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Acceptance of COVID-19 Booster Dose 3 Based on the Health Belief Model: A Study at Peureulak Public Health Center

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ABSTRACT

Background: The COVID-19 vaccination program faces significant challenges due to public hesitation, with some individuals rejecting or harboring doubts across the 34 provinces of Indonesia. The Health Belief Model, one of the most widely used theories for understanding health and illness behaviors, provides a framework for examining participants' perceptions of susceptibility, severity, benefits, barriers, self-efficacy, and cues to action regarding COVID-19 vaccination. This study aimed to assess the acceptance of the third dose of the COVID-19 vaccine (Booster) using the Health Belief Model. **Method:** This research employed an analytical quantitative approach with a cross-sectional design, involving 394 participants selected through purposive sampling, and was conducted at the Peureulak Public Health Center, East Aceh. Data analysis methods applied include univariate, bivariate, and multivariate. **Result:** Results showed a significant association between perceived susceptibility and vaccine acceptance, particularly concerning infection risk. However, no significant relationship was identified between perceived severity and acceptance. Perceived benefits, in the terms of the belief that vaccination could reduce the risk of infection or complications and alleviate concerns about COVID-19 were strongly associated with vaccine acceptance. Perceived barriers were also significantly related to vaccine acceptance, especially regarding concerns over potential side effects. Additionally, cues to action, such as adequate information about COVID-19 and vaccination, positively contributed to increased vaccine acceptance. **Conclusion:** perceived susceptibility, perceived benefits, perceived barriers, and cues to action were significantly related to vaccine acceptance.

Introduction

On March 11, 2020, the World Health Organization (WHO) declared the novel coronavirus (COVID-19) a global pandemic [1]. By October 3, 2023, more than 676 million cases and over 6.88 million deaths had been reported globally since the onset of the pandemic [2]. As of December 8, 2022, the total number of Indonesians who have received the first dose of COVID-19 vaccination is 86.85%, the second dose is 74.32%, the third dose is 28.70% and the fourth dose is 4.26% [3]. The cumulative cases of Covid-19 cases in Aceh have reached 26,720 people, as of August 13, 2021. There are 6,227 Covid-19 patients being treated. There are 19,353 Covid-19 survivors. Meanwhile, the cumulative death toll has reached 1,140 people. Various treatment strategies have been employed in an attempt to mitigate the surge in morbidity and mortality caused by the SARS-CoV-2 virus [4]. However, despite these efforts, the number of cases and deaths remains difficult to control and continues to rise. In addition to medical treatments, countries have implemented various preventive measures, such as social distancing and mandatory face mask use, in order to slow the transmission of the disease.

In December 2020, the United States Food and Drug Administration (FDA) approved the Pfizer-BioNTech COVID-19 vaccine [5], followed by the authorization of other vaccines developed by Moderna, AstraZeneca/Oxford, and Janssen. Consequently, mass vaccination campaigns against COVID-19 were initiated worldwide.

The first batch of COVID-19 vaccines arrived in Indonesia on December 6, 2020, comprising 1.2 million doses of CoronaVac, produced by Sinovac. The Indonesian government launched its COVID-19 vaccination program on January 13, 2021, after receiving Emergency Use Authorization (EUA) from the National Agency of Drug and Food Control (BPOM) [6]. A four-dose vaccination scheme was implemented, with priority for the fourth dose given to healthcare workers. As of December 8, 2022, the percentages of Indonesians receiving COVID-19 vaccinations were as follows: 86.85% for the first dose, 74.32% for the second dose, 28.70% for the third dose (booster), and 4.26% for the fourth dose [7].

In Aceh, the first dose of vaccination has reached 3,525,767 residents, or around 87.5% of the total target of Covid-19 vaccination in Aceh which reached 4,028,891 people, the second dose of vaccination has been received by 1,624,544 people, or around 40.3%, and the booster vaccination has reached 75,746 residents, with a total target of Covid-19 vaccination in Aceh of 4,028,891 people. as of February 11, 2022. In Peureulak Subdistrict, East Aceh as of November 28, 2022, only 14.3% of the population had received the third dose (booster), leaving approximately 85.7% who either refused or delayed receiving it. Peureulak Subdistrict is one of the regions with the lowest distribution of third-dose (booster) COVID-19 vaccinations in East Aceh Regency [8].

A survey of 115,000 individuals across 34 provinces in Indonesia revealed that a portion of the population still rejects or remains hesitant about vaccination programs [9]. In response, the World Health Organization (WHO) established the Strategic Advisory Group of Experts (SAGE) working group to address vaccine hesitancy and its scope [10]. Vaccine hesitancy is defined as the refusal or delay of vaccination despite the availability of vaccination services. In 2019, vaccine hesitancy was listed among the top 10 global health threats [11]. Hesitancy toward vaccination can be influenced by various factors, including concerns about vaccine safety and efficacy, fear of post-immunization side effects, attitudes of healthcare workers toward COVID-19 vaccination, the availability of COVID-19 vaccines in healthcare facilities, mandatory COVID-19 vaccination policies, and sociodemographic factors, many of which are closely linked to public participation in COVID-19 vaccination programs [12].

The Health Belief Model (HBM) is one of the most widely used theories for understanding health and illness behaviors. The key components of HBM include perceived susceptibility, perceived severity, perceived benefits, perceived barriers, self-efficacy, and cues to action. Perceived susceptibility refers to beliefs about vulnerability to infection, while perceived severity relates to beliefs about the negative effects of contracting an infection. In the context of vaccination, perceived benefits refer to an individual's belief in the advantages of receiving a vaccine, while perceived barriers involve beliefs that vaccination is hindered by psychosocial,

physical, or financial factors. Cues to action include information, people, and events that prompt an individual to get vaccinated.

The components of HBM are recognized as significant predictors of influenza vaccine uptake and have been utilized in numerous previous studies [13–15]. Thus, exploring the HBM components that significantly influence COVID-19 vaccination could be critical for tailoring interventions to enhance the acceptance of the third dose (booster). HBM has been employed to predict COVID-19 vaccination intentions in various countries [16] and provides a useful framework for explaining and predicting COVID-19 vaccine hesitancy [17].

The COVID-19 vaccine has provided new hope for Indonesian society, including the community within the working area of the Peureulak Public Health Center, which has been affected by the pandemic. However, while some individuals willingly accept the vaccine, others firmly refuse it. Therefore, this study aims to examine community acceptance of the COVID-19 third dose (booster) in the Peureulak Public Health Center area using the HBM theories.

Materials and Method

Study design and study population

This study is a quantitative analytical study using a cross-sectional design, where data collection is conducted at a single point in time, and data for each variable is gathered simultaneously. The data used are primary data obtained through questionnaires designed to gather detailed information on the acceptance of COVID-19 vaccines in the working area of the Peureulak Public Health Center, aiming to identify behaviors related to vaccine acceptance based on the Health Belief Model.

The study was conducted in the working area of the Peureulak Public Health Center, East Aceh, in July 2023. The study population comprised all individuals aged 18–59 years within the Peureulak Public Health Center's jurisdiction, totaling 24,805 people [18]. A sample of 394 participants was selected using purposive sampling and calculated using the Slovin formula [19]. Healthcare workers and individuals with chronic illnesses such as cancer, heart failure, hypertension, chronic kidney failure, and diabetes were excluded from the sample.

Data collection

The research instrument consisted of a questionnaire divided into two sections. The first section, the COVID-19 Vaccination Acceptance Questionnaire, contained questions regarding the completion of the third dose (booster) of COVID-19 vaccination. The second section included a questionnaire exploring factors influencing vaccine acceptance based on the Health Belief Model, covering independent variables (perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and cues to action) and the dependent variable (COVID-19 vaccine acceptance).

The second part of the questionnaire is an adaptation of a previously developed questionnaire in English, which was used by Li Ping Wong from the University of Malaya, Malaysia [16]. The questionnaire was modified by the researcher to ensure better comprehension by respondents in this study. For instance, phrases such as "serious threat" were rephrased as "death" for clarity. Additionally, while the original questionnaire used statements, they were converted into questions to make them easier for respondents to understand. The final questionnaire consists of 16 questions and 2 open-ended questions regarding the primary reasons respondents accepted or refused the COVID-19 third dose (booster). Responses to the questionnaire were measured using a dichotomous scale. The critical value from the product-moment table for 30 respondents at a 5% significance level is 0.361. Each question with a value ≥ 0.361 was deemed valid. Reliability was measured using Cronbach's alpha, which yielded a value of 0.889. The Kuder-Richardson (KR-20) method, commonly used for dichotomous scales, provided a reliability score of 0.895, indicating very strong reliability [20].

Respondents were offered two answer choices: "yes" and "no." For positive questions, "yes" was assigned a score of 1 and "no" a score of 0. Conversely, for negative questions, "yes" was assigned a score of 0 and "no" a score of 1. Primary data for this study were collected directly

from respondents through completed questionnaires. Secondary data were obtained from the East Aceh District Health Office and the Peureulak Public Health Center regarding COVID-19 vaccination distribution and population statistics within the working area of the Peureulak Public Health Center.

To facilitate data collection, the researcher enlisted the help of two surveyors. Prior to data collection, the surveyors underwent a one-day briefing session conducted by the researcher. This session covered the study's objectives, the content of the questionnaire, and the correct method of completing it. The researcher adhered strictly to ethical principles throughout the study. These principles included respecting individual integrity, ensuring the rights of respondents were honored, and treating all participants equally. Respondents' decisions to participate were free from external pressure. Researchers and surveyors met respondents who visited the Pereulak Health Center, introduced themselves and explained the purpose of the research and respondents filled out the questionnaire. Before commencing the study, the researcher clarified the study's purpose and objectives and obtained informed consent, which respondents were required to read and agree to. All data collected from participants were kept confidential and used solely for research purposes.

Data analysis

The data analysis methods utilized in this study included univariate analysis, bivariate analysis, and multivariate analysis. Univariate analysis was employed to describe the frequency distribution of both independent and dependent variables. This approach provided insights into the characteristics of each variable in the study. The independent variables included perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and cues to action, while the dependent variable was the acceptance of the COVID-19 vaccine. Bivariate analysis was conducted to evaluate the correlation between independent and dependent variables. The chi-square test was applied for this purpose, allowing researchers to test hypotheses involving nominal-level variables. Similar to other inferential statistical methods, the reliability of the chi-square test increases when the data are derived from large, random samples [21]. Multivariate analysis was used to integrate multiple independent variables and the dependent variable to identify the strongest relationships among them. Logistic regression analysis was chosen as the statistical method since both independent and dependent variables were measured on categorical scales. This analysis is crucial because a dependent variable, such as vaccine acceptance, is unlikely to be influenced by a single factor alone. All statistical analyses were conducted using SPSS software to ensure accurate and efficient processing.

Ethical consideration

The Universitas Ahmad Dahlan Ethical Review Committee (approval number 012209136) gave its stamp of approval to this study. All participants provided voluntary and written informed permission in accordance with the principles outlined in the Declaration of Helsinki (2013 revision).

Results

The study was conducted at the Peureulak Public Health Center (Puskesmas Peureulak), located in the village of Alue Nibong Village, Peureulak Subdistrict, East Aceh Regency. This public health center serves a working area comprising 30 villages with a total population of 40,426 residents. It is one of the 28 public health centers in East Aceh Regency, situated approximately 20 km east of the East Aceh Regency government center. The sub district capital is located about 4 km from the health center, with the working area covering 30,039 km². Geographically, Peureulak Public Health Center is bordered by Rantau Peureulak Sub district to the north, East Peureulak Sub district to the east, the Malacca Strait to the south, and West Peureulak Sub district to the west. Then, as many as 394 participants completed the self-administered questionnaire, with an average age of 35 years (SD = 10.40), and the most of them was female (249; 63.20%).

Table 1. Acceptance of the Third Dose of COVID-19 Vaccine (Booster)

Variables (N=394)	n (%)
Acceptance of the Third Dose (Booster) of COVID-19 Vaccine	
Already vaccinated	113 (28.7)
Unvaccinated	281 (71.3)

COVID-19 vaccination services at Peureulak Public Health Center are provided daily without restrictions on the number of recipients who visit the health center. Reporting is conducted online each day. Mass vaccination events are organized monthly in each village on a rotational, monthly basis in each village. The health center collaborates with village leaders and sub district officials in Peureulak to facilitate mass vaccination campaigns, ensuring that the community has access to COVID-19 vaccines.

The acceptance of the third dose (booster) of the COVID-19 vaccine, as well as perceptions of susceptibility, severity, benefits, barriers, and cues to action among the community within the working area of Peureulak Public Health Center, East Aceh, indicates that 281 respondents (71.3%) reported not having received the COVID-19 booster vaccine (Table 1).

The variable of perceived susceptibility indicates that while the majority of respondents believe contracting COVID-19 is possible (55.6%), a significant proportion also feel it is highly unlikely they will contract the virus in the near future (87.6%). All sub-variables under perceived severity suggest that respondents generally agree with each indicator of severity. The variable of perceived benefits shows that respondents tend to agree on the advantages of vaccination, with 68.3% believing that vaccines can reduce the risk of infection or complications, and 55.6% feeling that vaccination can alleviate concerns associated with COVID-19. For perceived barriers, most unvaccinated respondents who have not been vaccinated tend to believe that vaccines are effective and safe. However, many express concerns about vaccine side effects, which appear to be a more significant barrier compared to other indicators of perceived barriers. Finally, the variable of cues to action demonstrates that a large proportion of respondents find the information they have received to be adequate (76.6%), and a substantial number report being advised to get vaccinated (83.5%) (Table 2).

Bivariate analysis conducted to evaluate the correlation between two variables, specifically the relationship between HBM components and the acceptance of the COVID-19 third dose (Booster) vaccine, reveals that almost all sub-variables have a p-value ≤ 0.05. This indicates a significant association with vaccine acceptance. However, there is one sub-variable that shows no significant relationship with vaccine acceptance: concerns about vaccine accessibility. The sub-variable "vaccine reduces infection or complications" has an odds ratio (OR) of 7.136, meaning respondents who believe that vaccines are beneficial in reducing infections or complications are seven times more likely to accept the vaccine compared to those who do not perceive such benefits (Table 3).

In the multivariate analysis conducted to identify the variables most strongly associated with vaccine acceptance using logistic regression, six sub-variables were found to be significantly related to the acceptance of the COVID-19 third dose (Booster). These sub-variables are: concern about contracting COVID-19, belief that contracting COVID-19 is likely, perception that the vaccine reduces infection or complications, perception that the vaccine alleviates worry, concern about vaccine side effects, and adequacy of information received.

The most dominant factor associated with vaccine acceptance was the perception that the vaccine reduces worry, as it had the smallest p-value ($p = 0.001$) and the highest odds ratio (OR = 3.096; 95% CI: 1.588–6.037). This indicates that respondents who did not believe the vaccine could reduce their worry about contracting COVID-19 were three times more likely to refuse the vaccine compared to those who believed the vaccine alleviates worry. The R-square value in the multivariate analysis was 0.383, indicating that the analyzed variables explained 38.3% of the variance in acceptance of the third dose (booster) of the COVID-19 vaccine. The remaining 61.7% is influenced by other factors not examined in this study.

Table 2. Vaccine Acceptance based on the Health Belief Model

Variables	Vaccine Receipt		Total n (%)
	Already Vaccinated n (%)	Unvaccinated n (%)	
Perception of Susceptibility			
Worried about contracting COVID-19			
Yes	82 (44.6)	102 (55.4)	184 (46.7)
No	31 (14.8)	179 (85.2)	210 (53.3)
The possibility of getting infected in the near future is very high			
Yes	27 (55.1)	22 (44.9)	49 (12.4)
No	86 (24,9)	259 (75.1)	345 (87.6)
Getting infected with COVID-19 is possible			
Yes	91 (41.6)	128 (58.4)	219 (55.6)
No	22 (12.6)	153 (87.4)	175 (44.4)
Perception of Severity			
COVID-19 causes death			
Yes	89 (36.2)	157 (63.8)	246 (62.4)
No	24 (16.2)	124 (83.8)	148 (37.6)
Fear of contracting COVID-19			
Yes	95 (40.4)	140 (59.6)	235 (59.6)
No	18 (11.3)	141 (88.7)	159 (40.4)
Feeling very sick if you have COVID-19			
Yes	85 (37.9)	139 (62.1)	224 (56.9)
No	28 (16.5)	142 (83.5)	170 (43.1)
Perception of Benefits			
Vaccines reduce infections or complications			
Yes	103 (38.3)	166 (61.7)	269 (68.3)
No	10 (8.0)	115 (92.0)	125 (31.7)
Vaccines reduce anxiety			
Yes	91 (41.6)	128 (71.3)	219 (55.6)
No	22 (12.6)	153 (87.4)	175 (44.4)
Perception of Barriers			
Worried that the vaccine won't work			
Yes	35 (22.7)	119 (77.3)	154 (39.1)
No	78 (32.5)	162 (67.5)	240 (60.9)
Worried that vaccines are not safe			
Yes	33 (22.1)	116 (77.9)	149 (37.8)
No	80 (32.7)	165 (67.3)	245 (62.2)
Worried about vaccines being hard to reach			
Yes	18 (30.0)	42 (70.0)	60 (15.2)
No	95 (28.4)	239 (71.6)	334 (84.8)
Worried about vaccine side effects			
Yes	45 (21.1)	168 (78.9)	213 (54.1)
No	68 (37.6)	113 (62.4)	181 (45.9)
Worried about the halalness of vaccines			
Yes	29 (21.3)	107 (78.7)	136 (34.5)
No	84 (32.6)	174 (67.4)	258 (65.5)
Cues to Action			
Adequate vaccine information			
Yes	102 (33.8)	200 (66.2)	302 (76.6)
No	11 (12.0)	81 (88.0)	92 (23.4)
Many advise to get vaccinated			
Yes	104 (31.6)	225 (68.4)	329 (83.5)
No	9 (13.8)	56 (86.2)	65 (16.5)

Table 3. Health Belief Model and Acceptance of the Third Dose of COVID-19 Vaccine (Booster)

Variables	Adjusted OR (95% CI)	P-value
Perception of Vulnerability		
Worried about contracting COVID-19	2.150 (1.153 – 4.010)	0.016*
The possibility of getting infected in the near future is very high	1.271 (0.585 – 2.760)	0.545
Getting infected with COVID-19 is possible	2.367 (1.257 – 4.456)	0.008*
Perception of Severity		
COVID-19 causes death	0.921 (0.451 – 1.879)	0.820
Fear of contracting COVID-19	1.332 (0.636 – 2.788)	0.447
Feeling very sick if you have COVID-19	1.295 (0.648 – 2.588)	0.465
Perception of Benefits		
Vaccines reduce infections or complications	2.600 (1.132 – 5.973)	0.024*
Vaccines reduce anxiety	3.096 (1.588 – 6.037)	0.001*
Perception of Barriers		
Worried that the vaccine won't work	1.165 (0.576 – 2.356)	0.670
Worried that vaccines are not safe	0.452 (0.194 – 1.054)	0.066
Worried about vaccines being hard to reach	0.620 (0.281 – 1.364)	0.234
Worried about vaccine side effects	2.512 (1.249 – 5.056)	0.010*
Worried about the halalness of vaccines	1.627 (0.769 – 3.442)	0.203
Cues to Move (Cues to Action)		
Adequate information	2.357 (1.053 – 5.275)	0.037*
Many advise to get vaccinated	1.481 (0.610 – 3.596)	0.385
Perception of Vulnerability		
Worried about contracting COVID-19	4.642 (2.874 – 7.498)	0.000*
The possibility of getting infected in the near future is very high	3.696 (2.001 – 6.826)	0.000*
Getting infected with COVID-19 is possible	4.944 (2.935 – 8.329)	0.000*
Perception of Severity		
COVID-19 causes death	2.929 (1.761 – 4.871)	0.000*
Fear of getting infected	5.315 (3.050 – 9.263)	0.000*
Feeling very sick if you have COVID-19	3.101 (1.906 – 5.047)	0.000*
Perception of Benefits		
Vaccines reduce infections or complications	7.136 (3.574 – 14.246)	0.000*
Vaccines reduce anxiety	4.944 (2.935 – 8.329)	0.000*
Perception of Barriers		
Worried that the vaccine won't work	1.637 (1.030 – 2.603)	0.048*
Worried that vaccines are not safe	1.704 (1.065 – 2.727)	0.034*
Worried about vaccines being hard to reach	0.927 (0.508 – 1.692)	0.928
Worried about vaccine side effects	2.247 (1.439 – 3.509)	0.000*
Worried about the halalness of vaccines	1.781 (1.096 – 2.896)	0.026*
Cues to Move (Cues to Action)		
Adequate information	3.755 (1.915 – 7.364)	0.000*
Many advise to get vaccinated	2.876 (1.371 – 6.035)	0.006*

* there is a significant relationship (α ≤ 0.05)

Discussion

Perceived Susceptibility

In this study, two categories were found to be associated with vaccine acceptance: concern about contracting COVID-19 and the belief that contracting COVID-19 is likely. These findings align with the previous research, which suggests that concern about infection heightens the perceived likelihood of contracting COVID-19 [16]. A study conducted in Egypt revealed that concern about contracting COVID-19 may stem from expectations that COVID-19 is a severe disease and the belief that it is incurable. Additionally, concern about infection has been linked to high levels of discrimination and stigma within the surrounding community [22].

Although many vaccinated individuals believe that contracting COVID-19 is possible, they feel it is unlikely to occur in the near future. This sentiment may be influenced by the World Health

Organization's (WHO) official termination of the Public Health Emergency of International Concern (PHEIC) status for COVID-19. In Indonesia, since early pandemic in January 13, 2020, the President announced the transition of the COVID-19 pandemic status to an endemic phase. However, the Ministry of Health spokesperson stated that as of May 2023, approximately 30% of hospitalized COVID-19 patients were individuals who had not received a complete vaccination up to the third dose (Booster). The spokesperson urged continued vigilance, emphasizing that COVID-19 has not been fully eradicated and that the risk of transmission remains. In Aceh, the Regional Police (POLDA Aceh) continued conducting COVID-19 vaccination campaigns as recently as June 2023 [23].

Perceived Severity

This study examines perceived severity through three categories: belief that COVID-19 can cause death, fear of contracting COVID-19, and the expectation of severe illness if infected. Multivariate analysis revealed that none of the categories of perceived severity were the most influential predictors of vaccine acceptance. This finding aligns with a study conducted in China, which demonstrated that the Health Belief Model (HBM) components can serve as effective predictors of vaccine acceptance, except for perceived severity [24] (Hu et al., 2022). The results of this study indicate that most participants believe COVID-19 can cause death and that they would experience severe illness if infected. However, many still refused the vaccine. Among 168 respondents who declined the booster dose, a significant concern was the fear of vaccine side effects. Previous studies identified the main reasons for rejecting the booster vaccine as inconvenience or lack of time, concerns about potential side effects, a decline in COVID-19 cases, and the absence of vaccine recommendations [25]. Booster vaccines are strongly recommended to reduce the risk of mortality. On November 8, 2022, a total of 27,081 patients confirmed to have COVID-19 were hospitalized. Nearly half (10,639 patients) experienced moderate, severe, or critical symptoms, and 74% of them had not received a COVID-19 booster dose [26].

The findings also reveal that most vaccinated and unvaccinated individuals reported fear of contracting COVID-19. During the pandemic, psychological impacts such as fear and anxiety were common, particularly as infection rates and death tolls surged [27]. Prior research suggested that exposure to COVID-19 information through media influenced fear levels, shaping beliefs about the virus's severity, susceptibility to infection, and preventive measures. It also noted that individuals who did not fear contracting COVID-19 perceived themselves as low risk and were less likely to adopt preventative measures [28] (Hita et al., 2023). Another study conducted in Italy found that specific groups, including young adult women, urban residents, divorced women, healthcare workers, individuals in quarantine, those suspected of being infected, and individuals with mental health issues, were at higher risk of experiencing fear related to COVID-19 [29].

Perceived Benefits

In this study, perceived benefits are categorized into two dimensions: the belief that vaccines reduce infection or complications and the belief that vaccines reduce anxiety. A study conducted in China found that perceived benefits are a significant dimension associated with the acceptance of the third dose (booster) of the COVID-19 vaccine [30]. Similarly, research has shown that the majority of respondents believe that the booster dose reduces the likelihood of contracting COVID-19 and its complications, thus safeguarding their work [31]. These findings align with a study in Romania, where most respondents agreed that the booster dose would protect them and their families from severe complications of COVID-19, even if they did not consider themselves at high risk of severe outcomes [32]. In Jordan, research found that the most common reasons for rejecting the booster dose were beliefs that the benefits of the booster vaccine were not scientifically proven, that a booster dose was unnecessary for at least one year, and that it was unnecessary for those who had previously contracted COVID-19 [33]. However, a large-scale study involving 1.15 million participants demonstrated that the third dose of the BNT162b2 vaccine was 91% effective against symptomatic infection, 93% effective in preventing hospitalization, and 92% effective in reducing severe cases compared to only two doses of the

vaccine [34]. Another study in Poland revealed that COVID-19 vaccination significantly reduced anxiety related to infection and the disease itself. Following vaccination, individuals reported increased satisfaction with life, mental health, and financial stability compared to those who had not completed vaccination (one dose). Those who rejected the vaccine exhibited lower levels of anxiety and adherence to government recommendations to limit the spread of SARS-CoV-2 [35].

Perceived Barriers

In this study, concerns about side effects emerged as a category of perceived barriers significantly associated with the acceptance of the third dose (booster) of the COVID-19 vaccine. A study investigating booster vaccine acceptance across 14 countries in the Eastern Mediterranean region found that approximately one-quarter of respondents declined vaccination due to witnessing severe side effects in vaccinated individuals. Hesitancy toward receiving the booster dose was linked to concerns over vaccine safety and efficacy [22]. Contrarily, research in Spain has demonstrated the effectiveness of the booster dose in enhancing protection against SARS-CoV-2 infection and mitigating the severity of COVID-19 complications [36]. Similarly, a multinational study indicated that the rapid development of vaccine formulas was associated with concerns about side effects [37]. Some global communities have been influenced by conspiracy theories regarding the origins of SARS-CoV-2 and COVID-19 vaccines. For example, a study conducted in Arab countries (primarily Jordan and Kuwait) reported that about one-quarter of participants believed that COVID-19 vaccines were intended to implant microchips in recipients and could cause infertility [38] refused additional doses of the COVID-19 vaccine, with side effects being the primary barrier [39].

Regarding vaccine safety, other research has documented that pain is the most commonly reported side effect. Some individuals experienced tachycardia, elevated liver enzyme levels, and chest pain following the third (booster) dose of the COVID-19 vaccine [40]. This highlights the necessity of conducting preliminary health assessments before administering booster vaccines. This study also revealed that the public does not perceive accessibility as a barrier since the Indonesian government provides free vaccination services up to the booster dose [41]. Additionally, concerns about the vaccine's halal status were minimal. The Indonesian Ministry of Health, with a recommendation from the Supreme Court, approved the Sinovac vaccine as one of the halal-certified booster vaccines under the MUI Fatwa No. 2 of 2021 [3]. Islamic values are crucial considerations for young Muslim individuals when using halal-certified vaccines [42].

Cues to Action

This study found that the availability of adequate information significantly influences the acceptance of COVID-19 booster vaccination. Research conducted in Saudi Arabia indicates that sufficient information about the third dose of the COVID-19 vaccine and vaccine acceptance among coworkers contribute to vaccine uptake [43]. Similarly, a study in Kuwait revealed that individuals who lacked adequate information from healthcare providers or did not have family members with a college degree who had received the vaccine were more hesitant about vaccination [44]. Effective communication to educate the public, correct misinformation, and emphasize the benefits of vaccination has been identified as a key strategy to increase vaccine acceptance [45].

Although this study shows that most respondents believed they had received sufficient information about COVID-19 and vaccination, many still refused the booster dose. This refusal can be attributed to the widespread circulation of hoaxes in Indonesia. These hoaxes have fueled vaccine rejection due to the dissemination of false information. A study analyzing vaccine-related misinformation found that rumors included claims that COVID-19 vaccines contained hazardous substances such as formalin, Vero cells, and borax. Some even believed that the vaccines were made from male fetuses. Hoaxes also spread false claims about side effects, including infertility, death, male genital enlargement, and DNA alteration [46]. Additionally, social media posts falsely claimed deaths caused by COVID-19 vaccines; these were promptly debunked by Indonesia’s National Committee for Post-Immunization Events (Komnas KIPI) as misinformation [47].

The study further revealed that advice to get vaccinated, though widespread, did not significantly influence booster vaccine acceptance. More than 80% of respondents reported receiving advice to get vaccinated but still refused the booster dose. This indicates that vaccine acceptance and rejection cannot be attributed to a single factor. Research has identified various reasons for vaccine hesitancy, including doubts about vaccine safety, feeling no need for vaccination, lack of trust in the government and vaccine efficacy, fear of vaccination (e.g., fear of needles), and perceived inability to access vaccines [48].

The Most Influential Factor in Acceptance of the COVID-19 Booster Vaccine

This study identified the perception of benefit, particularly the belief that vaccination reduces anxiety about contracting COVID-19, as the most influential factor in booster vaccine acceptance. Similar findings have been reported in other studies, which highlight that the perception of benefit is the most significant predictor of vaccine acceptance [16,30,43,49]. Several variables were significantly associated with vaccine acceptance after controlling for other factors. These include concerns about contracting COVID-19, the perception that contracting COVID-19 is possible, the belief that vaccination reduces infection or complications, the perception that vaccination alleviates anxiety, concerns about vaccine side effects, and the availability of adequate information.

Conclusion

The distribution of frequency for perceived susceptibility indicates that 46.7% of respondents reported being worried about contracting COVID-19, 12.4% perceived a very high likelihood of being infected in the near future, and 55.6% believed that contracting COVID-19 was a possibility. Regarding perceived severity, 62.4% of respondents believed that COVID-19 could cause death, 59.6% reported fear of infection, and 56.9% stated they would feel severely ill if infected with COVID-19. For perceived benefits, 68% of respondents believed vaccination could reduce the risk of infection or complications, while 55.6% felt it could alleviate concerns about COVID-19. Conversely, in terms of perceived barriers, 39.1% of respondents were concerned about the vaccine's efficacy, 37.8% doubted its safety, 15.2% stated the vaccine was difficult to access, 54.1% worried about side effects, and 34.5% expressed doubts regarding the halal status of the COVID-19 vaccine. Meanwhile, in the cues to action dimension, 76.6% of respondents felt they had received adequate information about vaccination, and 83.5% acknowledged having been advised by others to get vaccinated. Nevertheless, 71.3% of respondents reported not having received the third dose of the COVID-19 vaccine (Booster).

The analysis of relationships between variables revealed a significant association between perceived susceptibility and vaccine acceptance, particularly in terms of concerns about contracting COVID-19 and believing that infection was a possibility. However, no significant relationship was found between perceived severity and acceptance of the COVID-19 Booster vaccine. Perceived benefits showed a significant association, especially regarding the belief that vaccination could reduce infections or complications and alleviate concerns about COVID-19. Perceived barriers were also related to vaccine acceptance, particularly concerning worries about side effects. Additionally, cues to action, such as adequate information about COVID-19 and vaccination, contributed to improved vaccine acceptance. Perceived benefits, specifically the belief that vaccination can reduce concerns about COVID-19, emerged as the most influential factor in accepting the third dose of the COVID-19 vaccine (Booster). These benefits, alongside information regarding vaccine side effects, are crucial components in enhancing vaccine acceptance. Therefore, strategies should be developed to disseminate information about the benefits of the third dose of the COVID-19 vaccine (Booster) and to address barriers related to side effects and vaccine safety.

Recommended strategies include raising awareness and disseminating accurate information through regular community outreach programs in different villages, involving influential figures such as village leaders or religious leaders. The content of the outreach messages should be culturally tailored and adapted to the community's level of understanding to address the root

causes of vaccine hesitancy. Furthermore, it is recommended that every patient visiting health centers (Puskesmas) be encouraged to receive the third dose of the COVID-19 vaccine (Booster). This approach can facilitate daily increases in vaccine acceptance rates. Collaborative efforts are anticipated to significantly enhance vaccination coverage.

Declaration

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