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Potential Preventive Analysis for The COVID-19 Pandemic Cases in Yogyakarta with Multiple Criteria Analysis Method

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Abstract

The spread of the COVID-19 outbreak has a significant impact on human life around the world, especially in Indonesia. Many aspects have been affected by the spread of the COVID-19 virus, such as social, cultural, and economic aspects. This research using multiple criteria analysis decision making to complete the preventive strategy of COVID-19. One method that can be used to analyze possible preventive the spread of Covid-19 is Analytic Hierarchy Process. Through this model, the preventative approach can be determined by some of the activities with the potential spreading the COVID-19 outbreak. Subsequently, each activity is given weight by AHP and analyzes the best prevention strategy by selecting activities with the highest value. Each activity has been the most significant risk factor in spreading the virus. And The contribution of this research is to obtain strategic planning for Coronavirus disaster management, especially in Yogyakarta.

Keywords: Multiple Criteria Analysis, Covid-19, Analysis Hierarchy Process, Preventive Strategy

I. INTRODUCTION

Currently, the spread of the COVID-19 outbreak has become a world problem. Since December 2019, many states have reported cases of Covid-19, which have infected residents in these countries. Since WHO has declared the Corona Covid-19 virus a pandemic, various countries made an effort to prevent the transmission of the disease, transmission through physical contact is through the mouth, eyes, and nose. The spread of the COVID-19 outbreak has a significant impact. Many aspects have been affected by the spread of the COVID-19 virus, such as social, cultural, and economic aspects impact significantly. The government took the unreadiness of the healthcare facility, and the significant steps can be the cause increase in cases pandemic COVID-19, especially in Indonesia. It is crucial to avoid an epidemic peak that potentially overwhelms healthcare service. So, it is necessary to mitigate disasters in breaking the spread of the virus COVID-19.

To prevent the spreading of the COVID-19, The central and local governments have taken several precautionary measures, such as tracing contacts, quarantining infected people, carrying out social appeals such as wearing masks, etc. (Peng and Yang, no date). Theoretical studies based on statistical analyses or mathematical modeling can also understand the characteristics of the spread of the

COVID-19 outbreak and then be used to formulate policies and rules to stop the spread of the COVID-19 outbreak. (Peng and Yang, no date). (Singh and Avikal, 2020) This researcher selected several preventive activities to be analyzed based on several studies and then evaluated the impact of these activities on the spread of the COVID-19 outbreak.

The multiple Criteria Analysis method proposed identifying some of the activities by giving weight to each activity based on the level of importance. The multicriteria method is used because it can divide a complex problem into several components needed to get the structure of the hierarchy. (Sangiorgio and Parisi, 2020). Criteria are measures or standards used in decision making (Ho, Xu and Dey, 2010). Based on Multiple Criteria Analysis can be developed decision-making approach considering the rate of some of the activities and sub-activities.

More researches in the past discuss COVID-19. The study of (Shakil *et al.*, 2020) reviewed literature regards the impact of the spread of the Covid-19 outbreak on the environment globally. (Rajkumar, 2020) has reviewed some of the literature about the effect of mental health risks of the Covid-19 virus happened in society. And then (Harapan *et al.*, 2020) also investigated a literature review of information on pathogens and the virus epidemic by considering the causative transmission COVID-19 and strategies for controlling and preventing the spread of the Covid-19 virus. (Sangiorgio and Parisi, 2020) predict the risk of transmission in urban districts to support the government in identifying the best strategy for reopening activities after lockdown conditions, taking into account the socio-economic situation taken into account in some areas.

(Huang *et al.*, 2020) the model proposed is a rush return simulation, analytical hierarchical process method, and techniques for order preference with similarities to the ideal solution method, the model used to determine when is the best time to open the lockdown status. A (Singh and Avikal, 2020) evaluated activities by giving a weight of activities in its effect on the chronology of its impact on preventing the spread of the Covid-19 and considered impact priority activities. (Singh and Avikal, 2020) has determined seven main criteria, which are considered as criteria for the prevention of the COVID-19 virus. Unfortunately, Javanese culture, through market activities with attended the traditional market and the cultural phenomena of a hand kiss can be increase infection of the COVID-19 outbreak, especially in Yogyakarta.

The cultural value system is a concept that is held as a guideline for community life and values in social life and daily life. This system is implemented as a direction for community behavior (Herliana, 2015). People go to the traditional market to have been become a culture, especially in Yogyakarta. The traditional market with economic transactions via money and goods can be trigger infection of COVID-19 and potentially be new suspect areas virus COVID-19. Furthermore, the cultural phenomena of a hand kiss that occurred toward Javanese people can occur disease of COVID-19 too. Kissing hands is also considered a demand for courtesy and respect in human relationships (Rachmadiana, 2004). Hand kissing, it's meant a movement of inhaling something (hand) with the nose or attaching the nose to the hand. This movement/activity is an expression of courtesy and respect for other people (Rachmadiana, 2004).

In this research, several important activities in the spread of the Coronavirus have been selected based on previous research. (Singh and Avikal, 2020) have been selected seven activities as main criteria and twenty-three sub-criteria. In other research (Harapan *et al.*, 2020) explained the transmission of the virus COVID-19 from the traditional market. (Herliana, 2015) have been described as cultural effects with some activities Javanese people in Yogyakarta, such as trade-in traditional markets. So,

the research adds new activities associated with culture/behavior with three sub-activities is culture tourism traditional market, Hand kissing, and Manual transactions.

This study aims to analyze the best prevention strategies to prevent the spread of the COVID-19 virus by selecting a total of eight main activities and twenty-six sub-activities that use as problem criteria. The activities can be estimating activities that can prevent infection for the COVID-19 outbreak. And The contribution of this research is to obtain strategic planning for Coronavirus disaster management with multiple criteria analysis methods. The multiple criteria analysis calculates the weight based on its impact on spreading the COVID-19 virus, especially in Yogyakarta.

II. LITERATURE REVIEW

II.1. Strategic Decision Making

In the decision-making process, internal capabilities and the external environment can influence decisions in choosing the best among possible alternative solutions (Rai, 2004). The decision-making process involves a systematic and scientific method of analyzing information to select alternative solutions (Petrou *et al.*, 2020). it is crucial because it concerns fundamental decisions; thus, the strategic decision-making approach should be considered carefully (Papulova and Gazova, 2016).

II.2. Analytic Hierarchy Process

The analytic hierarchy process manages multicriteria elements by paying attention to qualitative and quantitative information to determine alternative solutions in the decision-making process (Taherdoost, 2018). (Taherdoost, 2018) explained that the analytic hierarchy process is a system used in the decision-making process with several criteria. This method can provide hierarchical problem formulations and consider alternative solutions based on quantitative and qualitative information.

III. RESEARCH METHODOLOGY

Multi-criteria decision-making uses the Analytic Hierarchy Process (AHP) can analyze the spread of the COVID-19 virus. AHP can be used to analyze complex decision-making problems. Its purpose is to solve the problem between practical demand and decision making. There are two phases in AHP, first, compiling a hierarchy based on issues, second, determining the weight of each criterion, and then used to specify alternative priorities.

There are three main steps in the AHP method (Taherdoost, 2018):

1. Breakdown, problems are brought hierarchically into related decision elements and then determine the hierarchical structure.

2. The criteria and sub-criteria were entering into a pairwise comparison matrix, and a questionnaire was designed and distributed to several respondents. The scale in the questionnaire ranged from one to nine, where the number one indicated that the two elements were equally important. The number nine states that one element is more important than the others in the pairwise comparison matrix.

The scale of importance reflects the scale of the risk of spreading COVID-19 infection. And each scale is shown in Table 1.

Table 1. The scale for comparison pairwise matrix

Scales	Definition of Scales
1	The two elements are equally important
2	one of the elements is considered quite important
3	one priority is quite important
4	One element medium to very important
5	Very important to prioritize
6	Strongly to very strongly important
7	Very strongly to important
8	Very strongly to extremely important
9	extremely important

The evaluation requires a certain level of consistency, i.e. the element's linear independence. That can be accessed by employing the consistency index (CI). The CI can be calculated by Equation (1).

$$CI = \frac{\lambda_{max} - n}{n - 1} \quad (1)$$

Where CI is the consistency index, $_{max}$ is the maximum eigenvalue, n is the no. of criteria.

3. in order to validate the results of the AHP, the consistency ratio (CR) is calculated using the formula by Equation (2).

$$CR = \frac{CI}{RI} \quad (2)$$

Where the value of RI is related to the dimension of the matrix.

The hierarchical structure is seen in Figure 1. They are considering the importance of the role of the selected activity and sub-activity, which is then used for a person to prevent the spread of the COVID-19 virus, starting from himself. Some of these activities were selected based on previous research and the particular case of the Yogyakarta local government with its rich culture. Then from some of these activities, data was collected by surveying medical representatives and the Covid-19 Task Force to evaluate the impact of these activities on COVID-19.

IV. FINDING AND DISCUSSION

And for his study of COVID-19 preventions in Yogyakarta, from eight main activities with twenty-six sub-activities. The main activities and sub-activities have been calculated to get their risk weights and analyze each activity associated with the potential preventive strategy for the COVID-19 outbreak. And their result has been shown in Table 2.

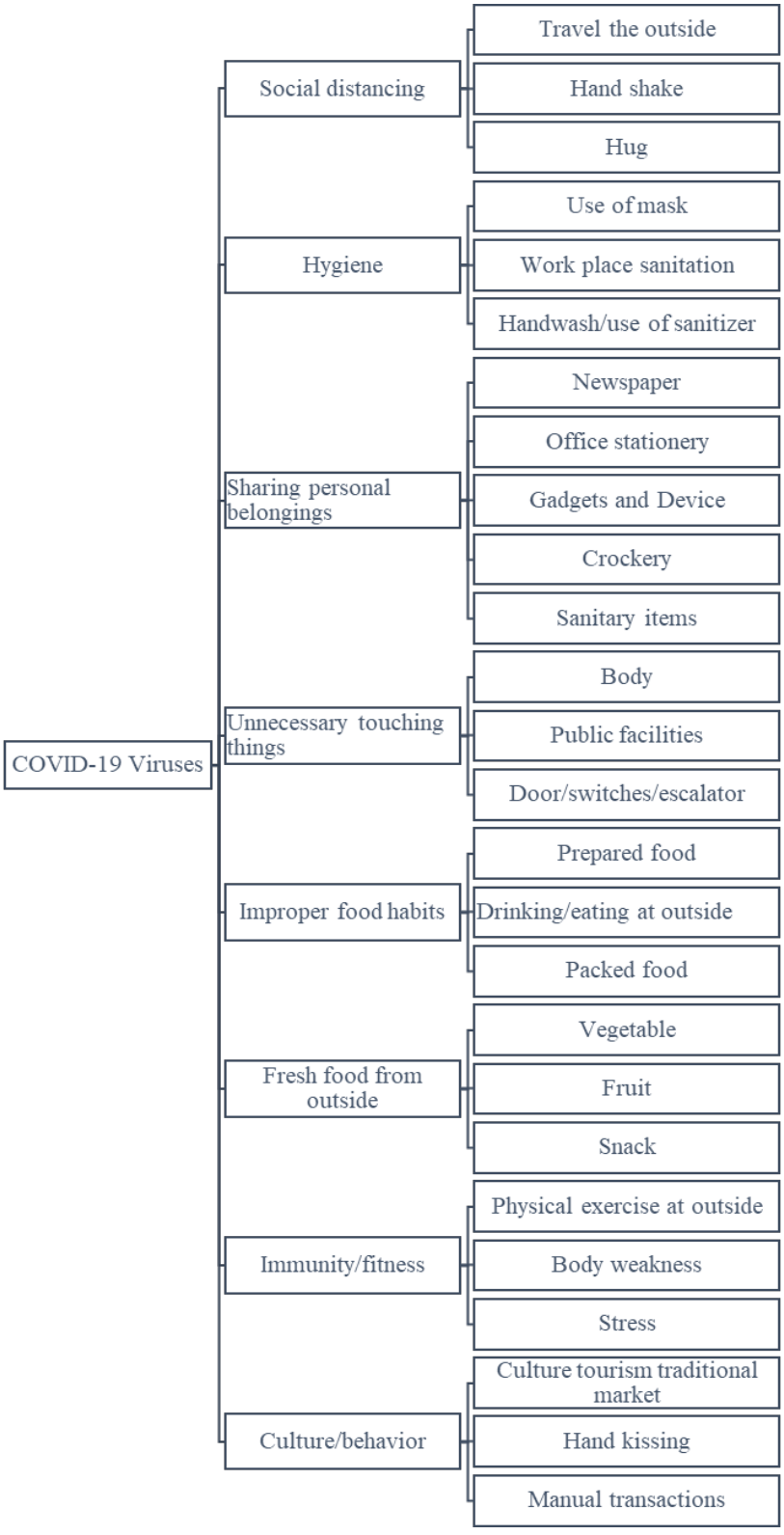

Figure 1. Structure of hierarchy of main activities and their sub-activities

Table. 2
Results of the weight of each criterion, sub-criteria, and analysis.

Activities	Sub-activities	Weights of main activities	Weights of sub-activities	Analysis
Social distancing		0.214		Social distancing is a critical factor to prevent the spread of the virus between humans.
	Travel the outside		0.639	Travel the outside can cause a person to become easily infected, especially traveling from lockdown areas on public transport.
	Handshake		0.2599	People shaking hands are not encouraged because people are touching each other, and the possibility of spreading the virus between infected humans.
	Hug		0.1062	Avoid hugs. The Covid-19 virus can move through clothes and body surfaces, especially of positively infected people.
Hygiene		0.0755		Hygiene is an essential aspect of everyday life, especially during a pandemic like now. Hygiene can also prevent the spread of the COVID-19 virus.
	Use of mask		0.6438	Everyone must wear a mask that can help prevent the spread of COVID-19. And it is required by the government.
	Workplace sanitation		0.0738	Sanitations helps minimize the spread of the COVID-19 virus, especially in public places. And it must be available in various places.
	Handwash/use of sanitizer		0.2824	Hand washing is very recommended for the independent prevention of COVID-19. And become new behavior in the world community
Sharing personal belongings		0.1752		Avoid not sharing personal items.
	Newspaper		0.4132	Newspapers can be a medium for spreading the COVID-19 virus between newspapers from sellers to buyers, so this needs to be avoided.
	Office Stationery		0.1251	Sharing office stationery must be avoided because many people use and touch it with their hands to become a channel for spreading the COVID-19 virus.
	Gadgets and Device		0.4011	Mobile phones, laptops, etc., become a channel to the spread of the COVID-19 virus. So avoid being shared among people.
	Crockery		0.0345	Glassware, plates, etc. are not recommended to be used together because you have to touch them with your hands and lips, which can potentially spread the virus.
	Sanitary items		0.0261	Sanitation equipment is an item that everyone must carry to avoid potential transmission of the COVID-19 virus.
Unnecessary touching things		0.1874		Unnecessary touch can accidentally enter the human body and reach the human body.
	Body		0.5252	Don't touch body parts such as eyes, mouth, ears, etc. with your hands before washing your hands. it is fear that it can carry the virus.
	Public facilities		0.3341	Avoid use and touch public objects, such as ATMs, public transport, etc.
	Door/Switches/ Escalator		0.1407	Avoid touching door handles, electric switches, and armrests, as these can be a media for transmitting the virus.
Improper fo od habits		0.0206		The grocery store does not provide a place to eat/drink
	Prepared food		0.55	Avoid eating packaged foods. It involves several people as the food is cooked, packaged, and delivered.
	Drinking/eating outside		0.14	Don't drink or eating in public places.
	Packed food		0.31	Generally, packaged foods can carry viruses. However, the spread of the COVID-19 virus through packaged foods is not significantly.
Fresh food from outside		0.0634		It is necessary to pay attention to eating fresh food. People should be careful when buying and consuming these items.
	Vegetable		0.25	The distribution of vegetables is very multi-stakeholder and can accidentally carry the virus. So the vegetables must be cleaned and cooked at high temperatures to kill the virus in these vegetables.
	Fruit		0.096	Fruits are also almost the same as vegetables, and they are consumed without being cooked before. It can be carrying the virus.
	Snack		0.654	Snacks from outside can also carry viruses that can stick to the package.
Immunity/fit ness		0.1134		Body health is vital in increasing the body's resistance to prevent infection from the COVID-19 virus.
	Physical exercise at outside		0.411	Daily exercise is essential for good health and is recommended to maintain the body's immunity power and fitness.
	Body weakness		0.328	It takes adequate rest time to increase the body's resistance to disease.
	Stress		0.261	Recommend eating good nutritious food to keep the body healthy.
Culture/beha vior		0.1505		The traditional market with economic transactions via money and goods can be trigger infection of COVID-19 and potentially be new suspect areas virus COVID-19
	Culture tourism traditional market		0.557	People go to the traditional market to have been become a culture, especially in Yogyakarta.
	Hand kissing		0.2326	Hand kissing, it's meant a movement of inhaling something (hand) with the nose or attaching the nose to the hand and potentially transmit the virus COVID-19
	Manual transactions		0.2104	The traditional market with economic transactions via money and goods can be trigger infection of COVID-19

V. CONCLUSION AND FURTHER RESEARCH

Based on the research results, it can be seen that each activity has a weight which is influencing of preventive strategy COVID-19 outbreak in Yogyakarta. Such activity-travel has been the most significant risk factor in spreading the virus in social distance activities. Travel the outside can cause a person to become easily infected, especially traveling from lockdown areas on public transport. And then, use a mask is the next risk in spreading the virus. Everyone should use a mask that can help contain COVID-19. And it is regulated by the local government.

Further, the next risk in spreading the virus is sharing gadgets and devices. Gadgets and devices such as mobile phones, laptops, etc., become a channel to the spread of the COVID-19 virus. So avoid being shared among people. Then touching one's body parts is the next risk issue in spreading the virus. Avoid Don does not touch body parts such as eyes, mouth, ears, etc. with your hands before washing your hands. it is fear that it can carry the virus. Outside prepared food and Snack is the next risk in spreading the virus too. Furthermore, exercise at outdoor and culture tourism traditional markets become the next risk issue in spreading the virus. There are still many people who go outdoors by not implementing social distancing and national health protocols.

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