

# Effect of Health Education Interventions on Knowledge, Attitudes and Behaviour of Women Experiencing Infertility

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## ABSTRACT

**Background:** Prevention and management of infertility are important issues in reproductive health services. The purpose of this study was to measure the effect of an educational model for primary infertile women. **Methods:** A quasi-experimental design and General Linear Model Repeated Measures (GLM-RM) test were used in a population of 80 couples at KRMT Wongsonegoro Hospital and 50 couples at Tugurejo Semarang Regional Hospital. The minimum sample size was 25 individuals, determined using the Lameshow formula and inclusion criteria. An additional 20% was added, resulting in 30 people in the intervention group, who participated in a module and direct practice for six weeks, and 30 individuals in the control group, who received general health information through a WhatsApp group for six weeks. **Results:** A significant increase in knowledge, attitude, and healthy behaviour was observed in post-test 2. Respondents' knowledge in the intervention group increased by 2 points, attitude by 3 points, and healthy behaviour by 5 points with the health education programme carried out by healthcare professionals. **Conclusion:** There is an increase in knowledge, attitudes, and behaviour variables through this educational model, which is conducted effectively and in an engaging manner. The study suggested that providing this educational model for primary infertile women over an extended period strengthens its effectiveness.

**Keywords:** *Healthcare Services; Healthy Behaviour; Primary Infertility; Reproductive Health*

## INTRODUCTION

Infertility is the inability of a couple to conceive, defined as failure to achieve a pregnancy after 12 months or more of regular, 2–3 times per week, unprotected sexual intercourse (Boedt *et al.*, 2021). Data from the WHO (2021) stated that 50–80 million couples, or one in seven couples, have fertility problems (Carson & Kallen, 2021). The improvement of primary infertile women's quality of life requires special treatment (BKKBN, 2020). In Indonesia, more than 20% of married couples experience infertility problems. Infertility affects 15% of couples aged between 30–34 years, 30% of couples aged between 35–39 years, and 55% of couples aged between 40–44 years. Based on data from the Indonesian Association for In Vitro Fertilisation (Perfitri), the total number of IVF cycles in Indonesia during 2021 reached 10,000. This is categorised as a large number of infertility interventions (All Indonesian Hospital Association, 2021).

The infertility problem affects 66% of couples of reproductive ages in Semarang, and based on 2020 data, there were 227 cases of primary infertility in women after more than a year of marriage and 100 cases up to October 2021 (Jateng, 2022). Data from KRMT Wongsonegoro Semarang Hospital stated that 213 cases of primary infertility and reproductive diseases were recorded from January 2022 to February 2023 (Wongsonegoro, 2022). Couple fertility may be affected by reproductive organ disorders such as endometriosis, PCOS (Polycystic Ovarian Syndrome), age, stress levels, under- or over-Body Mass Index (BMI), occupation, miscalculation of fertile days, hormones, and anatomical abnormalities (Younis *et al.*,

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2020). Infertility could also be influenced by external factors such as the environment and lifestyle (Mena, Mielke & Brown, 2019). An unhealthy lifestyle and the use of excessive oestrogen-containing medicines could lead to implantation and tube function disorders, reducing fertility. Additionally, excessive caffeine consumption can inhibit fertility (Asazawa *et al.*, 2019; Chazan & Kushnir, 2019). The significant or dominant factors of infertility include alcohol consumption, smoking habits, an unhealthy diet, genital organ care, age, body weight, and genetics (Boedt *et al.*, 2021).

Infertility is related to physical, psychological, and social problems that require social support to achieve better quality of life (Tripathy, Nayak & Khosla, 2020). Infertility is also a significant stressor in a woman's life (Omani-Samani *et al.*, 2018). Studies have proven that poor psychological states can reduce the number of IVF-ET pregnancies and negatively affect pregnancy outcomes. During fertility treatment, it is essential to understand and integrate information about healthy behaviour (Zurlo *et al.*, 2019). The preliminary analysis of 10 primary infertile women revealed that they had not properly understood the correlation between infertility and behaviour following clinical assessment, as well as health behaviour in response to infertility problems. Additionally, hospitals have not provided educational media for primary infertile couples. The only available service is direct counselling after clinical assessment, without the use of any media. Five nurses and midwives reported difficulties in observing patients with primary infertility, particularly women, as there is no existing model for primary infertile patients. The gap in research is the absence of a comprehensive educational model that addresses the specific needs of women experiencing infertility in healthcare services. Therefore, the purpose of this study is to support women experiencing infertility by increasing their knowledge, attitudes, and behaviours, ultimately improving their quality of life.

## **METHODOLOGY**

### **Study Design and Setting**

A quasi-experiment was conducted using pre-tests, post-test 1, and post-test 2 with a control group design, allowing the intervention to be carried out without harming the participants. Quasi-experiments are also easier to apply in real practice as they are conducted in conditions that more closely resemble everyday life. The study was carried out from March to June 2023 at KRMT Hospital and Tugurejo Hospital, Semarang, Central Java, Indonesia. Women with primary infertility were divided into two groups: the intervention group and the control group. The intervention group was based at KRMT Hospital, while the control group was located at Tugurejo Hospital. These two hospitals had the same hospital type characteristics and provided infertility services in accordance with Type B hospital standards. In the intervention group, a module and education card were provided to women with primary infertility. Meanwhile, in the control group, participants received a leaflet once a week for two months without any monitoring from nurses or midwives.

### **Respondents and Criteria**

The study was conducted on 80 couples at KRMT Wongsonegoro Hospital in Semarang and 50 couples at Tugurejo Semarang Regional Hospital that population 130 couples. The determination of the sample size of this study used a sample formula for hypothesis testing of 2 or more proportions, so that the hypothesis testing depends on the combined proportion of P1 and P2 according to Lameshow. In case-control studied, the calculation of the sample size is carried out with the aim of finding a minimum for each, both the case group (intervention) and the control group), with the number of case and control group sample comparisons of 1: 1. Calculating the minimum sample size of this study, the calculation of the delta value ( $\Delta$ ) on the P1 and P2 values as per the Lameshow formula, is based on the test results of a similar study conducted by Park and Shin (2021), the title "How satisfaction about web-based online information for infertile women". The results of the study showed a significant difference in the intervention group of 74.2% (0.742) compared to the proportion of the control group of 25.8% (0.258). Furthermore, calculations were carried out to determine the minimum sample size of the study.

Based on calculations, it was determined that the minimum sample size for each group was 25 individuals using the Lameshow formula. To avoid dropout risks in the sample, 20% of 25 ( $\pm 5$  individuals) were added,

resulting in 30 individuals in the intervention group at KRMT Wongsonegoro Hospital and 30 individuals in the control group at Tugurejo Semarang Regional Hospital from April to August 2023. The sampling technique used was purposive sampling, with inclusion criteria being primary infertile women with infertility duration > five years, marriage duration > 5 years, and no previous history of in vitro fertilisation. Exclusion criteria included direct infertile women who had successfully become pregnant and those who refused to participate as respondents.

### **Health Education Intervention**

In the intervention group, participants were provided with educational materials in the form of modules and educational cards containing an understanding of infertility from spiritual, psychological, physical, and social aspects commonly faced by primary infertile women over six weeks (material and practice sessions were conducted every week for 70 minutes) at the hospital. The pretest was conducted before the intervention, the post-test 1 evaluation was done in the 6<sup>th</sup> week after the intervention, and the post-test 2 evaluation was conducted in the 7<sup>th</sup> week, one week after post-test 1. The control group received general education via WhatsApp through leaflets over six weeks. WhatsApp was chosen because it was a very popular instant messaging application and was widely used by various groups of people. This means they were likely familiar with and had access to this application, making it easier to distributed materials with leaflets.

### **Study Variables and Study Instrument**

The variables included statements on knowledge about the definition of infertility, understanding the link between causes and management of infertility, attitudes towards coping with infertility, perceived support and coping strategies for infertility, and behaviours related to maintaining health during infertility, regularity of healthy behaviours during infertility, and adherence to fertility care in health services. The questionnaire was validated and tested for reliability among primary infertile women at infertility clinics in Semarang. Validity and reliability test on the knowledge questionnaire of 15 infertility women with 20 questions, on the attitude questionnaire of 15 infertility women with 30 questions and on the behaviour questionnaire of 15 infertility women with 15 questions on infertile women. The knowledge questionnaire had a correlation coefficient ( $r$  calculated) > critical correlation coefficient ( $r$  table = 0.254), indicating validity, and Cronbach's Alpha value greater than 0.6 (0.633 > 0.6), indicating reliability. The attitude questionnaire had a correlation coefficient ( $r$  calculated) > critical correlation coefficient ( $r$  table = 0.254), validity, and Cronbach's Alpha value greater than 0.6 (0.787 > 0.6). The behaviour questionnaire also showed validity with a correlation coefficient ( $r$  calculated) > critical correlation coefficient ( $r$  table = 0.254) and Cronbach's Alpha value greater than 0.6 (0.649 > 0.6).

### **Data Analysis**

In this study, there were eight confounding (age, education, occupation, living arrangement, income, duration of infertility, history of reproductive diseases and frequency of fertility treatment. Variables in this study by controlling the confounding variables, so a homogeneity test is needed so that the confounding variables can be minimised. There were eight confounding equated with the relationship between knowledge, attitudes and healthy behaviour. The Levene's test was used to check the homogeneity of the intervention group and the control group with a  $p > 0.05$ . Normality tests using skewness kurtosis with  $Z$ -score  $\pm 3.29$  (Mishra *et al.*, 2019). And the results of all normality tests. So, analysis was then conducted through descriptive characteristics of the two groups and a paired  $t$ -test within-group. Effect size was measured to determine the intervention and the control group used General Linear Model Repeated Measures (GLM-RM) test, because the health education program measured repeated pretests-post-test 1-post-tests 2 and had met the requirements for all data to be tested normally.

### **Ethics Consideration**

The researchers obtained ethical clearance from the ethics committee at KRMT Wongsonegoro Hospital, in Semarang, Indonesia with reference number B/3229/010/V/2023 on 4<sup>th</sup> May 2023.

## RESULTS

### Respondents' Characteristics

The respondents in this study are primarily infertile women. The intervention is provided for six weeks. The characteristics of the respondents for intervention group and control group are presented in Table 1.

**Table 1: Frequency Distribution of Characteristics of Respondents in the Intervention and Control Groups**

Characteristics of Respondents	Group				p-value
	Intervention		Control		
	n	%	n	%	
<b>Age</b>					0.521
20-<35 years	24	80	19	63.3	
≥ 35 years	6	20	11	36.7	
<b>Education</b>					0.030
High School	18	60	14	46.7	
Diploma (D3)	12	40	8	26.7	
Bachelor/Diploma IV (S1/D4)	0	0	8	26.7	
<b>Occupation</b>					0.605
Housewife	13	43.3	11	36.7	
Private Sector	17	56.7	19	63.3	
<b>Living Arrangement</b>					0.544
With mother-in-law	8	26.7	7	23.3	
With biological mother	8	26.7	6	20	
With partner	14	46.7	17	56.7	
<b>Income</b>					0.648
Supported by husband	13	43.3	11	36.7	
2.000.000-2.500.000	11	36.7	14	46.6	
2.500.000-3.000.000	2	6.7	5	16.7	
> 3.000.000	4	13.3	0	0	
<b>Duration of Infertility</b>					1.000
5-<10 years	26	86.7	22	73.3	
≥ 10 years	4	13.3	8	26.7	
<b>History of Reproductive Diseases</b>					0.467
None	8	26.7	11	36.7	
PCOS (Polycystic Ovary Syndrome)	10	33.3	9	30	
Endometriosis	7	23.3	6	20	
Ovarian cysts	5	16.7	4	13.3	
<b>Frequency of Fertility Treatment</b>					1.000
Once a month	9	30	8	26.7	
Twice a month	16	53.3	14	46.6	
More than 4 times a month	5	16.7	8	26.7	

### Differences in Knowledge, Attitude and Health Behaviour Pretest, Post-Test 1 and Post-Test 2 in the Intervention Group and Control Group

In the difference test between the two groups, namely the intervention group and the control group, with normality results indicating that all variables are normally distributed, the difference test results are as follows: Table 2, Table 3 and Table 4.

**Table 2: Results of Difference Test for Variables Knowledge, Attitude, and Healthy Behaviour in the Intervention and Control Groups at Pretest**

Domain	Group	Mean score± SD	p-value
Knowledge	Intervention	9.36 ± 2.05	0.959 <sup>a</sup>
	Control	9.33 ± 2.89	
Attitude	Intervention	68.03 ± 8.49	0.682 <sup>a</sup>
	Control	66.9 ± 11.88	
Health Behaviour	Intervention	32.1 ± 4.34	0.581 <sup>a</sup>
	Control	32.76± 4.94	

<sup>a</sup>Analysed using Independent t test

**Table 3: Results of Difference Test for Variables Knowledge, Attitude, and Healthy Behaviour in the Intervention and Control Groups at Post-Test 1**

Domain	Group	Mean score± SD	p-value
Knowledge	Intervention	11± 3.52	0.044 <sup>a*</sup>
	Control	9.46 ± 2.04	
Attitude	Intervention	74.1 ± 11.5	0.024 <sup>a*</sup>
	Control	67.9 ± 8.85	
Health Behaviour	Intervention	35.5 ± 7.72	0.106 <sup>a</sup>
	Control	32.83± 4.85	

<sup>a</sup>Analysed using Independent t test

\*Statistically significant at p=0.05

**Table 4: Results of Difference Test for Variables Knowledge, Attitude, and Healthy Behaviour in the Intervention and Control Groups at Post-Test 2**

Domain	Group	Mean score± SD	p-value
Knowledge	Intervention	14.8± 2.16	0.000 <sup>a*</sup>
	Control	9.46 ± 2.04	
Attitude	Intervention	83.8 ± 8.33	0.000 <sup>a*</sup>
	Control	67.9 ± 8.89	
Health Behaviour	Intervention	44.1 ± 4.65	0.000 <sup>a*</sup>
	Control	32.76± 4.94	

<sup>a</sup>Analysed using Independent t test

\*Statistically significant at p=0.05

In the difference test for the variable of knowledge among primary infertile women in the intervention and control groups, significant differences were observed. In post-test 1, the p-value was 0.044, and in post-test 2, the p-value was 0.000 (p-value < 0.05), indicating a strong increase in knowledge after utilising this model. Many respondents showed a better understanding of the definition of primary infertility and the health history factors that significantly affect couples' fertility, as well as an understanding of the causes of infertility in couples with fertility disorders. The increase in knowledge among primary infertile women in post-test 2 demonstrates that this educational model significantly influences respondents' knowledge greater than post-test 1.

Regarding the difference test for the variable of attitude among primary infertile women in the intervention and control groups, significant differences were found. In post-test 1, the p-value was 0.024, and in post-test 2, the p-value was 0.000. Thus, there was a substantial increase in respondents' attitudes after the intervention, most notably in post-test 2, with an increase compared to post-test 1. In the difference test for the variable of healthy behaviour among primary infertile women in the intervention and control groups, significant differences were observed in post-test 2 with a p-value of 0.000. This indicates a fivefold increase in healthy behaviour among wives after receiving the intervention in post-test 2.

Eight confounding factors were identified among primary infertile women. Therefore, a multivariate analysis was conducted using General Linear Model Repeated Measures (GLM-RM) due to repeated testing and normal distribution. The results are as follows Table 5.

Based on Table 5, the multivariate analysis conducted for the knowledge variable of primary infertile women showed that there were several potential eight confounding variables. These variables were tested for their relationship with the knowledge score of primary infertile women using the General Linear Model Repeated Measures (GLM-RM) test. The statistical analysis showed that none of the potential confounding variables had a significant impact. In the first week after the intervention, knowledge increased by 1.533 points, and by the fourth week, the increase reached 3.834 points. Therefore, it can be concluded that the intervention resulted in a knowledge improvement approximately 2 points higher than the control group.

The multivariate analysis results for the attitude variable of primary infertile women also showed several potential confounding variables. However, none of these variables proved to be confounding. There was a significant increase in attitude scores for the intervention group in post-test 1 and an even higher increase in post-test 2. In the first week after the intervention, there was an effect in the attitude by 6.167 points; after the fourth week, there was an increase of 9.7 points. Thus, it can be concluded that the intervention resulted in a 3-

point higher effect in compared to the control group. The multivariate analysis results for the healthy behaviour variable of primary infertile women showed several potential confounding variables. However, none of these variables proved to be confounding. A significant increase in healthy behaviour scores in post-test 2. In the first week after the intervention, there was an effect in the healthy behaviour by 2.733 points; after the fourth week, there was an increase of 8.634 points. Thus, the intervention resulted in a 5-point higher effect in compared to the control group.

**Table 5: GLM-RM Multivariate Test on Education Model for Primary Infertile Women Intervention Group and Control Group**

Variable Dependent		Group	B (coefficient)	p-value	95% Confidence Interval	
					Lower Bound	Upper Bound
Knowledge	Pretest	Intercept	9.333	0.000	8.416	10.251
		Intervention	0.033	0.959	-1.264	1.331
		Control	0 <sup>a</sup>			
	Post-test 1	Intercept	9.467	0.000	8.414	10.520
		Intervention	1.533	0.044	0.044	3.022
		Control	0 <sup>a</sup>			
	Post-test 2	Intercept	9.467	0.000	8.696	10.237
		Intervention	5.367	0.000	4.277	6.456
		Control	0 <sup>a</sup>			
Attitude	Pretest	Intercept	66.933	0.000	63.158	70.708
		Intervention	1.100	0.682	-4.239	6439
		Control	0 <sup>a</sup>			
	Post-test 1	Intercept	67.967	0.000	64.195	71.738
		Intervention	6.167	0.024	0.833	11.500
		Control	0 <sup>a</sup>			
	Post-test 2	Intercept	67.967	0.000	64.815	71.118
		Intervention	15.867	0.000	11.410	20.324
		Control	0 <sup>a</sup>	0.000	63.158	70.708
Healthy Behaviour	Pretest	Intercept	32.767	0.000	31.065	34.469
		Intervention	-0.667	0.581	-3.074	1.740
		Control	0 <sup>a</sup>			
	Post-test 1	Intercept	32.833	0.000	30.477	35.190
		Intervention	2.733	0.106	-0.599	6.066
		Control	0 <sup>a</sup>			
	Post-test 2	Intercept	32.67	0.000	31.011	34.523
		Intervention	11.367	0.000	8.883	13.850
		Control	0 <sup>a</sup>	0.000	31.065	34.469

**DISCUSSION**

The results of the analysis show that there are significant differences between knowledge, attitudes and health behaviour between the intervention group and the control group. The intervention group is provided with midwife who have been trained in the health education program concept, so that these nurse and midwives provide intensive to women primary infertile. The knowledge, there was an increase in all indicators of the knowledge variable. There was a significant increase in knowledge on the importance about definition of primary infertility and the health history factors that significantly affect couples' fertility, as well as an understanding of the causes of infertility. There was also a significant increase in attitude values for all indicators of the attitude variable in the intervention group. The highest improvement in the attitudes about fertility needs to be considered through the menstrual cycle and agrees that the problem of infertility is caused by infrequent sexual intercourse. There was also significant increase in health behaviour variable in the intervention group. The highest improvement in the health behaviour about often like foods that can increase fertility every day.

Enhanced understanding of infertility correlates with improved quality of life for primary infertile

couples, reduced anxiety, and increased adoption of healthy lifestyle habits during fertility treatment, particularly among primary infertile women (Massarotti *et al.*, 2019; Ikemoto *et al.*, 2021). The knowledge aspect can be further improved by education, which in turn might also improve practice among women of childbearing age (Yuan *et al.*, 2024). Respondents' attitudes improved after using this model, adhering to healthcare provider advice. Over time, the increased involvement in self-improvement efforts, particularly in addressing spiritual, psychological, physical, and social aspects during infertility, is evident by the seventh week of the intervention. Additionally, other studies have shown that attitudes of infertile women regarding fertility and treatment become more realistic with the duration of treatment, alongside emotional, physical, and financial demands, leading to increased anxiety while awaiting fertility outcomes (Chu *et al.*, 2021; Ni *et al.*, 2021).

Awareness of beneficial lifestyle factors, such as reducing obesity, could positively impact the adoption of healthy living habits among primary infertile women. Supported from nurse and midwife could influence behavioural changes toward a healthier lifestyle, including nutrition, to enhance fertility (Bayoumi *et al.*, 2021; van Dammen *et al.*, 2021; Lam, Linh & Thuy, 2021). The implementation of the multivariate analysis showed that education influenced the effectiveness of the educational intervention. There was a significant increase in knowledge during post-test 2, conducted one week after post-test 1 in the seventh week, indicating an improvement in respondents' understanding of the importance of various aspects, such as spiritual, psychological, physical, and social aspects during infertility. This finding highlights the necessity for improved patient education and enhanced care coordination in low-resource settings. More data is needed as this program continues to improve the delivery of fertility care (Ruderman *et al.*, 2020). After the intervention, there was an increase in knowledge about fertility information, and the effectiveness of health education interventions models (Golshani *et al.*, 2021). Consistent with research that the positive impact and emphasise the importance of continuous educational programs like regarding IVF to improve knowledge, decrease stress levels, and increase their overall satisfaction with the treatment (Mohamed *et al.*, 2024).

The nursing approach in supporting primary infertile women should be holistic, taking into account physical, psychological, social and spiritual aspects so that patients can develop more adaptive coping mechanisms and improve their quality of life. Consistent with other studies, attitudes towards fertility are highly recommended during fertility treatment at hospitals, allowing effective intervals for attitude changes that can provide strong motivation for primary infertile women (Iordăchescu *et al.*, 2021; Skvirsky *et al.*, 2018; Massarotti *et al.*, 2019). Indicated a substantial increase in healthy behaviour after the intervention. The repeated implementation of the educational model with regular intervals significantly improved respondents' healthy behaviour, focusing on adopting healthy lifestyle changes without considering other burdens (Tripathy, Nayak & Khosla, 2020). Consistent with further research, regular healthy behaviour during primary infertility treatment and adherence to recommended by healthcare, along with support from surrounding individuals, contribute to improving the quality of life for primary infertile women. Additionally, it increases primary infertile women's efforts and endeavours in coping with clinical management (Güneri, Kavlak & Göker, 2019). Another research that the main support system of participants was family, husband, and friends. Prayer and getting busy and adoption were the most common coping strategies (Mpono *et al.*, 2024). Based on the findings of this study, policymakers can develop, or updated policies related to education for infertility women.

### **Limitation**

The study has some limitation that it exclusively focused on primary infertile women receiving care within hospital health services, without including participants from outside the hospital community. As a result, the findings may not be generalisable to women seeking infertility care in non-hospital settings. Future research could address this limitation by developing a model applicable to community-based healthcare environments.

### **CONCLUSION**

Research in reproductive health and infertility management has had broad and profound impacts. These impacts include increasing knowledge and quality of services, improving access and equity, and strengthening spiritual, physical, and psychosocial support. The implementation of research findings can enhance patient experience and outcomes and support the development of more effective and inclusive policies.

The implementation of this educational model, using a nursing and midwifery approach, led to increased knowledge, improved attitudes, and healthier behaviours among participants, particularly evident by the seventh week of the intervention. The use of modules, educational cards, regular monitoring, and repeated evaluations contributed to this positive change. Respondents demonstrated a better understanding of infertility definitions and causes, and their attitudes toward fertility showed significant improvement. This model is recommended for women with primary infertility undergoing fertility treatment. Future research could explore how this model enhances care quality and outcomes, integrate technology to assess the influence of family and friends on primary infertile women, and identify knowledge gaps to inspire new innovations.

### Conflict of Interest

All the authors declare that there are no conflicts of interest.

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