



The Effectivity of Virtual Education Toward Knowledge and Perception About COVID-19 Vaccine Among Pregnant Women

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ABSTRACT

Pregnant women are a high-risk population in the occurrence of COVID-19 transmission, some cases present with severe symptoms to death. In recently, the number of pregnant women who have received the vaccination are fewer than pregnant women who have not receive it. Knowledge and perceptions of pregnant women are important in preventing COVID-19, one of which is by vaccinating. Virtual education was chosen because it was considered relevant and possible in a pandemic. Purpose of this research is to identify the effectiveness of virtual education on knowledge and perceptions of pregnant women about the COVID-19 vaccine. The method was Quasy-Experimental quantitative research with Two Group Pre-Post test design, on 70 samples with inclusion criteria: pregnant women who have not been vaccinated, can read and have a smartphone. The questionnaire consists of knowledge and perception about COVID-19 vaccine by online. Virtual education about COVID -19 vaccine was given to the treatment group. The data analysis using T-test and ANCOVA. The results shows that the respondents was 30.09 years old (SD = 4,794), 50% wiveshouse, 31,4% had been exposed to COVID-19, and 84.3% had no comorbidities. There is a significant difference in the pre and post-test scores in the intervention group with the results of the Paired T-Test (p-Value 0.000) and the ANCOVA test (p-Value 0.000). The conclusion show that virtual education is effective to increase knowledge and perceptions of pregnant women about the COVID-19 vaccine. Virtual education can be an alternative method during the pandemic to promote health about COVID-19 vaccination.

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INTRODUCTION

The Maternal Mortality Rate (MMR) in Indonesia is still quite large. Based on information from the Sampling Registration System (SRS) in 2018, there were close to 76% of maternal deaths occurring in the labor and post-partum, with a proportion of 36% during labor and 40% post-delivery, whereas in the pregnancy it was 24%. Some of the causes of the causes of maternal death include bleeding, hypertension, and eclampsia, and there are also causes of comorbidities such as heart disease, diabetes or infectious diseases(Ariska & Marfuah, 2019). The maternal mortality rate increased by 300 cases in 2019 to 4,400 deaths in 2020(Kemenkes RI, 2020).

Currently, one of the infectious diseases is COVID-19. COVID-19 is still causing a worldwide health pandemic. This pandemic started with a case of pneumonia of unknown cause, which was first reported in Wuhan, Hubei province, China in December 2019. This disease is growing very rapidly and has spread to other provinces in China and even spread to Thailand and South Korea in less than 1 month. Thus, on 11 February 2020 WHO announced that this disease is Coronavirus Disease (COVID-19) caused by the SARS-COV-2 virus previously called 2019-nCoV, and was declared a pandemic on 12 March 2020(Susilo et al., 2020).

Pregnant women are a group that is susceptible to health problems, especially infectious diseases due to changes in body physiology and immune response mechanisms in their bodies(Widiastuti & Marfuah, 2019). Based on data on cases of women who were confirmed positive in the United States in August 2020, there were 15,735 people (0.3% of the total 8 confirmed cases). According to data from the Indonesian Obstetrics and Gynecology Association (POGI) Jakarta, 13.7% of pregnant women are more easily infected with COVID-19,9 compared to those who are not pregnant(Rohmah & Nurdianto, 2020).

Based on information from the Directorate of Family Health on September 2021, there were 1,086 mothers who died with positive PCR/antigen swab test results. In addition, from data from the Ministry of Health's Data and Information Center, the number of babies who died with positive swab/PCR test results was recorded as 302 people. According to data from POGI until April 2021 as many as 536 pregnant women in Indonesia were exposed to COVID-19. Of these 16 people died or it is estimated that for every 1,000 pregnant women, 32 of them died. Of these, it was classified that 3% of them died and 9.5% were in the category of People Without Symptoms, while 4.5% of the total number of pregnant women who were confirmed positive needed treatment in the ICU. While

under normal conditions (no pandemic), the average maternal mortality rate is 3 people out of every 1,000 pregnant women. So the number of maternal deaths during this pandemic is very high, it was increase 10 times than before (“BKKBN: Kematian Ibu Hamil Saat Pandemi Sangat Tinggi, Mencapai 10 Kali Lipat,” n.d.).

Pregnant women are the priority population who are recommended to receive the COVID-19 vaccine, but in China, pregnant women are often unwilling to receive vaccinations due to lack of relevant knowledge, negative attitudes towards vaccines, no previous experience with vaccines, and worry about side effects as well safety of vaccines (Dewi & Widowati, R., 2021). The level of knowledge about the COVID-19 vaccine is very important, because knowledge is one of the factors that underlies a person to determine participation in vaccination (Stuckelberger et al., 2021).

In West Java, the new vaccination coverage is about 20.4% of the approximately 37 million vaccination targets. The number of pregnant women in West Java is around 900,000 people, and those according to the vaccine criteria, namely gestational age of 13-34 weeks as many as 193,479 people. Based on data up to August 2021, the number of pregnant women who have vaccinated the first doses is 3419 people, while only 12 people have vaccinated the second dose. Judging from the data, only a small proportion of pregnant women have participated in the government's program to tackle the pandemic by means of this vaccination (Covid.go.id, 2021).

In this case, virtual education can be an alternative in providing health education during a pandemic. This is because virtual education does not lead to face-to-face interaction (Kartikawati, Pujiastuti, & Rofiah, 2020). In the other hand, it is widely used because it is interesting, not boring, and can be watched repeatedly, so it is hoped that it can further increase public interest in paying attention to educational materials and increase their knowledge and perceptions (Baety & Munandar, 2021). Other studies also show that education or counseling can increase the knowledge of pregnant women about preventing COVID-19 (Marfuah & Mutiar, 2020). Therefore, The researchers are so interested to study about the effectivity of virtual education toward knowledge and perception about Covid-19 vaccine in pregnant women.

METHODS

This research is a quasi experimental with pretest-posttest with control group design. The population were pregnant women who performed Ante Natal Care (ANC) in an independent midwife practice. Samples were taken from pregnant women who performed Ante Natal Care (ANC) at the midwife's practice using convenience sampling technique, namely the sampling technique based on the willingness and ease of obtaining it. The estimated number of samples was calculated using G-Power software version 3.1.9.4 and obtained 70 samples with inclusion criteria: pregnant women who have not received the COVID-19 vaccine, can read and write, and have a smartphone. This research was conducted in January-February 2022.

The questionnaire was adopted and adapted from Mohamed NA, et al (2021). The questionnaire consists of two sections: knowledge and perception about COVID-19 vaccine. The instrument of knowledge used in this study is a questionnaire which has been translated and tested for content and has been tested for reliability with a Cronbach alpha value of 0.718 and has also gone through the content validity process in the translation process. The questionnaire consists of 10 question items related to the COVID-19 vaccine. These questions relate to the basic ingredients of the vaccine, the safety of the vaccine, the effectiveness of the vaccine, who can get the vaccine, the route of administration of the vaccine, and the side effects of the vaccine. Respondents are categorized with good knowledge, namely if the respondent has a score of ≥ 6 and is categorized as poor if the respondent has knowledge < 5 of a total score, namely 10 (Mohamed, Solehan, Mohd Rani, Ithnin, & Isahak, 2021).

In measuring the perception of this instrument, it includes statements about susceptibility, severity, barriers to following vaccination, as well as the benefits of the COVID-19 vaccine and encouragement to follow vaccination. This instrument is also a reliability test with Cronbach's alpha values of 0.714, 0.714 and 0.834, this questionnaire has also gone through the content validity process in the translation process. Measurements on this instrument use a Likert scale with answer choices: 1: strongly agree, 2: agree, 3: neutral, 4: disagree, and 5: strongly disagree with each statement mentioned on each item. In this section there are 17 questions that will describe respondents' perceptions of susceptibility (1 item), severity (1 item), barriers/barriers to following vaccination (8 items), as well as the benefits of the COVID-19 vaccine (3 items) and encouragement to participate in vaccination (4 items) (Mohamed et al., 2021).

Data analysis was carried out using univariate for respondent characteristics distribution and bivariate was carried out to see the difference in pre and post test scores with the paired t-test, while to test the effect of virtual education on knowledge and perceptions of pregnant women about the COVID-19 vaccine, the ANCOVA test was carried out using IBM software. statistic version 26. The next step is statistical test for the value of significance (p-Value), which compares the value of p-Value with the value of (0.05). The hypothesis is said to be accepted if the p-value $< (0.05)$. This study has already accepted Ethical Clearance Letter or Ethical Approval from Health Research

Ethics Committee from Nursing School of PPNI, West Java with lisensi number is III/101/KEPK-SLE/STIKEP/PPNI/JABAR/XII/2021.

RESULTS AND DISCUSSIONS

Result

The characteristics of the respondents in this study were based on age, religion, education, occupation, comorbidities, and history of exposure to COVID-19 which are depicted in the Table 1.

Table 1. Univariate Analysis and Homogeneity test for The Intervention and Control groups (n=70)

| Characteristics | Total (n=70) F(%) | Intervention Group n=35 (%) | Control Group n=35 (%) | P-value |
|--|----------------------|--------------------------------|---------------------------|--------------------|
| Respondents' ages (Years) Mean ±(SD) | 30,09 ± 4.794 | 29.86 ± 4.894 | 30.31 ± 4.751 | 0.693 ^a |
| Religions | | | | |
| Moslem | 70 (100) | 35 (100) | 35 (100) | |
| Non Moslem | 0 | 0 | 0 | |
| Backgrounds | | | | |
| Elementary School | | 0 (0) | 0 (0) | 0.127 ^b |
| Junior High School | 2 (2.8) | 2 (5.7) | 0 (0) | |
| Senior High School | 16 (22.9) | 7 (20) | 9 (25.7) | |
| D-3 (Diploma Degree) | 34 (48.6) | 20 (57.1) | 14 (40) | |
| S1 (Bachelor Degree) | 16 (22.9) | 5 (14.3) | 11 (31.4) | |
| S2 (Master Degree) | 2 (2.8) | 1 (2.9) | 1 (2.9) | |
| Occupations | | | | |
| Housewife | 35 (50) | 20 (57.1) | 15 (42.9) | 0.741 ^b |
| Private Employee | 23 (32.9) | 10(28.6) | 13 (37.1) | |
| Teacher | 2 (2.9) | 0 (0) | 2 (5.7) | |
| Government employee | 1 (1.4) | 1 (2.9) | 0 (0) | |
| Health Worker | 9 (12.8) | 4 (11.4) | 5 (14.7) | |
| History of Covid-19 confirmed | | | | |
| Confirmed covid-19 | | | | |
| No confirmed covid-19 | 22 (31.4) | 9 (25.7) | 13 (37.1) | 0.282 ^b |
| | 48 (68.6) | 26(74.3) | 22 (62.9) | |
| History of other disease | | | | |
| Yes | 11 (15.7) | 5 (14.3) | 6 (17.1) | 0.855 ^b |
| No | 59 (84.3) | 30 (85.7) | 29 (22.9) | |

Note : ^a independent t-test ; ^bChi-Square test

Based on the Table 1, it can be seen that the average respondent in this study was 30.09 years old (SD = 4,794). Meanwhile, the religion of all respondents was moslem in both the control group and the intervention group. The highest education level was diploma degree with 30 of the total respondents (48.6%), in this case the number of respondents with this level of education was almost evenly distributed in both groups. As many as 50% of the total respondents were housewives, and there were also health workers as much as 12.8%. Based on the history of exposure to COVID-19, there were 22 respondents (31.4%) who had been exposed to COVID-19, and 59 people (84.3%) had no history of comorbidities. Furthermore, on the respondent's characteristic data, a homogeneity test was carried out with the Independent T-test and Chi-Square with the results showed no significant difference between the intervention and the control group in the categories of age, religion, education, occupation, history of exposure to COVID-19, and history of other disease.

Table 2. Frequency Distribution of Respondent's Knowledge about Covid-19 Vaccine in The Intervention and Control Groups

| | Total (n=70) Mean±(SD) | Intervention Group n=35 | | | Control Group n=35 | | |
|------------------|---------------------------|-------------------------|-----------|---------|--------------------|---------|-----------|
| | | Mean ±(SD) | Min - Max | F (%) | Mean ±(SD) | Min-Max | F (%) |
| Knowledge | | | | | | | |
| Pre-test | 6.09±1.894 | 6.03±2.065 | 1-10 | | 6.14±1.734 | 3-9 | |
| Good | 46 (65.7) | | | 23(66) | | | 21(60) |
| Poor | 24(34.3) | | | 12(34) | | | 14(40) |
| Post-test | 6.70±1.883 | 7.20±1.891 | 3-10 | | 6.20±1.762 | 3-9 | |
| Good | 56 (80) | | | 28 (80) | | | 22 (62.9) |
| Poor | 14 (20) | | | 7 (20) | | | 13 (37.1) |

Based on Table 2 showed about the knowledge of the respondents in the intervention and control groups. From this study, reseachers found that the respondent's knowledge category was in a good category with a score of > 6 in both groups.

Table 3. Frequency Distribution of Perception's Respondent about Covid-19 Vaccine in The Intervention and Control Group (n=70)

| | Total (n=70) Mean ± (SD) | Intervention Group n=35 | | | Control Group n=35 | |
|-------------------------------------|-----------------------------|----------------------------|-------------|-----------|-----------------------|-----------|
| | | Min - Max | Mean ± (SD) | Min - Max | Mean ± (SD) | Min - Max |
| Perceived susceptibility | | | | | | |
| <i>Pre-test</i> | 3.04±1.279 | 1-5 | 3.03±1.317 | 1-5 | 3.06±1.259 | 1-5 |
| <i>Post-test</i> | 2.80±1.223 | 1-5 | 2.66±1.211 | 1-5 | 2.94±1.235 | 1-5 |
| Perceived severity | | | | | | |
| <i>Pre-test</i> | 3.06±1.273 | 1-5 | 3.06±1.305 | 1-5 | 3.06±1.259 | 1-5 |
| <i>Post-test</i> | 2.67±1.236 | 1-5 | 2.37±1.165 | 1-5 | 2.97±1.248 | 1-5 |
| Perceived barriers | | | | | | |
| <i>Pre-test</i> | 27.07±3.789 | 17-35 | 26.71±3.486 | 17-33 | 27.43±4.089 | 17-35 |
| <i>Post-test</i> | 28.44±3.670 | 17-35 | 29.37±2.723 | 24-33 | 27.51±4.259 | 17-35 |
| Perceived benefits | | | | | | |
| <i>Pre-test</i> | 9.67±2.172 | 5-15 | 9.94±2.043 | 6-15 | 9.40±2.291 | 5-15 |
| <i>Post-test</i> | 7.93±2.475 | 4-15 | 6.57±1.703 | 4-9 | 9.29±9.29 | 5-15 |
| Encouragement to participate | | | | | | |
| <i>Pre-test</i> | 16.49±2.345 | 11-20 | 16.46±2.477 | 11-20 | 16.51±2.241 | 12-20 |
| <i>Post-test</i> | 12.60±4.541 | 6-20 | 8.63±2.016 | 6-12 | 16.57±2.305 | 12-20 |
| Total of perception scores | | | | | | |
| <i>Pre-test</i> | 62.37±5.971 | | 64.14±5.314 | 53-74 | 60.60±6.137 | 49-74 |
| <i>Post-test</i> | 60.27±5.751 | | 60.03±5.388 | 49-70 | 60.51±6.161 | 49-74 |

The description of perceptions obtained in this study showed that respondents' perceptions of the COVID-19 vaccine was in the neutral answer scale option on the pre-test in the domains of perceived susceptibility, perceived severity, perceived barriers and perceived benefits of the COVID-19 vaccine. Meanwhile, the domain of encouragement to participate had an average value of 16.49 (SD=2,345) this indicated that on average the respondents did not agree to participate in the vaccination program.

Bivariate analysis was carried out to determine the effectiveness of virtual education on the knowledge and perception of pregnant women on the COVID-19 vaccine by using the Paired Sample T-test and ANCOVA parametric statistical tests on the IBM SPSS 26 windows application. And the results were as follows:

Table 4. Distribution of Differences in knowledge and perception scores in the intervention and control groups (n = 70)

| Variabel | Pre-test (Mean±SD) | Post-test (Mean±SD) | MD (95 % CI) | t | P- value |
|-----------------------------------|-----------------------|------------------------|----------------------|---------|-------------|
| Total of Knowledge Scores | | | | | |
| Intervention Group | 6.03±2.065 | 7.20±1.891 | -1.171(-1.327-1.016) | -15.305 | 0.000 |
| Control Group | 6.14±1.734 | 6.20±1.762 | .057(-.242-.128) | -.627 | 0.0535 |
| Total of Perception Scores | | | | | |
| Intervention Group | 64.14±5.314 | 60.03±5.388 | 4.114(3.753-4.475) | 23.164 | 0.000 |
| Control Group | 60.60±6.137 | 60.51±6.161 | -.086(-.183-.012) | -1.785 | 0.083 |

Note: using *p- pair t test*

The table 4 showed that the value of knowledge in the intervention group increased from 6.03 (SD = 2.065) to 7.20 (SD = 1.891) with t value = -15,035 and p-value = 0.000. Whereas in the control group, it can be seen that the mean value of the difference in knowledge between before and after the intervention was given in the control group was 0.57 and the statistical test results get a p value of 0.535, it can be concluded that at alpha 5% there was a significant difference in knowledge in the intervention group after being given virtual education.

The description of perceptions obtained in the pre-test of the intervention group had an average of 64.14 (SD = 5.314), while for the post-test after being given the intervention the perception produced had an average of 60.03 (SD = 5.388). It can be seen that the mean difference in perception between before and after being given virtual education in the intervention group was 4.11 and the statistical test results obtained a p value of 0.0001, it can be concluded that at 5% alpha there was a significant difference in perception between before and after being given virtual education in the intervention group.

Meanwhile, in the control group, the perception of respondents at the time of the pretest had an average of 60.60 (SD = 6.137) and the post-test results obtained an average of 60.51 (SD = 6.161). It can be seen that the mean value of the difference in perception between before and after being given an intervention in the control group was 0.06 and the results of statistical tests obtained a p value of 0.083, it can be concluded that at alpha 5% there was no difference in perception between before and after the intervention was given in the control group.

Table 5. The effect of virtual education on knowledge and perceptions of pregnant women about the COVID-19 vaccine (n = 70)

| Source | Type III Sum of Square | Df | Mean Square | F | Sig. |
|--------------------|------------------------|----------|----------------|----------------|-------------|
| Pengetahuan | | | | | |
| Corrected Model | 229.221 ^a | 2 | 114.610 | 496.073 | .000 |
| Intercept | 6.959 | 1 | 6.959 | 30.122 | .000 |
| Pre-Test | 211.721 | 1 | 211.721 | 916.400 | .000 |
| Group | 21.377 | 1 | 21.377 | 92.529 | .000 |
| Error | 15.479 | 67 | .231 | | |
| Total | 3387.000 | 70 | | | |
| Corrected Total | 244.700 | 69 | | | |
| Persepsi | | | | | |
| Corrected Model | 2241.558 ^a | 2 | 1120.779 | 1864.046 | .000 |
| Intercept | 2.412 | 1 | 2.412 | 4.011 | .049 |
| Pre-Test | 2237.430 | 1 | 2237.430 | 3721.225 | .000 |
| Group | 258.327 | 1 | 258.327 | 429.642 | .000 |
| Error | 40.285 | 67 | .601 | | |
| Total | 256567.000 | 70 | | | |
| Corrected Total | 2281.843 | 69 | | | |

^asig = significant value (p < 0.05)

Based on the Table 5 with the ANCOVA statistical test, there was a difference in knowledge scores which increased significantly in the group that was given the virtual education intervention compared to the group that did not receive treatment (control group) with p-Value = 0.000 (p < 0.05). Likewise, the perception value changed significantly in the group that was given the virtual education intervention compared to the control group that was not given the intervention with p-value = 0.000 (p < 0.05). So with the values obtained, it can be said that the results of the first hypothesis testing Ho were rejected and Ha accepted, which means that virtual education was effective in changing the knowledge and perceptions of pregnant women about the COVID-19 vaccine. Virtual education was a significant to increase knowledge and perception about Covid-19 Vaccine on pregnant women.

Discussions

The Knowledge about Covid-19 Vaccine in Pregnant Women

This study showed that 46 respondents (65.7%) of the total respondents have good knowledge about the COVID-19 vaccine. Previous study was found that the community and pregnant women in Ngrongah have good knowledge in preventing COVID-19(5). The level of knowledge about the COVID-19 vaccine is very important, because knowledge is one of the factors that underlies a person to determine participation in vaccination (6). So that a good level of knowledge can lead to good behavior towards preventing COVID-19 in pregnant women.

One aspect that affects a person's knowledge is the level of education, in this study the highest level of education was diploma graduates with a total of 30 people from the total respondents (48.6%). Previous study showed that education affects the learning process, the higher a person's education, the easier it is for that person to receive information. Therefore, with a high education, someone will tend to more easily get information, both from other people and from the mass media. The more information that comes in, the more knowledge you get about health (11).

In addition to the level of education, age is also a factor that can affect a person's knowledge. The average age of the respondents in this study was 30.09 (SD=4.794). Because age affects a person's perception and mindset. The older you get, the more your grasping power and mindset will develop so that the knowledge you get will get better(Moudy & Syakurah, 2020).

Someone who has good knowledge will tend to act better in maintaining health. This is in accordance with previous study that behavior based on knowledge will be more affecting than behavior that is not based on knowledge. In this case, knowledge is needed in growing COVID-19 prevention behavior by participating in a vaccination program (13). Therefore, education for pregnant women must be carried out even in a pandemic. Utilization of technology can be done as an alternative method of providing education.

The Perception about Covid-19 Vaccine on Pregnant Women

This study showed that the perception of pregnant women on the perception of susceptibility, namely the individual's susceptibility to being exposed to COVID-19, was on a neutral scale with an average of 3.04 (SD = 1,279). Likewise with the perception of severity, which means that the probability of an individual being exposed to COVID-19 with severe symptoms was on a neutral scale with an average value of 3.06 (SD=1.273). On the perception of barriers, which in this case showed the barriers of pregnant women to participate in vaccination, the average was 27.07 (SD = 3.789). Meanwhile, in the perception of benefits that describe the benefits after following vaccination, the average value was 9.67 (SD=2.172). Different results were obtained in the domain of perceived urge to participate in the vaccination program, with an average of 16.49 (SD=2,345), and the average value indicates that the average of the total respondents did not agree to participate in the vaccination program.

The same results were found in previous other studies which stated that pregnant women often thought again about taking vaccinations. The reason for this incident is due to a negative view of vaccines caused by fear of side effects on the fetus being conceived and complications in pregnancy so that it becomes an obstacle to participating in vaccination(Januszek et al., 2021).

In another study, the majority of respondents had a positive view of the COVID-19 vaccine, they thought that the COVID-19 vaccine could protect themselves from COVID-19, apart from that the recommendations from the local government also made them have the desire to take vaccinations(Mohamed et al., 2021). Similar research also showed that more than half of pregnant women have positive attitudes and perceptions towards preventing COVID-19. This was in accordance with the previous study, which states that in the implementation of health management, especially the prevention of COVID-19 in pregnant women, almost all respondents have carried out health management well (5). So that a positive perception of vaccines can increase the interest of pregnant women to participate in vaccination programs in the context of preventing COVID-19. Age is also one of the factors that can affect perception. The average age of the respondents in this study was 30.09 years with SD=4.794, which means they are in the early adulthood phase. According to previous study, it reported that there are often problems related to values and emotions as well as changes in roles in individuals, so that individuals often feel worried, easily tense, unstable, and doubtful in making decisions. The results of other studies also show that a person's age is one of the influential factors in the decision to be vaccinated against COVID-19(Reiter, P. L., Pennell, M. L. and Katz, n.d.).

A total of 22 people (31.4%) of the respondents had been exposed to COVID-19, and 11 respondents had a history of co-morbidities. In this case, perception can also be influenced by history and experience. Individual perception of something can be influenced by several factors. Likewise, the willingness of pregnant women to vaccinate as an effort to prevent COVID-19, this can be influenced by family, history, environment, community, and the information media that conveys this matter(Dewi & Widowati, R., 2021).

The Effect of Virtual Education on Knowledge and Perception

Based on the data obtained from this study, virtual education can change the knowledge of pregnant women about the COVID-19 vaccine, as evidenced by an increase in the average score of 1.17 in the intervention group. Other studies also show that education or counseling can increase the knowledge of pregnant women about preventing COVID-19, in this case one of them is about vaccination (Erlinawati & Parmin, 2020). The results of a similar study also obtained data that the average post-test score in the intervention group was given online education through video media, because the video can convey messages by showing certain movements and effects so that it is a good educational medium because it can strengthen the message in learning and can attract the attention of the object being educated (Sabarudin et al., 2020). Based on this data, it can be shown that video media is effective in the process of education and delivering the right information, in this case related to the COVID-19 vaccine for pregnant women.

From the data, it was found that the total average value of perception in the intervention group increased by 4.11 in the post test. The same thing was found in a study in Vietnam which showed that 67.8% of respondents had a good perception of the COVID-19 vaccine and made them take action to participate in vaccination (Nguyen et al., 2021). Similar results were also obtained in another study in China, which found that pregnant women are often worried when they will be given the vaccine due to lack of relevant knowledge (Wang, n.d.). Therefore, education for pregnant women about COVID-19 vaccination is very necessary in increasing the knowledge of pregnant women for the prevention of COVID-19. In this case, virtual education can be an alternative in providing health education during a pandemic (Kartikawati et al., 2020).

Therefore, proper information is needed to generate perceptions of the benefits of vaccines and increase interest in participating in vaccinations (Samannodi, 2021). Pregnant women should be provided with information regarding the benefits and side effects along with the results of research on vaccines to generate perceptions of benefits and encouragement to participate in vaccination activities. Health workers and leaders must participate in providing information to pregnant women. Because the immune system changes during pregnancy so that pregnant women are included in the category of population at risk, apart from that when something bad happens, not only the mother, but the fetus will have the same risk based on several cases in newborns who have positive swab results (Martinez-Portilla et al., 2021). That's why vaccination as a way to prevent the occurrence of COVID-19 in pregnant women is highly recommended, and education related to this is needed to create a perception of the benefits of vaccines for pregnant women.

CONCLUSIONS

Based on the data obtained in this study, it was found that there was a difference in the average value of knowledge before and after being given a virtual education in the intervention group with a significance ($p = 0.000$). There was a difference in the average value of perception before and after being given a virtual education in the intervention group ($p = 0.000$). So, referring to these results, it can be concluded that virtual education is effective in changing knowledge and perceptions of pregnant women about the COVID-19 vaccine with a value ($p = 0.000$). For health workers, virtual education can be an alternative means to conduct health education by utilizing network and computer-based technology to increase public health promotion activities. For further research, it can be done with a larger number of samples, and or combined with virtual interventions with additional leaflets/flyers for further researchers, and taking into account the characteristics of other respondents such as culture and the influence of environmental factors on individual knowledge and perceptions about health issues that can underlie a person in making decisions about health problems. A part from that, the sources of information that respondents have obtained about vaccines can also be things that affect a person's knowledge and perception of the COVID-19 vaccine.

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