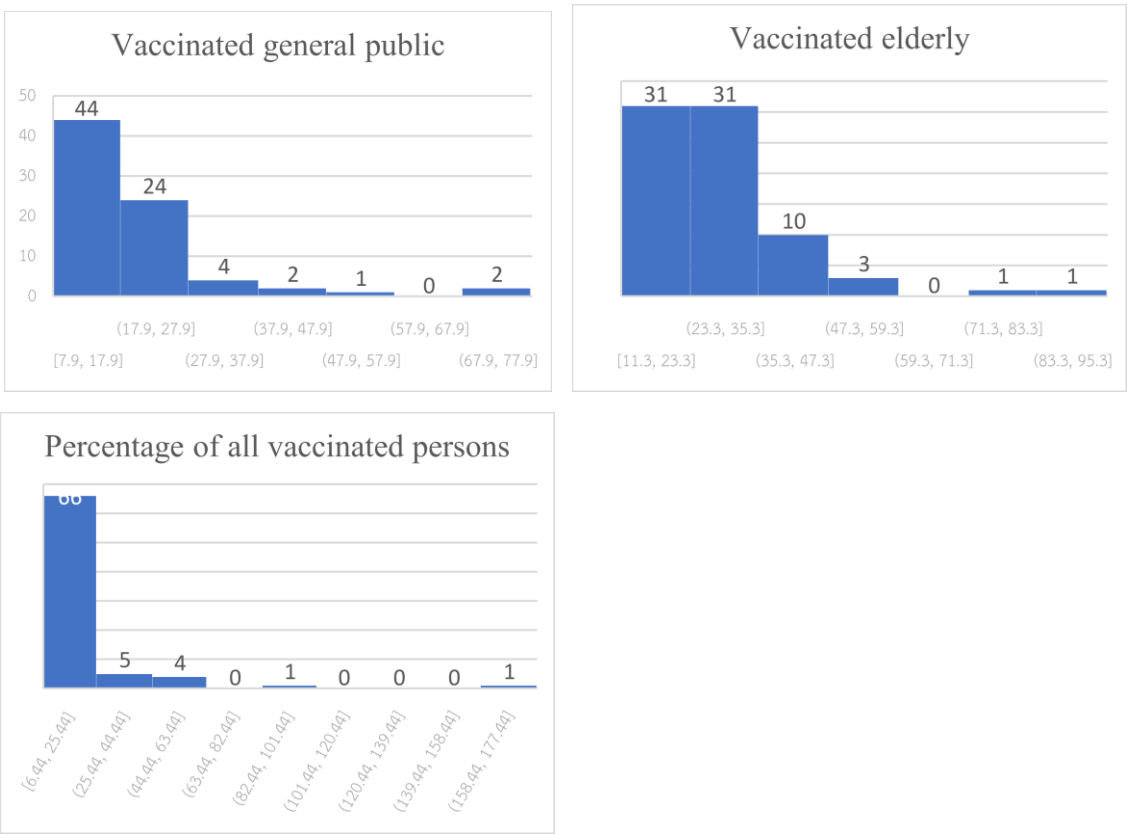

Figure 2 Vaccine distribution in Thailand

From the descriptive statistics analysis, the results are shown in Table 1 and Figure 2. It was found that skewness = 2.80, 2.08 and 4.97, respectively. In most provinces, more than 60 provinces have been allocated vaccinations to the people in the range of not more than 35%.

From the results of Geographically Weighted Regression showing the relationship of vaccination allocation in each province was found that the R2 value of 0.79 indicates that the vaccination allocation in Thailand is consistent with the area with cumulative infection among the people in that province.

Table 3. The spatial relationship model parameters.

Bandwidth	2.37
ResidualSquares	855623342.8
EffectiveNumber	11.26
Sigma	3607.67
AICc	1489.86
R2	0.79
R2Adjusted	0.75

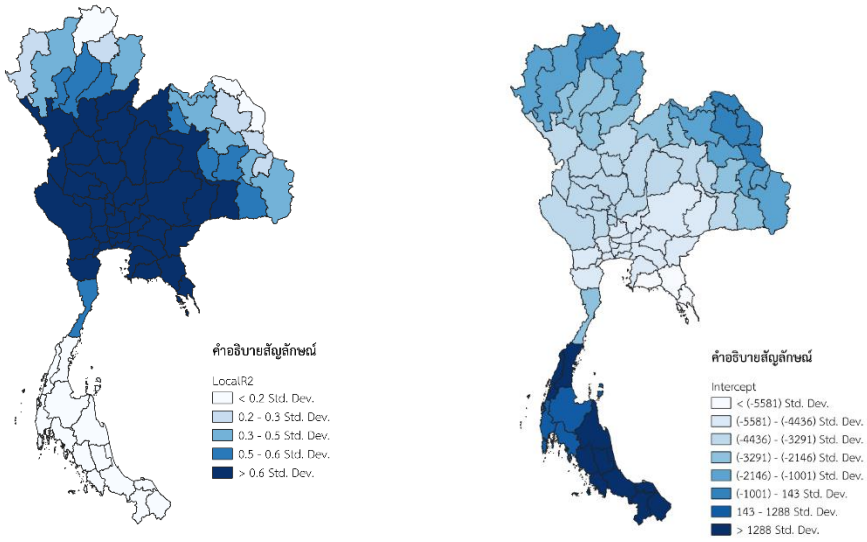

Figure 3. A map showing the spatial distribution of Explanatory variables' Influence towards Dependent variable through the two parameters: local coefficients and local intercepts.

The results of this GWR analysis were used to create a map showing the correlation coefficient of each province as shown in Figure 3. It was found that the central region, the eastern region, and some parts of the northeastern region. and the northern region was allocated an amount of vaccine that was clearly consistent with the cumulative number of infections.

4. CONCLUSION

From the descriptive statistic and GWR analysis, the allocation of the COVID-19 vaccine in Thailand spreads across areas with a reasonable cumulative number of cases, with a correlation coefficient of 79.03%. The central region in the provinces surrounding Bangkok and the eastern region received relatively large vaccination allocations compared to the remote areas.

5. REFERENCES

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