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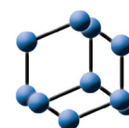
**Health Belief Model for Public Acceptance of Implementing COVID-19
Vaccination in Singkawang City, Indonesia**

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RESEARCH ARTICLE

Health Belief Model for Public Acceptance of Implementing COVID-19 Vaccination in Singkawang City, Indonesia

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Abstract:

Background:

The efficacy of immunization is contingent upon public acceptance. Using the behavioral theory of the Health Belief Model (HBM), this study seeks to determine intervention strategies against the most influential factor towards the acceptance of the COVID-19 vaccination program among the societies of Singkawang City.

Methods:

This investigation involved a cross-sectional design. The perceived severity, susceptibility, barriers, benefits, cues to action, and self-efficacy were the independent variables. The dependent variable was the adoption of the COVID-19 vaccine by the public. Mann-Whitney, Chi-square and Multivariate tests were used to present vaccine acceptance differences, relationships and impacts of each variable towards COVID-19 vaccine acceptance.

Results:

There was a total of 461 participants in this study. For the majority of respondents (56.40%), COVID-19 vaccine acceptance among them remains modest. The difference between the low and high vaccination acceptance groups (p -value < 0.05) was revealed. Except for perceived severity, this study demonstrated that all HBM constructs had a significant relationship with vaccination acceptance (p -value < 0.05). In addition, the results of the logistic regression test indicated that the cues-to-action construct was the most influential factor in vaccine acceptance (OR= 7.156; CI, 95%= 4.107 – 12.469), followed by self-efficacy (OR=3.218; CI, 95%=1.819 – 5.694).

Conclusion:

Thus, health policymakers should focus on cues-to-action and self-efficacy factors for developing a strategy to increase vaccine acceptance among the Indonesian population by using current study results among the Singkawang population as a model to start the persuasion techniques.

Keywords: Public acceptance, COVID-19, Health belief model, Singkawang, Indonesia .

Article History

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1. INTRODUCTION

The COVID-19 vaccine acceptance survey in Indonesia, which was conducted by WHO, the Indonesian Ministry of Health, the United Nations Children's Fund (UNICEF), and the National Immunization Expert Advisory Committee in September 2020 among 115,000 respondents from 34 provin-

ces, revealed that only 64.8% of respondents were willing to be vaccinated [1]. A global map of the COVID-19 vaccination program revealed that vaccination hesitancy and low eagerness to have vaccination were more prevalent in the MENA, Central/Western Africa, Central Asia, and Europe [2, 3]. The identification of determinants of timely vaccinations may facilitate the development of health policy best practices that enhance the capacity of nations to withstand pandemic crises [4 - 6]. In order to effectively achieve herd immunity, increased vaccination acceptance is required [1]. According to studies conducted among the adult population in Lebanon and

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Bangladesh who exhibit uncertainty regarding the COVID-19 vaccination program, vaccination hesitancy could be mitigated through the consistent and transparent dissemination of evidence-based safety and efficacy information regarding vaccines [7, 8]. As of September 22, 2021, the COVID-19 vaccination coverage remained inadequate, particularly among communities residing in Singkawang City, West Kalimantan Province, Indonesia. The initial dose coverage rate was recorded at 32.96%, and the subsequent dose coverage rate was 21.21% [9]. On the contrary, it was determined that vaccine coverage ranging from 80% to 90% was the most effective level of vaccination administration in maintaining the decline in confirmed cases as well as fatalities [10].

In order to comprehend the factors that influence acceptance of the COVID-19 vaccine, a study revealed that the majority of individuals are likely ambivalent regarding the vaccine, contingent upon their personal characteristics and inclinations [6, 11, 12]. Individuals who are hesitant to receive a vaccine may reconsider administering it or postpone it until they receive another vaccination [11]. In a prior psychology investigation carried out in the western region of Indonesia, it was documented that vaccine acceptance was substantially influenced by smoking status, the frequency of COVID-19 tests, the agreeableness personality trait, trust in government and scientists, and other favourable predictive and discriminant factors [13]. Health authorities are obligated to anticipate these behaviours proactively, particularly given the potential for changes in the influencing characteristics over time. However, the stringent policies and requirements to reach 90% might weaken democracy and cause socioeconomic crises worse than pandemics [10, 14]. This information may help the government set the right target for vaccine efforts and health policies to handle the next pandemic without causing socioeconomic issues. Gaining insight into the behavior of individuals as they react to a novel health initiative, specifically the COVID-19 vaccination, is not only intriguing but crucial for determining the most effective policies. Previous research has shown the ability of the Health Belief Model (HBM) constructs to predict behaviour related to influenza vaccination [15]. The HBM has been widely used to understand health behaviour and provide guidance for designing health behaviour improvement interventions. The HBM consists of six constructs, *i.e.*, perceived severity, susceptibility, barriers and benefits, cues to action, and self-efficacy [16, 17]. Exploring COVID-19 vaccination behaviour through HBM constructs also provided intervention plans to increase vaccine acceptance [18]. This study, therefore, investigated the factors that influence public adoption of the COVID-19 vaccine in Singkawang City. The findings may inform intervention strategies to increase vaccination acceptability among Indonesians.

2. METHOD

2.1. Study Design, Sample, Data Collection, and Ethical Clearance

This study was a cross-sectional survey conducted among the inhabitants of Singkawang City, West Kalimantan Province, Indonesia. Respondents involved in the study were people of Singkawang City with a minimum age of 18 years who had not yet received a COVID-19 vaccination and people who were COVID-19 survivors within the last three months. Pregnant women were excluded from this study due to the restriction applied for COVID-19 vaccination. The minimum calculated sample was 400, with a population size of 235,064 and a margin of error of 0.05. Respondents were recruited more than the minimum sample size to anticipate a sample shortage due to subjects dropping in the middle of the research. Sample recruitment using the snowball technique resulted in 565 respondents. The data were collected using a pre-tested questionnaire informed by the HBM constructs, *i.e.*, perceived severity, susceptibility, barriers and benefits, cues to action, and self-efficacy. The HBM questionnaires were distributed to 565 respondents *via* the WhatsApp application containing a Google Form link for respondents. The data collection was conducted in July 2021. The ethical clearance has been obtained from the Health Research Ethics Committee of Dr. Abdul Aziz Regional Public Hospital of Singkawang City, West Kalimantan Province, Indonesia, with the Certification Number of Ethical Review, 16/KEPK/2021, dated July 1, 2021.

2.2. Measures of Variables using the HBM Questionnaire

Six independent and one dependent variable are measured to analyze the factors influencing public acceptance of the COVID-19 vaccine. Data of the independent variables (*i.e.*, the HBM constructs: perceived susceptibility, perceived severity, perceived barriers, perceived benefits, cues to action, and self-efficacy) were collected to explore the dependent variable (*i.e.*, public acceptance regarding receiving the COVID-19 vaccine). A pre-tested questionnaire of HBM constructs was applied to collect the data. The questionnaire test for content validity employed a professional judgment approach. The reliability test of the questionnaires showed Cronbach's alpha values of ≥ 0.6 for each statement. Furthermore, a language comprehension test was conducted on the users. The questions on the HBM questionnaire used in this research are presented below. Each of the six independent variables contains five questions, and the dependent variable consists of four. The total number of questions on the HBM questionnaire in this study is 34, with favourable and unfavourable forms. The complete HBM questionnaire used in this research can be obtained upon request.

Perceived susceptibility:

1. I still have physical contact when I meet family or friends during the COVID-19 pandemic.
2. I always obediently wear a mask when outside the house.
3. When I am outside the house, I am not worried about any risks that will happen to me, including the risk of contracting COVID-19.
4. I am worried that if I do not comply with health protocols, it could make other people sick.
5. I will attend family gatherings or reunions with friends on a large scale during the COVID-19 pandemic.

Perceived severity/seriousness:

1. Preventing transmission of COVID-19 to myself and my family is not my current priority.
2. My health will worsen if I am confirmed positive for COVID-19.
3. My health will worsen if I am confirmed positive for COVID-19
4. I feel that my health condition will worsen if I am confirmed to have COVID-19
5. If I have a chronic disease, then COVID-19 will worsen my health condition

Perceived benefits:

1. The COVID-19 vaccine helps me reduce the severity if I develop COVID-19 disease.
2. The COVID-19 vaccination protects people from COVID-19 disease so they remain socially and economically productive.
3. Medicine is better than COVID-19 vaccination.
4. The COVID-19 vaccination can improve the body's immune system to prevent COVID-19 infection.
5. The COVID-19 vaccination cannot protect people from being infected with COVID-19.

Perceived barriers:

1. I am confident in the safety of the COVID-19 vaccine currently in use.
2. Visiting a health facility for vaccination makes me feel uncomfortable
3. I am not sure that the COVID-19 vaccine currently being used meets the requirements according to my religion.
4. I am not worried about the side effects of the COVID-19 vaccine.
5. The information I received regarding COVID-19 vaccination was inadequate.

Cues to action:

1. The availability of information regarding the safety of the COVID-19 vaccine encouraged me to get vaccinated.
2. The information that the benefits of COVID-19 vaccination outweigh the risks encouraged me to get vaccinated.
3. News about vaccine side effects makes me worried about COVID-19 vaccination.
4. The experience of people vaccinated against COVID-19 makes me more confident about carrying out vaccination.
5. People's enthusiasm for vaccination does not encourage me to participate in the COVID-19 vaccination.

Self-efficacy:

1. I am not sure my immune system will improve with the COVID-19 vaccination.
2. I believe vaccination is the government's effort to ensure public safety from COVID-19 infection.
3. I cannot protect others from infection if I have received the COVID-19 vaccine.
4. I believe vaccination is the most appropriate prevention of COVID-19 at this time.
5. I believe that COVID-19 vaccination is one step to ending the pandemic.

Acceptance:

1. I am willing to be vaccinated through the COVID-19 vaccination program.
2. I will support the people around me in being willing to be vaccinated against COVID-19.
3. I believe my body's natural immunity can prevent COVID-19 infection.
4. I am confident that the COVID-19 vaccination program can be successful.

2.3. Models and Data Analysis Procedure

The scale used in the HBM questionnaire is a Likert scale with five answer choices, *i.e.*, strongly disagree, disagree, neutral, agree, and strongly agree, with scores of one, two, three, four, and five, respectively. The number of questions on each independent variable was five; thus, the total score for each independent variable was between 5 and 25. The number of questions on the dependent variable was four; thus, the total score was between 4 and 20. The total score of each variable obtained was divided by the number of samples to obtain an average score for each variable. Each respondent's score was categorized as "high" if the score exceeded the average score and "low" if the score was less than or equal to the average score.

Statistical analysis of the data consisted of 1) a data normality test, 2) an analysis of differences between the two groups of vaccination acceptance, 3) an analysis of the relationship between HBM constructs and vaccination acceptance, and 4) an analysis of HBM constructs having the most contribution to vaccination acceptance. The Kolmogorov-Smirnov Test was applied for the data normality test. The

differences test between the two vaccination acceptance groups were analyzed using the Mann-Whitney Test. The Mann-Whitney Test results determined that if the p-value is > 0.05 , there is no significant difference between the two groups, and *vice versa*.

The significant relationship between HBM constructs and vaccination acceptance was analyzed using the Chi-square Test. The Chi-square Test results were determined based on the p-value asymptotic significance (2-sided). If the p-value is > 0.05 , no significant relationship exists between each independent and dependent variable, and *vice versa*.

The analysis of HBM constructs contributing most to vaccination acceptance used a binary logistic regression test. The dependent variable was categorized into two groups, namely the low vaccination acceptance group and the high vaccination acceptance group. The logistic regression test results were determined from the Odds Ratio values. The contribution of the independent variable to the dependent variable was indicated by the value of $EXP(B)$ (OR). If the p-value is > 0.05 , the independent variable does not have a significant partial contribution to the dependent variable, and *vice versa*.

Table 1. Characteristics of respondents in the study of public's acceptance of COVID-19 vaccination in singkawang city based on the health belief model.

No.	Respondent Characteristics	Frequency (n = 461)	Percentage (%) (n = 461)
1.	Gender	-	-
-	Female	290	62.91
	Male	171	37.09
2.	Age	-	-
-	18 to 19 years	97	21.04
	20 to 60 years	359	77.87
	>60 years old	5	1.08
3.	Occupation	-	-
-	College Student	154	33.41
	Entrepreneur	111	24.08
	Housewife	54	11.71
	Private Employee	50	10.85
	Student	28	6.07
	Unemployed	23	4.99
	Teacher	17	3.69
	Civil Servant	9	1.95
	Health Workers	5	1.08
	Laborer	4	0.87
	Farmer	4	0.87
	Army	2	0.43
4.	District of Domicile	-	-
-	Center Singkawang	159	34.49
	West Singkawang	125	27.11
	South Singkawang	89	19.31
	North Singkawang	65	14.10
	East Singkawang	23	4.99
5.	Education Background	-	-
-	Elementary School/equivalent	16	3.47
	Junior High School/ equivalent	16	3.47
	Senior/Vocational High School/ equivalent	346	75.05
	Bachelor's Degree	80	17.34
	Master's Degree/Doctoral Degree	3	0.54

3. RESULTS

Five hundred and sixty-five respondents were recruited and approached to complete the questionnaire. However, only 461 respondents returned their answers, resulting in a response rate of 81.60%. Table 1 shows more females (62.91%) than males. Three groups of respondents' occupations or routine activities are college students (33.41%), self-employed (24.08%), and household mothers (11.71%). The majority of respondents have a senior high school diploma or its equivalent. In addition, most respondents are between the ages of 20 and 60 years (77.87%).

3.1. The Comparison of Low Group and High Group COVID-19 Vaccination Acceptance

The comparison between low and high COVID-19 vaccination acceptance groups is 56.40%: 43.60%. The statistical test using Mann-Whitney indicates a significant difference between the two groups, $p\text{-value} < 0.001$. This result

denotes that COVID-19 vaccination program acceptance for most of Singkawang City societies is still lower (56.40%) than the previous survey results at the province level (West Kalimantan Province), with 63% vaccine acceptance [1].

3.2. The Relationship Between Behaviour Factors of HBM and COVID-19 Vaccination Program Acceptance

1. Perceived Susceptibility to the COVID-19 Factor and Vaccination Acceptance

The highest number of respondents is in the group with a low perception of susceptibility and low vaccination acceptance (35.14%). The Chi-Square Test result shows that perceived susceptibility is significant in relation to COVID-19 vaccination program acceptance in Singkawang City societies ($p\text{-value} < 0.001$), i.e., $\chi^2 (1, N = 461) = 15.760, p < 0.001$.

2. Perceived Severity of the COVID-19 Factor and Vaccination Acceptance

The highest number of respondents is in the group with low perceived severity and low vaccination acceptance (31.45%). The Chi-Square Test result revealed that perceived severity had no significant relationship with people's COVID-19 vaccination acceptance in Singkawang City (p -value = 0.109), *i.e.*, χ^2 (1, N = 461) = 2.272, $p < 0.001$. Table 2.

3. Perceived Benefits of the COVID-19 Factor and Vaccination Program Acceptance

The group with the lowest perceived benefits and COVID-19 vaccination program acceptance has the greatest number of respondents (39.26%). The Chi-Square Test reveals a significant relationship between perceived vaccine benefits and COVID-19 vaccination program acceptance in Singkawang City societies (p -value < 0.001), *i.e.*, χ^2 (1, N = 461) = 79.316, $p < 0.001$.

4. Perceived Barriers to Conducting Vaccination Factors and COVID-19 Vaccination Program Acceptance

The respondents with high perceived barriers and low vaccine acceptance are as many as 38.61%. The Chi-Square test result demonstrates that perceived barriers to vaccination implementation are significant in relation to COVID-19 vaccination program acceptance in Singkawang City (p -value = 0.000), *i.e.*, χ^2 (1, N = 461) = 78.670, $p < 0.001$.

5. Cues to Action Factor and Acceptance of COVID-19 Vaccination

The highest number of respondents is in the group with low cues to action and low vaccine acceptance (44.68%). The Chi-Square Test result shows that the encouragement to join COVID-19 vaccination had a significant relationship with public acceptance of COVID-19 vaccination in Singkawang (p -value = 0.000), *i.e.*, χ^2 (1, N = 461) = 160.557, $p < 0.001$.

6. Self-Efficacy of the Vaccine Factor and Acceptance of COVID-19 Vaccination

The highest number of respondents is in the group with self-efficacy and low vaccine acceptance (47.28%). The Chi-

Square Test result shows that self-efficacy of the COVID-19 vaccine has a significant relationship with public acceptance of COVID-19 vaccination in Singkawang (p -value = 0.000), *i.e.*, χ^2 (1, N = 461) = 116.196, $p < 0.001$.

7. Most Factors Contributing to the Public's Acceptance of COVID-19 Vaccination in Singkawang City, Indonesia, Based on the Health Beliefs Model (HBM)

The contribution of factors to the public's acceptance of COVID-19 vaccination in Singkawang City is shown in Table 3. Factors of susceptibility, severity, benefits, and barriers do not significantly or partially contribute to vaccination acceptance. It suggests that these can influence vaccination acceptance if other factors appear. The constructs of cues to action and self-efficacy significantly contribute to vaccination acceptance. In other words, these factors can independently contribute to vaccination acceptance without the appearance of the other factors. In addition, the most influencing factor in vaccination acceptance is the cues to action, as shown by the result of the largest *Exp (B)* or Odds Ratio (OR) in which the OR value = 7.156; *CI*, 95% = 4.107 – 12.469. This result indicates that the cues-to-action construct is the most influential factor in the public's COVID-19 vaccination acceptance in Singkawang City. The value of this construct is 7.156 times, contributing to public acceptance in Singkawang City to implement COVID-19 vaccination.

The self-efficacy variable demonstrates the value of *Exp (B)* or Odds Ratio (OR) in which OR value = 3.218; *CI*, 95% = 1.819 – 5.694. The value of this factor is 3.326 times, contributing to public acceptance in Singkawang City to implement COVID-19 vaccination. Hence, the Singkawang City Government can use these results to conceptualize intervention strategies that focus on matters related to the cues for action aspects. Moreover, the set of independent variables, *i.e.*, the HBM constructs, can explain the dependent variable (acceptance behaviour of COVID-19 vaccination) by 48.3%, as indicated by *Nagelkerke R Square*. The rest are 51.7%, indicating that behaviour toward COVID-19 vaccination acceptance in Singkawang City societies is 51.7%, which other variables outside this research can explain.

Table 2. Relationship between HBM factors and COVID-19 vaccination program acceptance in the study analysis of public acceptance of COVID-19 vaccination in singkawang city based on the theory of health belief model.

Variable/Factor	Category	Vaccine Acceptance (n =461) in %		Pearson Chi-square p-value
		Low	High	
Perceived susceptibility	Low	35.14	18.87	0.000
	High	21.26	24.73	
Perceived severity	Low	31.45	21.04	0.109
	High	24.95	22.56	
Perceived benefits	Low	39.26	11.93	0.000
	High	17.14	31.67	
Perceived barriers	Low	17.79	32.10	0.000
	High	38.61	11.50	
Cues to action	Low	44.69	8.46	0.000
	High	11.71	35.14	

(Table 2) contd.....

Variable/Factor	Category	Vaccine Acceptance (n =461) in %		Pearson Chi-square p-value
		Low	High	
Self-efficacy	Low	47.29	14.97	0.000
	High	9.11	28.63	

Table 3. Results of the logistic regression test in the study analysis of public's acceptance of COVID-19 vaccination in singkawang based on the theory of health belief model.

Variables in the Equation									
		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
								Lower	Upper
Step 1 ^a	Susceptibility	.261	.269	.944	1	.331	1.299	.767	2.201
	Severity	-.256	.265	.933	1	.334	.774	.461	1.301
	Benefit	.265	.301	.776	1	.378	1.303	.723	2.349
	Barrier	-.361	.282	1.639	1	.200	.697	.401	1.211
	Encouragement	1.968	.283	48.248	1	.000	7.156	4.107	12.469
	Self-efficacy	1.169	.291	16.119	1	.000	3.218	1.819	5.694
	Constant	-4.751	.906	27.471	1	.000	.009	-	-
a. Variable(s) entered on step 1: Susceptibility, Severity, Benefit, Barrier, Encouragement, Self-efficacy.									

Model Summary			
Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	425.343 ^a	.361	.483
a. Estimation terminated at iteration number 5 because parameter estimates changed by less than .001.			

4. DISCUSSION

This study analyzed 461 data sets and found that 56.4% still had low acceptability of COVID-19 vaccination, which poses a challenge to the Indonesian government's goal of achieving herd immunity through COVID-19 vaccine coverage of 70% [19]. The coverage of COVID-19 vaccination in Singkawang City recorded until September 22nd, 2021, for the first dose was 32.96%, and for the second dose was 21.21% (average= 27.08%) [9]. This situation depicts that the vaccination coverage in Singkawang City has not yet reached the number targeted by the government, which the low COVID-19 vaccination acceptance might cause. As reported by the previous study about vaccine uptake in LMICs, the COVID-19 vaccine acceptance was generally explained by a desire for personal protection against COVID-19, while the most common cause for reluctance was fear about adverse effects [20 - 22]. Level of education, socio-demographic and emotional factors were reported as associated factors of COVID-19 vaccination uptake intent [12, 23]. In Russia [24], the educational background of a population is known to affect the proportion of individuals who exhibit neglectful health behaviour, especially among the younger age group. The occurrence of this particular form of logical behaviour in response to health recommendations was observed to be more prevalent among participants who were 50 years of age or older and held a bachelor's degree [24].

Similar to the study from Malaysia⁶, the reported study found a significantly higher proportion of the group with a low perception of the susceptibility to COVID-19 and low vaccination acceptance, even though the transmission of

SARS-CoV-2 can easily occur when having close physical contact with patients with COVID-19 [25]. A study from Hong Kong found that respondents viewed COVID-19 infection as a mild disease unless the infected individual had a high-risk condition [3]. In fact, a vaccine is needed to activate a patient's immunity against certain diseases [21, 26]. To prevent the spread of infections, it is necessary to raise awareness of the COVID-19 vaccine to overcome a person's susceptibility to infection following exposure to the virus [27]. Moreover, the case fatality rate in this city (4.57%) was higher than in the whole country (2.71%) [28]. Such data should trigger the authorities to provide information to the public related to the severity and case fatality of patients with COVID-19. The government must improve the communication and dissemination of information regarding environmental factors to prevent the spread of COVID-19 infection [5, 29, 30].

In line with previous studies by Wong *et al.* (2021) in Hongkong [15], Wong *et al.* (2020) in Malaysia [18], and Mercadante and Law (2021) in the United States [31], this reported study uncovered a significant relationship between the perceived benefits of COVID-19 vaccination and respondents' acceptance of the vaccination program. As a consequence, information regarding the primary benefits of the COVID-19 vaccination and its correlation to COVID-19 infection-fighting efficacy should be available to community members [21, 32]. Moreover, as a response to the report by the Indonesia Food and Drug Authority regarding the 50% efficacy of the COVID-19 vaccine [33], a study by Machindra *et al.* (2020) in Indonesia revealed that 93.3% of respondents wanted to get vaccinated for a vaccine with 95% of efficacy; however, the

acceptance decreased to 67.0% for a vaccine with 50% efficacy [34]. The public's approval of the vaccination program was not enhanced by the fact that the COVID-19 vaccine is considered cost-effective compared to medication [26].

Furthermore, the vaccine's safety and halal aspects are the main factors in vaccine acceptance in Indonesia. The National Food and Drug Agency of the Republic of Indonesia has guaranteed the safety of the COVID-19 vaccine in Indonesia. Not everyone experienced adverse effects following immunization (AEFI) after the vaccination. The AEFI has been reported as normally mild [35]. Public endorsement of the vaccination program is contingent on medical issues and public confidence in vaccination-related institutions (social-institutional context) [36, 37]. Thus, when developing strategies, health policymakers must also consider discussions about this context. Through the Council of Indonesian Ulama (MUI), the government has guaranteed that the vaccines can be used in Indonesia; for example, the MUI *fatwa* on COVID-19 vaccine products from Sinovac Life Sciences Co. Ltd. China and Bio Farma (company). According to credible and competent experts, the two products are legally holy and halal for Muslims as long as their safety is guaranteed [38]. This result aligns with Wong *et al.* (2020) in Malaysia [18] and Wong *et al.* (2021) in Hong Kong [15]. Despite the association between *halal* concern and religiosity, a study among religious individuals found that the level of perceived distress induced by COVID-19 was correlated with the propensity to receive vaccinations [39]. Furthermore, the study found that as religious convictions increased, the inclination to receive vaccinations decreased [39].

The current study reports that low cues to action have a significant relationship with low vaccine acceptance among the respondents in this study. The cues to action are a trigger for actions coming from outside factors of individuals. The cues to action can be from the government, family members, or friends [27]. Some factors might have contributed to the low cues to action, such as disinformation or hoaxes in mass media or social media. For example, hoaxes or false information related to the COVID-19 vaccine on August 3, 2021, in Indonesia had 1,897 content on various social media [40]. Information about COVID-19 was the most sought-after information during the pandemic, and respondents' preferred source of information was social media [41, 42], suggesting that social media could be a contributing factor to the low levels of cues for action among the respondents in this study. False news about the COVID-19 vaccine on social media, such as negative issues regarding safety and *halal*, can trigger people's fear of receiving vaccination, which might contribute to the reluctance to vaccinate [41, 43]. Therefore, accountable information regarding the COVID-19 vaccines might help increase vaccination intentions among community members [44].

Consistent with Guidry *et al.* (2021) [45], the current study reports a significant relationship between low self-efficacy and low vaccine acceptance. Self-efficacy for getting vaccinated can be formed by correctly understanding the roles of vaccination in ending the COVID-19 pandemic. The theory of Peltzman Effects in Vaccinations posits that vaccination could potentially mitigate the immediate risk of severe complications

and high mortality rates associated with COVID-19. However, according to the theory, individuals will engage in more hazardous behaviour as safety measures are strictly enforced, and those who have received fewer COVID-19 vaccinations will perceive the risk less strongly [46]. Following vaccination, individuals would be more likely to engage in risky behaviour and make erroneous decisions, potentially contributing to the increased transmission of the viral agent within the population [10]. Sanctions such as suspension or termination of social security or social benefits, suspension or termination of government administrative services, and/or penalties may be imposed on such individuals [47]. Variables other than sanctions include, for instance, policies mandating COVID-19 vaccination for employees at government and private offices or school personnel. Encouragement of persuasion techniques [8] and the allocation of funds [48, 49] to ensure vaccine accessibility should be considered by health policymakers.

This study has some limitations. Data collection was performed online because the research was conducted during the pandemic. There was no direct meeting between the respondents and the researchers. Therefore, they could not directly ask understandable questions, if any. However, the questionnaire has a language comprehension test to minimize the obstacles. In addition, the age group of children was not included in the respondents' inclusion criteria because of the Circular Letter by the Directorate General of Disease Prevention and Control of the Ministry of Health HK.02.02/I/1727/2021 regarding the Third Period of Vaccination for Vulnerable Societies and Other Common Societies and the COVID-19 vaccination implementation for children aged 12–17 years, issued on June 30, 2021. This circular letter was issued during the data collection; thus, this study could not accommodate children aged 12–17.

Essentially, this study demonstrates the importance of promoting vaccination acceptance among the Indonesian populace. Even though the President of Indonesia pronounced the pandemic over, efforts to assist Indonesia's immunization program must continue. As reported by the previous qualitative study in Indonesia, caregivers and stakeholders believed that improved vaccine uptake was due to better knowledge and awareness among the nuclear and extended family [50]. The public can be made aware of their susceptibility to contracting COVID-19 by washing their hands, donning masks, maintaining a safe distance, avoiding crowds, and limiting their mobility by disseminating pertinent information. Other information for the public pertains to vaccination benefits, such as protection from COVID-19 infections, prevention of COVID-19 severity, and reduction of COVID-19-related morbidity and mortality. A previous report found that the majority of caregivers mostly use local health posts to obtain information about vaccination programs [50, 51]. Thus, we could start to spread positive information about vaccination through the local media in order to increase vaccine acceptance.

The government should disclose the level of efficacy of each COVID-19 vaccine used in Indonesia, the safety and halal status of the vaccine, and the veracity of rumours regarding the COVID-19 vaccine. Public concerns regarding post-

immunization incidents can be minimized by providing information on adverse effects after COVID-19 vaccination that can be accessed on the government's official website (<https://kipi.covid19.go.id>). The government can also socialize with the public before the vaccination about schedules and places for COVID-19 vaccination, and the public can access the site (<https://covid19.go.id/faskesvaksin>). The government can take those steps to increase COVID-19 vaccination acceptance among Indonesians. Moreover, the public's trust in vaccination programs is contingent upon their contributions to the community, encompassing social, political, moral, and biological aspects [52]. The scope of public health and its initiatives should extend beyond the mere use of vaccine technology [37]. The process of implementing these improvements, both in terms of narrative work and policy actions, will be crucial in attaining genuine vaccine confidence, regardless of the public's response to the precise COVID-19 vaccine that may be created.

CONCLUSION

In accordance with the Health Belief Model Theory, the factors that had the greatest impact on COVID-19 vaccination adoption in Singkawang City, West Kalimantan, Indonesia, were cues to action and self-efficacy. The Indonesian government should prioritise the aforementioned factors to develop a persuasion strategy that will increase vaccine acceptability among the targeted population. Providing Indonesians with *halal* certification for any medication intervention could be a crucial strategy for gaining the public's trust in the program. Ongoing vaccine awareness campaigns must be implemented in conjunction with complete government funding for vaccinations. The government must prioritize the enhancement of health education and public awareness as a pivotal concern to ensure the success of forthcoming health programs.

AUTHORS' CONTRIBUTION

Each author contributed to the conception and design of the study. TL was in charge of data acquisition. TL, AW, and PEND all participated in the interpretation and analysis of data. TL and PEND drafted the initial version of the manuscript, and AW provided feedback on earlier versions of the document. All authors have viewed and approved the final manuscript version.

LIST OF ABBREVIATIONS

HBM	=	Health Belief Model
UNICEF	=	United Nations Children's Fund
OR	=	Odds Ratio
COVID-19	=	Coronavirus Disease of 2019

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The ethical clearance has been obtained from the Health Research Ethics Committee of Dr. Abdul Aziz Regional Public Hospital of Singkawang, with the Certification Number of Ethical Review, 16/KEPK/2021, dated July 1, 2021.

HUMAN AND ANIMAL RIGHTS

No animals were used in this research. All procedures performed in studies involving human participants were in accordance with the ethical standards of institutional and/or research committees and with the 1975 Declaration of Helsinki, as revised in 2013.

CONSENT FOR PUBLICATION

Informed consent was obtained from all participants.

STANDARDS OF REPORTING

STROBE guidelines were followed.

AVAILABILITY OF DATA AND MATERIALS

The data and supportive information are available within the article.

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CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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