

Web-based learning about COVID-19 vaccination for improved knowledge and perception among community health workers

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Web-based learning about COVID-19 vaccination for improved knowledge and perception among community health workers

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Abstract

Aims: To ascertain how web-based learning interventions affect CHWs' understanding and attitudes regarding the COVID-19 vaccine.

Methods: The study conducted at the Pontianak City Health Center involved 44 CHWs who participated in this experimental study (22 in the intervention group and 22 in the control group). Participants in the experimental group learned about the COVID-19 vaccine via a website, whereas the control group used traditional printed modules. The CHW filled out a survey regarding their opinions and understanding of the COVID-19 vaccine. The independent samples t-test was the statistical method employed.

Results: The intervention group's mean knowledge scores, at 15.36 (SD 2.2), were statistically significantly higher than those of the control group, at 12.05 (SD 1.2), with a p-value of 0.000 ($\alpha < 0.05$), according to the results of the independent samples t-test. The perception of CHWs who received web-based education regarding the COVID-19 vaccine was also found to differ significantly from that of CHWs who received learning through printed modules, with higher perception scores of 53.77 (SD 1.4) compared to 48.18 (SD 3.5), with a p-value of 0.000 ($\alpha < 0.05$).

Conclusion: An efficient method for raising CHWs' awareness and understanding of the COVID-19 vaccine is web-based learning. In order to improve vaccine uptake among vulnerable populations, CHWs can provide health education and factual information regarding vaccinations as part of their healthcare services.

Keywords: Web-based learning, knowledge, perception, COVID-19 vaccination, community health workers (CHWs)

Introduction

The global coronavirus disease 2019 (COVID-19) pandemic is caused by SARS-COV-2 and was first identified in Wuhan City, Hubei Province, China, in December 2019 (Xu et al., 2020). The virus spread to various other regions in Asia and then rapidly spread worldwide in early 2020, and in May 2023, the WHO declared the public health emergency caused by COVID-19 over (Wise, 2023). In line with the WHO's declaration, the Indonesian government issued Presidential Decree of the Republic of Indonesia

Number 17 of 2023 concerning the Determination of the End of the Coronavirus Disease 2019 (COVID-19) Pandemic Status in Indonesia in June 2023.

The change in the endemic status of COVID-19 in Indonesia does not diminish efforts to address the COVID-19 issue. The Indonesian government, based on Minister of Health Regulation number 7 of 2023, needs to conduct vaccinations as part of the COVID-19 pandemic response. Especially in high-risk groups for COVID-19, such as the elderly (Müller et al., 2022), individuals with comorbidities (Silaghi-Dumitrescu et al., 2023), primary immunodeficiency diseases, pregnancy, smoking, those receiving corticosteroids or other immunosuppressive medications (NIH, 2023), obesity (Kuehn, 2021), and healthcare workers (WHO, 2022).

Acceptance of the COVID-19 vaccination remains a challenge for the Indonesian government. Although the number of first and second doses administered exceeds 70% (Kemenkes, 2024), vaccination coverage among vulnerable groups, especially the elderly, is still low (Kemenkes, 2025). According to data from the West Kalimantan Provincial Health Office, the vaccination rate among the elderly is approximately 0.5%, and 0.2% among other vulnerable groups, which means there is a threat to their health if they do not obtain vaccinated immediately, such as hypoxia, cardiovascular disorders, thromboembolic complications, and severe renal and gastrointestinal disorders (Gupta et al., 2020).

Low vaccination rates in vulnerable groups can be influenced by many factors such as vaccine availability (WHO, 2021), public knowledge and awareness (Lazarus et al., 2021), religious and cultural beliefs (Larson et al., 2014), perceptions of disease risk, complacency, discomfort, lack of confidence, and rational calculations of pros and cons (Betsch et al., 2015) as well as the influence of social media and misinformation (Puri et al., 2020), persepsi masyarakat yang rendah (Alfikrie et al., 2023), and hesitancy regarding the safety of the type of vaccine used (Perveen et al., 2022). In Indonesia, efforts to accelerate vaccine uptake during the endemic period are also supported by the government through the COVID-19 immunization program regulated by ministerial regulation number HK.02.02/C/2024. One of the strategies is to involve health cadres as part of health promotion and post-immunization monitoring.

The role of CHWs is crucial in efforts to socialize and motivate the community to accept vaccination (WHO, 2021). CHWs, as educators, provide information about vaccination, its benefits, and procedures, and correct misinformation circulating in the community using a communication- and trust-based approach (Kemenkes, 2021). However, the difference in knowledge and perception of CHWs regarding their function in efforts to increase COVID-19 vaccination acceptance remains a challenge today. Preliminary studies indicate that the knowledge level of CHWs regarding information about COVID-19 booster vaccinations is still considered low. Furthermore, five CHWs were unaware of COVID-19 information and had negative perceptions about vaccination.

Lack of knowledge or errors in receiving information can also lead to misperceptions about health issues. According to the concept of information processing theory, this theory explains that the output, which is the response or action produced, is based on two main components: the information obtained and information processing (Neisser, 2014). A previous study showed that 55.7% and 52.5% perceived barriers to the COVID-19 vaccine (Mohamed et al., 2023). Additionally, there is much missed or false

information about vaccination obtained through social media, chain messages, and also sourced from Indonesian online news portals and others, such as misleading stories and myths. This can lead to resistance and doubt among the Indonesian public toward the vaccine. This iteration can influence public attitudes, leading to distrust of the government and being misled by false information about vaccination programs (Ida et al., 2024)

Various strategies have been implemented to improve vaccination coverage in Indonesia, such as home visits by ambassadors to promote vaccination (Islam et al., 2024) and the use of mobile applications (AREEMA Self-Screening) (Sujarwoto et al., 2025), which have increased protective behaviors and vaccination rates. However, a method is needed that offers ease of accessibility, time flexibility, can be accessed anytime, and is interactive. Therefore, a strategy is needed to improve CHWs' knowledge and perceptions of COVID-19 vaccination. In this digital age, information technology has become an essential tool in the learning process. Learning through websites offers flexibility, ease of access, and the ability to present information interactively. Websites can be used as a platform to provide educational materials, such as videos, infographics, articles, and quizzes, which can be accessed anytime and anywhere (Dhawan, 2020). This study aims to determine the effectiveness of using website-based learning in improving knowledge levels and perceptions among CHWs in Pontianak City.

Methods

This research is a study on the effectiveness of a web-based learning system for CHW knowledge and perceptions of COVID-19 vaccination in Pontianak City. The research conducted was quasi-experimental, with measurements taken from two groups: an intervention group receiving website-based learning and a control group receiving conventional module-based learning.

This research was conducted at the Pontianak City Health Center, taking place from July to November 2025. The study population for this research is the CHW of Pontianak City. The sample size for this study was selected using the two-group sample size estimation with equal variances ($\alpha = 0.05$; power = 0.80) (Rosner, 2016). The standard deviation (σ) was determined from a previous study by Sinuraya et al., which was 1.74, and the difference between pre- and post-test scores (δ) was 1.5 (Cohen, $d=0.86$) (Sinuraya et al., 2023). The inclusion criteria for this study were 1) CHW aged 30-45 years, 2) understanding of smartphone and learning web usage, 3) never received training on COVID-19, 4) previously involved in vaccination implementation, and 5) minimum education of junior high school. A total of 44 CHWs were purposively selected and fully involved.

The research subjects involved were then divided into two main groups: the intervention group receiving web-based learning and the control group using conventional learning methods in the form of printed teaching modules. Before the intervention was implemented, both groups completed a pre-test questionnaire about knowledge and perceptions, which was administered online. Next, the intervention group received the learning process through a website developed by the researcher. Here is the website-based learning process.

Table 1. The learning process for CHWs through the COVID-19 learning website

Objective	Indicator	Study materials	Duration of learning hours	Activities Completed
Knowing the level of knowledge and perception about COVID-19 vaccination before learning begins	Knowledge and perceptions about COVID-19 vaccination	Pre-test questionnaire on knowledge and perceptions about COVID-19 vaccination	20 minutes	On the first day, knowledge and perception measurements were conducted
Able to explain about COVID-19	a. Able to explain the definition, causes, and transmission b. Able to explain signs and symptoms, management, and prevention.	a. Introduction of COVID-19 b. Definition of COVID-19 c. Causes and virology d. Transmission of COVID-19 e. Signs and symptoms f. Management g. Prevention	Intervention Group: 100 minutes of self-study on the web and 100 minutes of online discussion Control Group: 100 minutes of self-study using modules	a. On the second day, participants independently read and learned about the concept of COVID-19. b. On the third day, the researchers conducted follow-up and online discussions regarding understanding of the COVID-19 concept.
Able to explain about COVID-19 vaccination	a. Able to explain the definition, purpose, and target groups of COVID-19 vaccination. b. Able to explain the side effects, monitoring of side effects, and factors influencing vaccination.	a. Definition of vaccination b. Goals and benefits of vaccination c. Types of vaccination d. Target groups for vaccination e. Side effects f. Monitoring and management mechanisms for post-immunization events g. Safety of vaccination h. Factors influencing vaccination	Intervention Group: 100 minutes of self-study on the web and 100 minutes of online discussion Control Group: 100 minutes of self-study using modules	a. On the fourth day, participants independently read about the concept of COVID-19 vaccination. b. On the fifth day, the researchers conducted a follow-up and online discussion regarding understanding of COVID-19 vaccination
To understand the level of	Knowledge of COVID-19	Post-test questionnaire on	20 minutes	On the final day, participants took a

comprehension and perception after learning about COVID-19 vaccination.	vaccination and perceptions about COVID-19 vaccination	COVID-19 vaccination knowledge and perceptions about COVID-19 vaccination	post-test on their knowledge and perceptions of COVID-19 vaccination.
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Subjects in each group received instruction for six days. Each activity was conducted in stages, and the researcher followed up on learning outcomes and provided guidance/instructions to the intervention group thru the group. In the control group, each subject received a printed teaching module about COVID-19 vaccination.

This study uses two research questionnaires: a questionnaire on the level of knowledge about COVID-19 vaccination and a questionnaire on CHW' perceptions of COVID-19 vaccination. The questionnaires were developed based on the main theoretical concepts of COVID-19 vaccination during the endemic period and a perception questionnaire based on the theory of perception formation (Goldstein, 1989). The knowledge questionnaire consists of 20 questions using a Guttman scale, and the COVID-19 vaccination perception questionnaire consists of 13 questions using a Likert scale. The instrument's validity was assessed thru content validity by two experts (community health center nurses), and they all stated that the questionnaire was appropriate for the concepts being measured. Construct validity was assessed with 30 respondents at the Pontianak City Health Center. The results of the item-total correlation test on the knowledge questionnaire showed that all question items had a calculated r value > r table (0.361) and a Cronbach's alpha value of 0.9. Meanwhile, the results of the construct validity test on the perception questionnaire with item-total correlation showed that all r values were > r table (0.361) and the Cronbach's alpha value was 0.9. After the subjects completed the learning, the data obtained were analyzed. Data analysis began by testing the distribution of the research data using the Shapiro-Wilk test for data normality, the results of which showed that all data were normally distributed. The hypothesis test used to assess the effect of web-based learning with conventional modules is the independent samples t-test. This research has received ethical clearance from the ethical commission for health research at STIKes Yarsi Pontianak, with letter number 060/KEPK/STIKes.YSI/V/2025.

Results

This study involved 44 subjects divided into two groups: an intervention group that received web-based learning and a control group that received printed teaching modules. The average age of the CHWs involved in the experimental group was 39.55 (SD 4.03), and the average age in the control group was 42 (SD 2.69). The majority of CHWs have a junior high school education (54.8%) and work as housewives (59.1%). The characteristics of the subjects in this study are explained in Table 2.

Table 2. Demographic characteristics of CHWs (N=44)

No	Demographic	Experimental Group		Control Group		Total	
		n	%	n	%	n	%
1	Age						

(mean and SD)		39,55 (4,03)		42,00 (2,69)		-	
2	Education						
	Junior High School	8	36,4	17	77,3	25	54,8
	Senior High School	10	45,5	5	22,7	15	34,0
	University	4	18,2	0	0	4	9
3	Occupation						
	Housewife	10	45,5	16	72,7	26	59,1
	Self-employed	6	27,3	4	18,2	10	22,7
	Private sector	6	27,3	2	9,1	8	18,1

Following web-based learning, CHWs in the experimental group had higher average knowledge and perceptual scores ($p = 0.001$, $p = 0.001$). Furthermore, following traditional module-based learning, CHWs in the control group also saw an increase in their average knowledge and perception scores ($p = 0.001$, $p = 0.001$) (Tables 3 and 4).

Table 3. Paired t-tests were used to compare the test scores before and after training in each course in order to determine the knowledge and perception test outcomes for the experimental group before and after web-based learning

Experimental Group (n=22)	Pre-test		Post-test		t	p value
	Mean	S.D	Mean	S.D		
CHWs Knowledge and Perceptions of Vaccination						
Knowledge of CHWs	8,55	1,5	14,50	1,6	14,22	<0,001 ^a
CHW Perceptions	34,05	2,2	47,41	2,0	18,34	<0,001 ^a

^aLevel of significance at.01

Table 4. Using a traditional module and a paired t-test statistical analysis, the control group's knowledge and views of the COVID-19 immunization.

Control Group (n=22)	Pre-test		Post-test		t	p value
	Mean	S.D	Mean	S.D		
CHWs Knowledge and Perceptions of Vaccination						
Knowledge of CHWs	8,05	1,5	12,05	1,2	11,48	<0,001 ^a
CHW Perceptions	30,41	2,2	48,18	3,5	21,84	<0,001 ^a

^aLevel of significance at.01

Table 5. The independent t-test statistical test was used to examine the test results for both groups regarding CHWs knowledge and perception of COVID-19 immunization utilizing the module

Variables	Experimental (n=22)		Control (n=22)		t	p value
	Mean	S.D	Mean	S.D		
Knowledge and Perceptions of COVID-19 Vaccination among CHWs						
CHWs knowledge before intervention	8,55	1,5	8,00	1,5	1,76	0,246
CHWs knowledge after intervention	14,50	1,6	12,05	1,2	5,42	<0,001 ^a
CHWs perception before intervention;	34,05	2,12	32,86	1,85	1,96	0,056
CHW perception after intervention;	47,41	2,03	44,41	2,01	4,90	<0,001 ^a

^aLevel of significance at .01

The experimental and control groups' test scores were identical prior to the start of this investigation. Table 5 reveals that CHWs who received web-based learning had significantly higher average knowledge and perception scores than the group that got traditional module-based learning after the study ($p = 0.001$, $p = 0.001$).

Discussion

This study found that CHWs' knowledge and perceptions increased significantly after learning online using the web about COVID-19 vaccination compared to conventional modules. This aligns with previous research showing that multi-module online education programs utilizing evidence-based web design principles also demonstrate that web-based modules increase health workers' knowledge and confidence in providing immunization services (Mahimbo et al., 2023). Another study explains that understandable web-based learning supports parents' willingness to have their daughters vaccinated against HPV (Suzuki et al., 2021). This aligns with previous studies showing that online learning provides a more favorable and more effective understanding of vaccines compared to conventional training (Esposito et al., 2018). Participants can easily and interactively access relevant information about the vaccine. This is in line with previous studies that explained that online learning is perceived as easy, interactive, and enjoyable (Naciri et al., 2021). Participants gained comfort, the pace was adjustable to their speed, they had access to downloadable materials, they could replay content, and they strengthened their concentration skills (Goldin et al., 2021).

The results of this study indicate that CHWs' perceptions also improved after participating in web-based learning about COVID-19 vaccination. These findings align with previous studies that demonstrated that online learning using educational videos improved participants' attitudes, efficacy, and self-confidence (Shirahmadi et al., 2023). Another study showed that online learning through short videos also increased confidence, willingness, and perceptions of influenza vaccine safety (Jiang et al., 2022). Furthermore, health workers also experienced increased knowledge and self-efficacy in providing immunization services to children after participating in web-based learning (Shamsi et al., 2025). Furthermore, community involvement in learning and education sessions can also improve perceptions and vaccination coverage after the COVID-19 pandemic (Ibekwe et al., 2024).

Web-based learning has advantages over print media. E-learning, or online learning, incorporates a flexible, engaging, and participant-centered pedagogical approach (Ellaway & Masters, 2008). Learning through websites offers flexibility, ease of access, and the ability to present information interactively. Websites can be used as a platform to provide educational materials about COVID-19 vaccination, such as videos, infographics, articles, and quizzes, which can be accessed anytime and anywhere by participants (Dhawan, 2020). Web platforms also offer ease of learning, allowing participants to repeat material as needed. This has been linked to improved knowledge scores among participants participating in online learning compared to offline learning (Pei & Wu, 2019).

Increased knowledge among CHWs shapes positive perceptions about COVID-19 vaccination. This aligns with the theory that perception is formed when individuals use

their knowledge about others to predict and decide whether or not to interact with them (Tamir & Thornton, 2018). Online learning media also contributes to CHWs' positive perceptions about COVID-19 vaccination. Previous theory suggests that our brains achieve these effects by utilizing pre-existing information. For example, when speaking with someone, we interpret each word by considering not only the sounds and gestures coming from the speaker's mouth but also the meaning of previous words, the topic of conversation, and our lifetime knowledge of language. One important type of experience that can influence perception is what has just happened (i.e., temporal context) (Von Helmholtz, 1867)

CHWs play a crucial role in providing education, understanding, and preventing misinformation in the community, thereby increasing COVID-19 vaccination coverage, especially among vulnerable groups. Previous studies have shown that people with good knowledge are more likely to receive the COVID-19 vaccination (Sujarwoto & Maharani, 2023). Other studies have also shown that online learning has increased participants' confidence in explaining vaccine safety and effectiveness (Kaufman et al., 2022). CHWs serve as role models, and having adequate knowledge has been shown to contribute to increased acceptance of primary and secondary vaccinations during the COVID-19 pandemic (Shumba et al., 2024).

Therefore, although training programs for CHWs have improved their understanding and attitudes regarding COVID-19 immunization, the program still requires regular monitoring by community health center (Puskesmas) health workers who continuously supervise the CHWs. With the goal of increasing COVID-19 vaccination coverage, especially among vulnerable populations, CHWs play a crucial role in providing accurate information to the public regarding vaccine safety and efficacy.

Limitations

The final evaluation of knowledge and perceptions was carried out six days after the learning, which is regarded as short-term knowledge, despite the fact that it enhanced knowledge and perceptions of the COVID-19 immunization. Consequently, it is impossible to predict how long the information will endure. Other limitations of the study included a lack of equipment and poor internet network availability.

Contribution to global nursing practice

The results of this study strengthen the role of nurses in promoting health in the community. Website-based learning provides a solution to the limitations of face-to-face interaction between CHWs and nurses and strengthens the role of CHWs as active partners close to the community environment, enabling them to act as educators for their surroundings and provide accurate information about COVID-19 vaccination, thus preventing misinformation.

Conclusion

The results of this study indicate that web-based learning has the ability to enhance vaccination-related knowledge and CHW perceptions. Therefore, it is advised to empower CHWs through web-based learning that is easily accessible at any time and from any location, given the significance of vaccination for health, particularly in vulnerable groups at risk of contracting COVID-19. Future studies can pinpoint the

elements that contribute to the enhancement of online education, particularly for CHWs and medical professionals.

Author Contribution

All authors contributed to this research.

Conflict of interest

The authors declare that there is no conflict of interest in this research.

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