

Covid-19 Prevention Zonation with Geographic Information System Based on Health Protocols in Southeast Sulawesi

Zonasi Pencegahan Covid-19 dengan Sistem Informasi Geografis Berdasarkan Protokol Kesehatan di Sulawesi Tenggara

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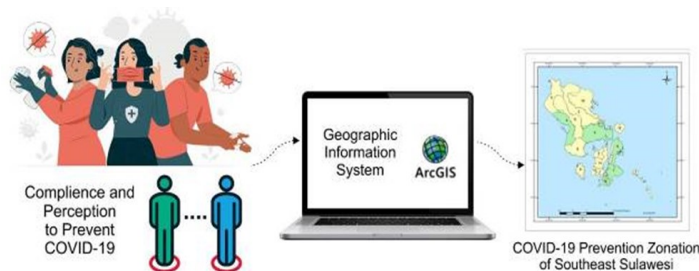
ABSTRACT

One noticeable effort to prevent Covid-19 cases in Indonesia is the enforcement of health protocols, popularly known as the 3M protocols. This movement is a massive campaign of the Covid-19 prevention task force, by wearing masks, washing hands, and maintaining a safe distance in order to prevent the spread of Covid-19. In relation to health protocols, it is very significant to review a person's point of view on whether he wants or not to take these preventive actions, and this can be seen by using the Health Belief Model Theory. This current study aimed to figure out the zoning rather than the prevention of covid-19 related to the 3M health protocols based on the Geographic Information System among citizens in South Sulawesi in 2020. This research applied descriptive quantitative research. There were 17 districts observed in this study with no red zone related to the variables of vulnerability, seriousness, benefits, obstacles, health motivation, and cues to act. Furthermore, there was merely 1 area that had a good level of compliance (green area) in preventing Covid-19 through the 3M protocols. Therefore, a deeper future study of the variables with a more detailed methodology is certainly needed, which can obtain results complementing each other for the future development of science.

ABSTRAK

Upaya dalam pencegahan Covid-19 di Indonesia termasuk penegakan protokol kesehatan, yang dikenal dengan gerakan 3M. Gerakan ini merupakan kampanye satgas pencegahan Covid-19, yakni dengan (memakai masker, mencuci tangan, dan menjaga jarak aman) dalam mencegah penyebaran Covid-19. Dalam hubungannya dengan protokol kesehatan, penting sekali meninjau ulang keinginan seseorang apakah mereka mau melakukan atau tidak mau melakukan tindakan-tindakan pencegahan tersebut, dan ini bisa ditinjau dari dengan menggunakan Teori Health Belief Model. Tujuan dari penelitian ini adalah untuk mencari tahu zonasi daripada pencegahan Covid -9 dalam Gerakan 3M berdasarkan Sistem Informasi Geografis pada masyarakat Sulawesi Selatan di tahun 2020. Penelitian ini menggunakan jenis penelitian Kuantitatif Deskriptif. Ada 17 Kecamatan/Kota, tidak ada Zona Merah pada variabel kerentanan, keseriusan, manfaat, hambatan, motivasi kesehatan, isyarat untuk bertindak dan hanya 1 wilayah yang memiliki tingkat kepatuhan yang baik (area hijau) dalam pencegahan Covid-19 melalui Gerakan 3M. Selanjutnya, diperlukan kajian yang mendalam terhadap variabel-variabel yang diteliti dengan metodologi yang lebih terperinci sehingga hasil-hasil yang didapatkan bisa saling melengkapi untuk pengembangan ilmu pengetahuan.

GRAPHICAL ABSTRACT



Keyword

compliance with health protocol
covid-19 pandemic
covid-19 gis
geographic information system
health belief model

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INTRODUCTION

The incidence of infectious diseases, which began to occur in early 2020, is considered a global phenomenon caused by viruses. The term Covid-19 has officially been used by WHO since February 11, 2020. Covid-19 in a person can trigger respiratory disorders such as colds, although it may be deadlier in some types of this disease (Yunus & Rezki, 2020). The World Health Organization (WHO) officially announced the increasing status from an epidemic to a pandemic level on March 11, 2020. In the global context, Covid-19 infections continued to increase. In August 2020, there were approximately 25,377,219 reported cases worldwide. In September 2020, it increased to 33,827,013 cases. Until October 2020, such cases gradually inclined up to 45,966,698 cases worldwide (Worldometer, 2020).

Indonesia is the country affected by the pandemic. As of October 31, 2020, there were 410,088 confirmed cases that were declared positive for Covid-19 in Indonesia (Worldometer, 2020). Another fact showed that many Covid-19 patients died. The Case Fatality Rate (CFR) in Indonesia itself has reached 3,4% (Kementerian Kesehatan RI, 2020). Based on the data obtained from the Southeast Sulawesi Provincial Health Office, the number of positive cases confirmed as of October 31, 2020, was roughly 4,950 cases, 3,862 people recovered, and the number of deaths due to Covid-19 was 82 people. There were no red zones (high-risk) for Covid-19, nine orange areas (medium risk), eight yellow zones (low-risk), and zero

green zones (non-affected areas) respectively in Southeast Sulawesi.

The effort to prevent Covid-19 from spreading in Indonesia included the implementation of the Health Protocol which was also campaigned through 3M actions. According to Bloom's Theory in Attamimy and Qomaruddin (2018), there were four major factors affecting the public health level where this theory could be approached through the Covid-19 preventive pattern in the society. Individual behavior affected the public health level by about 45%, the environmental factor affected by about 30%, the public health factor affected by 20%, and the genetic factor affected by about 5%. The biggest determinant factor was human behavior.

According to the above theory, the derivation of human behavior in the prevention of Covid-19 was carried out. One effective approach to do that was the review of the personal desire to implement or not the health protocol, which is regarded as a part of individual's attitude leading to their health behavior. The Health Belief Model theory emphasizes that the disease attacking individuals contribute to many perceptions which influence individuals to take action to reduce the effects or symptoms and even to cure the disease (Ekowati et al., 2017).

Based on the previous related studies, it was found that there were still many people who disobeyed the implementation of the Health Protocol (44,2%) (Wiranti et al., 2020). In another study, it was found that the variable of the Health Belief Model regarding seriousness, threat, benefits, barrier, motivation, and cues to act has played an

important role in shaping the human's behavior in Covid-19 prevention in Karela, India (Jose et al., 2020).

In an effort to increase people's awareness of health behavior, education with geographic health information can be carried out, as done by the Indonesian Covid-19 Task Force. Geographic Information Systems are regarded as the best media for monitoring by mapping because they are very capable of presenting spatial data along with the various attributes and modifications of various elements distinguished by color (Ainnurriza, 2020). The use of Geographic Information Systems provides the public with the benefits of associating the geographical mapping-based information. Therefore, the information can be organized by providing a wide variety of geographic information deliveries (Sulaksono, 2017). Particularly, it is aimed at the population of an area, providing them with an exclusive health approach, which is expected to be able to encourage healthy behavior, especially to carry out the preventive measures toward Covid-19 through the 3M actions.

Referring to the description above, this study aimed to classify zonation of the Covid-19 prevention regarding the 3M actions by using the Geographic Information System over citizens of Southeast Sulawesi. By utilizing the Health Belief Model domain and the level of compliance with the implementation of the Covid-19 prevention protocol, it is expected to predict and determine the follow-up actions regarding the interventions of promotional health in preventing Covid-19 spreads.

METHODS

This research applied descriptive quantitative research using the survey method. The variables of this study were the domains of health belief models, namely perceptions of vulnerability, seriousness, benefits, barriers, health motivations, cues for action, and the level of compliance. This research was conducted over 17 regencies/cities in Southeast Sulawesi from December to January 2020. The population in this study involved the citizens of Southeast Sulawesi, with a total of 2,704,737 people. The number of respondents, based on the calculation of the Lemeshow formula, was 385 people, which was later added to 400 people. Then, the proportion sample formula was used, and the number of respondents was obtained based on regencies/cities.

This research was conducted by using the incidental sampling method (non-probability sampling) with a google form. The zonation color adopted the Regulation of the Head of the National Disaster Management Agency in 2012 concerning General Guidelines for Risk Assessment and then adjusted to the category of research variables. The coloring of this index followed the rules that high-risk indexes used red, medium-risk indexes used yellow, and low-risk indexes used green.

RESULTS

Table 1 shows that the distribution of respondents is 400, consisted of various backgrounds, including age group, education level, and type of jobs. The majority of respondents were aged 18-22 years

Table 1
The Distributions of Respondents

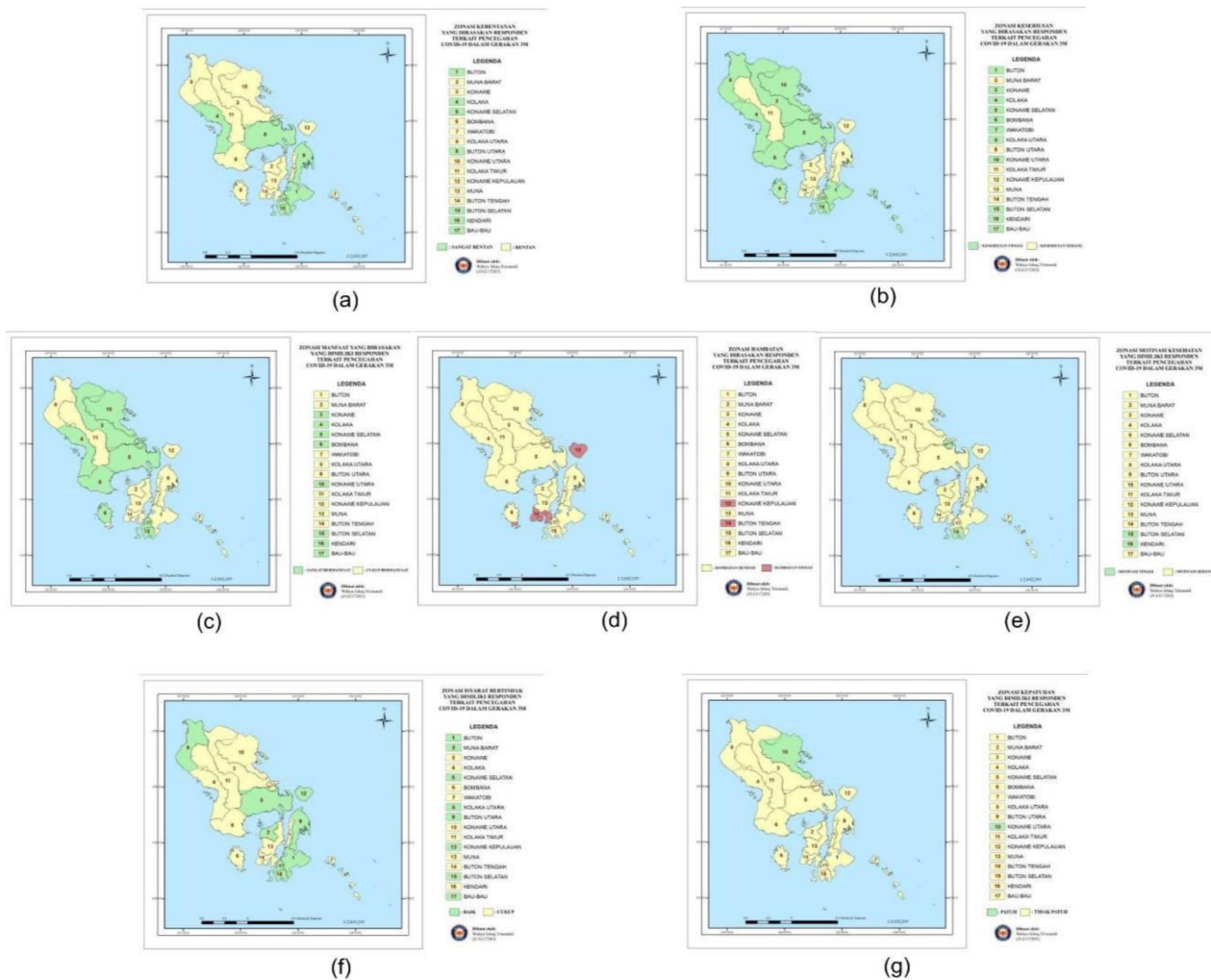
No.	Category	Number (n)	Percentage (%)
1	Age (Years)		
	13-17	21	5,3
	18-22	302	75,5
	23-27	37	9,3
	28-32	19	4,8
	33-37	4	1
	38-42	1	0,3
	43-47	6	1,5
	48-52	8	2,0
	53-57	1	0,3
	58-63	1	0,3
2	The last education obtained		
	Kindergarten/PAUD	0	0
	Elementary School/Equivalent	7	1,8
	Junior High School/Equivalents	4	1,3
	Senior High School/Equivalents	299	74,5
	A-3 Year Diploma	12	3
	Bachelor Degree/A-4 year Diploma	71	17,8
	Master Degree	7	1,8
	Doctoral Degree	0	0
3	Professions		
	Entrepreneurs	40	9,8
	Teacher/Lecturer	15	3,8
	TNI/POLRI (Armies/Polices)	2	0,5
	Government Employees	12	3
	Housewife	6	1,5
	Businessmen	9	2,3
	Students	16	4,5
	University Students	273	68
	Unemployed	27	6,8
	Total	400	100

(75.5%), as many as 74.5% of respondents were high-school graduates/equivalents, followed by 17.8% of the graduates of Bachelor's degree 4-year Diploma Degree. In opposite, the lowest number of respondents were graduates of Master's Degree and Elementary School/Equivalent levels, comprising only 1.8%. The respondents were dominated by students (68%), followed by Entrepreneurs (9.8%), and Army/Police (0.5%) respectively.

Figure 1 presents regency or district zonation based on respondents' vulnerability regarding the prevention of Covid

-19 throughout the 3M actions. It was found that 7 Green Zones (41.17%) had the perception of being very vulnerable to Covid-19 as these zones did not implement the prevention protocol in the 3M actions. In addition, there were as many as 10 Yellow Zones (58.83%) that had a perception that they were quite vulnerable to Covid-19 as they did not implement the prevention protocol in the 3M actions. There were no areas that fell into the red zone category or did not feel vulnerable to COVID-19 even though they did not implement the prevention protocol in the 3M movement (0%).

Figure 1
Zonation based Vulnerability of Health Protocol



Note: (a) Zonation based on Perceived Vulnerability, (b) Zonation based on Perceived Seriousness, (c) Zonation based on Perceived Benefits, (d) Zonation based on Perceived Barriers, (e) Zonation based on Health Motivation, (f) Zonation based on Cues for Actions, (g) Zonation based on Compliance Rate

Regency or district zonation was based on the seriousness felt by respondents regarding the prevention of Covid-19 through the 3M actions. The results of this study revealed that 11 Green Zones (64.70%) had a high perception of seriousness in implementing Covid-19 prevention through the 3M movement. There were 6 Yellow Zones (35.30%) that had a perception of moderate seriousness to prevent Covid-19 through the 3M movements. There were no areas

that fell into the red zone category or low seriousness to prevent Covid-19 through the 3M movement (0%). Regency or district zonation was based on the benefits felt by respondents related to the prevention of Covid-19 through the 3M actions. The results of this study revealed that 8 Green Zones (47.06%) had the perception of being very useful when preventing Covid-19 through the 3M movement. There were 9 Yellow Zones (52.94%) which had the per-

ception that it was quite useful when preventing Covid-19 through the 3M movements. There were no areas that were included in the red zone category, or preventing Covid-19 through the 3M movement was less useful (0%).

Figure 1 presents regency or district zonation based on the obstacles experienced by respondents regarding the prevention of Covid-19 through 3M actions. The results of this study revealed that 15 Yellow Zones (88.24%) had the perception that they had sufficient obstacles in their efforts to prevent Covid-19. In addition, there were 2 Red Zones (11.76 %) that had a high perception of obstacles to implementing the COVID-19 prevention protocol through the 3M movements, and there were no areas with a green zone category or low barriers to implementing the Covid-19 prevention protocol through the 3M movements (0%). Regency or district zonation was based on the health motivations of the respondents regarding the prevention of COVID-19 through the 3M actions. The results of this study revealed that 2 Green Zones (11.76%) had a high motivation to prevent Covid-19 using the 3M actions. There were also 15 Yellow Zones (88.24 %) that had the moderate motivation to prevent Covid-19 from using the 3M actions. There were no areas that fell into the red zone category or had low motivation to prevent Covid-19 using the 3M movement (0%).

Figure 1 shows regency or district zonation based on the respondents' cues for action regarding the prevention of Covid-19 through 3M actions. The results of this study revealed that 8 Green Zones (47.06%)

had a perception of good action cues to prevent Covid-19 using the 3M movements. There were also 9 Zones Yellow (52.94%) which had a perception that there were sufficient action cues to prevent Covid-19 from using the 3M movements. Additionally, there was no red zone or category of inadequate action cues for the people of Southeast Sulawesi to prevent COVID-19 using the 3M movements (0%). Regency or district zonation was based on the respondents' compliance with Covid-19 prevention via the 3M actions. The results of this study revealed that there was merely 1 Green Zone (5.88%) that had the compliance with all 3M movement items in the prevention of Covid-19, namely North Konawe Regency. There were around 16 Yellow Zones (94.12%) that had no compliance with all 3M movement items in the prevention of Covid-19. However, several items had been fulfilled to 100% out of the total four items submitted in the questionnaires.

DISCUSSION

Perceived Vulnerability

Based on the perceived vulnerabilities, in line with the research conducted by Scarinci et al. (2021), stating that the perception of vulnerability indicated by the community was 44.9% as exposed to Covid-19. Preventive behavior will increase as the perceived threat increases. Perceived susceptibility to the condition of disease will encourage individuals to take preventive actions (Narsih & Hikmawati, 2020).

Based on the results obtained above, the community felt very vulnerable as being exposed to Covid-19. Subjective assessment

of the risk of health problems is taken as a reference to the perception of vulnerability. If individuals have a low perception of being exposed to a disease, they will tend to take unhealthy actions. Conversely, as the individual has a high perception of being exposed to a disease, it is possible to take healthy actions to minimize the risk of developing such disease (Onoruoiza et al., 2015).

Perceived Seriousness

The citizens consider the serious impact of Covid-19 due to not complying with health protocols. This is in line with the previous research by Li et al. (2020), which suggested that the level of seriousness felt by people in China towards Covid-19 was relatively high, by 4.9 out of a scale of 5. The perception of seriousness could affect individuals in efforts to prevent the disease from others. A person will predict the health consequences if there is no treatment for the disease from an expert in the health sector. The higher the individual's perception of the seriousness of the disease, the more it is defined as a threatening thing so that it can encourage preventive actions (Husna, 2014).

Perceived Benefits

Referring to the research conducted by Jose et al. (2020) regarding the prevention of Covid-19 in the community in Kerala (India), 63.1% of respondents felt that they are more likely to avoid Covid-19 infection if they follow the recommendations of the local government regarding the prevention of Covid-19. A person will tend to

behave in a healthy manner when he feels the behavior is beneficial to reducing the risk of disease (Ali et al., 2020). In line with the research conducted by Lestari et al. (2018), it stated that the belief in healthy behavior is beneficial for preventing disease. Therefore, the consideration of the perceived benefits of the research results, which is very high, is the basis for individuals to carry out healthy behavior, especially in the prevention of Covid-19 disease.

Perceived Barriers

In the concept of the Health Belief Model, there are two health assessments that encourage preventive actions. The assessment consists of the perceived threat/seriousness of the health problem, as well as benefits and barriers (Prihantini et al., 2017). The perception of obstacles in preventing Covid-19 in this study can be explained through the results of the questionnaire answers. Here, the statement item "Masks are very expensive" accounted for 42.8% (171 people). In addition, the item indicating that "I feel branded arrogant when limiting physical interaction with others" was the second-highest item by 27% (108 people), suggesting an agreement with it. The public needs to increase their confidence in the impact of Covid-19 are that the preventive measures suggested by the government are the best recommendations for their health. Due to this motivation, the items of obstacles felt by the community can gradually decrease.

Health Motivation

Based on the health motivation, the overall motivation of the respondents was relatively good, about 66% in the regencies/cities in Southeast Sulawesi. This is in line with the prior research conducted by [Apriaji et al. \(2021\)](#), where research respondents showed good health motivation in preventing Covid-19 by 90% of all research respondents. In Vroom's concept of expectancy theory, the expectation of the results affects the person's motivation. The results are obtained from the existence of certain businesses and are interrelated, resulting in a positive response ([Dara et al., 2020](#)). Motivation plays a critical role in health compliance. The existence of high motivation indicates that a person has high hopes for health actions, thus encouraging a person's behavior to be able to comply with health actions, in this case, disease prevention ([Ihwatun et al., 2020](#)).

Cues for Action

Based on cues, action is believed as a triggering factor that makes people feel the need and accelerates healthy behavior actions. These cues to act can be sourced from information from the surrounding environment and mass media, advice, individual experiences, family support, and so on ([Juliati, 2020](#)). In line with this, all perceptions of acting cues have a good tendency where more than 50% of respondents have expressed agreement that family, friends, neighbors, colleagues, and other closest relatives much support the efforts to keep distance in preventing Covid-19 (86%).

Compliance Rate

Based on the level of compliance, referring to the study by [Kasim et al. \(2021\)](#), the frequency of the respondent's compliance level is higher than the level of community compliance with 59.8% of respondents. In fact, the respondents were not being obedient in carrying out Covid-19 prevention measures such as using masks, washing hands with soap, and keeping a safe distance in interaction.

According to [Riyadi & Larasaty \(2021\)](#), compliance can be influenced by gender, education level, and a person's age. Compliance can also be sourced from information obtained from the mass media and the surrounding environment that gave birth to the community ([Ginting et al., 2021](#)). In addition, ages influence the individual's level of compliance. According to the study conducted by [Sarlinda \(2018\)](#), there is a tendency that the older a person is, the more often they experience illness, so they often use health services. Older patients tend to have higher compliance with healthy behaviors. This is because the activities of the elder age are not too solid. Thus, individuals do not forget and remain obedient ([Aspan et al., 2020](#)). This is in line with the results of this study, where the elderly category overall has good compliance (100%).

CONCLUSIONS

Out of the 17 regencies/cities, there was no red zone (low/less category) with regard to the variables of vulnerability, seriousness, benefits, health motivation, and cues to action. There was one red zone on the obstacle variable and only one green

zone area, which had good compliance in Covid-19 prevention through the 3M actions.

The community is expected to be more open-minded so that they are able to receive information related to Covid-19 prevention, especially to increase compliance and minimize the potential for perceived barriers. Therefore, Covid-19 prevention becomes more optimal. Local governments are expected to continue to enforce health protocols regularly. This is to make people aware of the existence of Covid-19, so preventive measures need to be taken. For future researchers, they are expected to examine more deeply related to the relationship, influence, and differences in each variable in order to enrich the research and scientific development.

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