

## An Educational Package for Oncology Nurses Regarding Fertility Preservation among Female Cancer Patients

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### Abstract

**Background:** Advances in cancer treatment are significantly affecting the survival rate of females affected with cancer. However, chemo-radiotherapy regimens have a negative impact on future fertility. Oocyte cryopreservation is one of the available methods to females to preserve their fertility. **Study Aimed** to evaluate the effect of educational package for oncology nurses regarding fertility preservation among female cancer patients. **Subjects and Method:** A quasi-experimental pre and post-test design. Purposive sampling consisted of 61 nurses selected according to the inclusion criteria. The study conducted at oncology center, Mansoura University Hospital. **Tools:** Self-Administered Structured Questionnaire, Nurses' knowledge regarding fertility preservation, Nurse's attitude towards Fertility Preservation and Nurses Satisfaction Scale. **Results:** There was statistically significant improvement in the total knowledge score regarding fertility preservation from (8.2 ±3.1) pre-intervention to (12.3 ±5.4) post-intervention with highly significant difference (P= 0.001). The total attitude score of the study sample regarding fertility preservation were improved significantly from (26.5 ±4.9) pre-intervention to (40.4 ±4.6) post-intervention with highly significant difference (P= 0.001). Furthermore, the majority of nurses were satisfied, their satisfaction level reach 73.8%. There was significant association between the post-intervention total knowledge and attitude level among the nurses ( $X^2=7.389$ ,  $p=0.025$ ). **Conclusion:** Educational package was effective to improve the nurses' knowledge and attitudes towards fertility preservation as a novel method to sustain future reproductive capacity in newly diagnosed cancer female patients. **Recommendations:** The importance of considering this novel method to sustain fertility preservation in newly diagnosed cancer female patients as one of the main items in the nursing curriculum and evolve protocols and pathways to empower timely counselling and communication between health care team and the newly diagnosed cancer patients regarding fertility preservation options. Also, the need for a multidisciplinary collaboration between oncology health team and reproductive health care providers to improve awareness and availability of future fertility preservation in newly diagnosed cancer patients.

**Keyword:** Educational Package, Fertility Preservation, Oncology Nurses, Cancer Patients.

### Introduction:

Globally, cancer has its role in death, it is the second primary fatal disease; the number of cancer-related fatality was announced to be 8.8 million in 2015 (WHO, 2018). Nevertheless, due to the advancement in the treatment of cancerous diseases, this has significantly increased the life span of a cancer patient. As per recently published articles illustrated that 5-year survival rate for persons diagnosed with cancer were about 69%. In addition, the present significance is not only the survival, but also improve the quality of life, especially it is pivotal for preserving the fertility (Yinfeng et al., 2020). Unfortunately, due to cancer treatment, women may be susceptible to reduced fertility. Moreover, some women lose ovarian function temporarily, and others lose it permanently (Wright et al., 2018). Treatment of cancer usually causes long-standing fertility complications, the statistical values with estimated that about thirty to seventy-five percentage of male cancer patients and forty to eighty percent of female patients becoming infertile due to the effect of chemotherapy and radiotherapy (Miok et al., 2019). Routine administration of radiotherapy and chemotherapy treatment in order to increase the prospects of surviving cancer by treatments which are

often toxic to ovarian tissue resulting into ovarian failure (Roberts et al., 2015).

As stated by Sigismondi et al. (2015) that the future of female's fertility could be negatively affected by chemotherapy and radiotherapy regimens. Inhibition in the sexual desire, vaginal atrophy and dryness, menopausal symptoms, dyspareunia and fertility dysfunctions are considered other common side effect of chemotherapy and radiation therapy (Kort et al., 2014 & Schover et al., 2014). To illustrate, a premature ovarian failure is one of the fundamental consequences of cytotoxic chemotherapy and/or radiotherapy among females including children and young women, depending on certain factors such as: the follicular reserve, the age of the patient, and the type and dose of the implemented medication (Office of National Statistics, 2015; Statistics Canada, 2016).

Nowadays, developments in cancer treatment increase the percentage of recovery among women diagnosed with cancer and give a hope for living longer. (Office of National Statistics, 2015; Statistics Canada, 2016). Advances in cancer treatment and early detection are significantly affecting the survival rate of women affected with cancer and direct the attention to the improve quality of women life (Loren et al., 2013). The

rise in the number of cases surviving cancer highlights the long-term effects caused by its treatment and its impact on the quality of life. Fortunately, because of the improvements in the field of assisted reproductive technologies, such as ovarian tissue cryopreservation 1-3 of the cases has proven to overcome fertility issues caused by cancer (Covelli et al., 2019).

Fertility Preservation (FP) includes freezing and storage of gametes for future usage to maintain fertility treatment (Royal College of Nursing, 2017). The availability of fertility preservation strategy access should be based on informed choice and appropriate discussion about the proper timing, benefits, risks and success rate of the procedure (Del Pup et al., 2014). Embryo cryopreservation is one of the available methods to females to preserve their fertility. Recently, substantial enhancements have increased these options, specifically oocyte and ovarian tissue cryopreservation (Sigismondi et al., 2015).

Prominent among the instances of fertility medication enhanced technology including freezing of female gametes which is now provide chance for women who wish to maintain fertility, or protect their fertility especially in women who are diagnosed with cancer and will receive cancer treatment that might compromise their future fertility. FP requires dedicated staff to counsel patients and ensure they are fully informed regarding treatment implications, including all of their potential choices (Grabowski et al., 2017). It is significant issue that newly diagnosed cancer women should be counseled about the negative effect and risks associated with cancer therapy regimens and be provided with appropriate information regarding the current available options to improve the future fertility potential. Nurse and health care team should enhance their knowledge and understanding of potential fertility problems and alternative options to provide proper counselling for women in reproductive age and newly diagnosed with cancer about fertility preservation method as an alternative method to maintain fertility options before the beginning of cancer treatment (Parker et al, 2019).

#### Significance of the study:

There is a growing concern about FP for female cancer patients; infertility is one of the common results of cancer treatment. However, opportunities exist for cancer patient to preserve fertility treatment as priority. It was estimated that 1.7 million of diagnosed with cancer and 700.000 of those patients were in childbearing age (The American Cancer Society (2017). The ability to conceive children is commonly considered to be a priority for cancer female survivors within the reproductive age (Loren et al, 2013). It is worth mentioning that some scientific articles clarified those females could possibly be uninformed about the risks of infertility and the options to preserve it, and not

receiving the adequate guidance by a relevant healthcare provider before they proceed with the cancer treatments (Kim & Mersereau, 2015) & (Zhang et al, 2019). According to Logan & Anazodo (2019) who conducted a systematic analysis and reported that 29 out of 33 fertility preservation guidelines has provided clinical recommendations on the importance of fertility counselling especially in cancer patients.

Consequently, nurses who handle patients' problems should possess and develop a deeper apprehension of the possible side effects of different cancer treatments on fertility and a deeper understanding of the available opportunities to be able to provide adequate counselling. Furthermore, it is important to recognize the patients' needs of through conducting continual assessments and, as required refer the patients to the specialists prior to the commencement of receiving treatment till its end (Miok, 2019). Accordingly, Daniluk & Koert (2016) signify that the shortage of knowledge or uncertain expectations about FP among nursing staff could have a negative effect on poor uptake in oocyte preservation among cancer patients. Furthermore, nurses should be provided with the required knowledge regarding fertility preservation, and explore their attitude regarding it.

#### Aim of the study:

The study aimed to evaluate the effect of educational package for the oncology nurses regarding fertility preservation among female cancer patients through:

- Assessing nurse's level of knowledge and attitude regarding fertility preservation among female cancer patients
- Developing and implementing educational package for oncology nurses.
- Evaluating the effectiveness of educational package on nurse's level of knowledge and attitude regarding fertility preservation among female cancer patients.

#### Research Hypothesis:

Educational package was expected to be an effective method for improving the oncology nurse's knowledge and attitudes about fertility preservation in female cancer patients evidenced by:

H1: Significant improvement in the nurse's knowledge level.

H2: Significant change in the nurse's attitudes regarding fertility preservation.

H3: Significant relation between the oncology nurse's attitudes and knowledge.

**Operational Definitions:**

**Educational Package:** Intended knowledge to support nurses to be competent as a counselor about fertility preservation.

**Fertility Preservation (FP):** Is the effort to assist the cancer patients retain their fertility or their ability to procreate.

**Subjects and Method:****Research Design:**

A quasi-experimental (pre-posttest) research design.

**Study Setting:**

It was conducted at the oncology center, Mansoura University Hospital [MUH], Egypt from the period of November 2019 to April 2020.

**The Study Subjects:**

Purposive sampling was used. The study participants included 61 nurses selected according to the following inclusion criteria (female nurses who are working in oncology center, who are providing care for cancer patients for more than 3 months, and did not attend any training & workshop about FP).

**Sample size calculation:**

Based on data from literature (Grabowski et al., 2017), considering level of significance of 5%, and power of study of 80%, the sample size can be calculated using the following formula:

$$n = [(Z\alpha/2 + Z\beta)^2 \times \{2(SD)^2\}] / (\text{mean difference between the two groups})^2$$

where SD = standard deviation

$Z\alpha/2$ : This depends on level of significance, for 5% this is 1.96.  $Z\beta$ : This depends on power, for 80% this is 0.84.

Therefore,  $n = [(1.96 + 0.84)^2 \times \{2(7.6)^2\}] / (3.85)^2 = 61.1$ . Based on the above formula, the sample size required is 61.

**Tools for Data Collection [TDC]:**

**Tool [1]: The Self-Administered Structured Questionnaire [SASQ]:** It was designed by the researcher after checking & reviewing the related & relevant literature. [SASQ] it used to assess the general characteristics of the participants as age, educational level, residence, experience years.

**Tool [2]: Nurses' knowledge regarding fertility preservation:** This tool was improved by Miok et al., 2019 and used to investigate nurses' knowledge of fertility preservation. The

scale items were distributed across three subdomains: 1<sup>st</sup> domain consisted of 11 items used to assess the knowledge regarding the fertility impairment causes', 2<sup>nd</sup> domain consisted of 8 items assess the general knowledge about fertility preservation, and 3<sup>rd</sup> domain consisted of 6 items to assess the fertility preservation methods. The response of each item was classified as "yes/correct" =1 and "no/incorrect/do not know" =0. Meanwhile, the negative items were reverse coded. The range of total scores was 0-25 points, the higher scores showing a higher level of knowledge concerning fertility preservation. The knowledge level of each domain as well as the total knowledge were classified into poor knowledge (<50% of the maximum possible score), fair knowledge (50-65% of the maximum possible score) or good knowledge (>65% of the maximum possible score).

**Tool [3]: Likert scale (Nurses attitude towards Fertility Preservation) developed by Grabowski et al., (2017)** This instrument used to evaluate the nurses' attitudes and identify barriers and facilitators for addressing FP education with a patient following a new diagnosis of cancer in oncology settings. It divided in 5 factors subdivided to 15 items composed of a 5-point Likert scale ranging from strongly agree to strongly disagree; Factor one Confidence consisted of four items two with positive loading and two with negative loading with range (4-20). Factor 2, self-awareness, included five items, four with positive loading and one with negative loading with range (5-25). Factor 3, external barriers, included two items with positive loading with range (2-10). Factor 4, time barriers, included two items with positive loading with range (2-10). The time barriers were intended to capture workload time barriers experienced by the nurses. Factor 5, perceived treatment barriers, included two items with positive loading with range (2-10), combined score ranged (15-75), higher score signifies more recognition of self-perceived barriers to present fertility preservation choices to patients.

**Tool [4]: Nurses Satisfaction Scale:** The scale designed by researchers to assess nurses' satisfaction toward the implementation of educational package towards family preservation. It was consisted of four items (Educational package improve your knowledge, increase your confidence, satisfy with educational material & suggest to be repeated again on another topic). The response of each nurse was categorized by using Likert scale as

satisfy score (3), to some degree score (2) and not satisfy score (1).

#### Validity & Reliability:

The tools were revised by 3 experts in maternity nursing field to test the content validity, pre-testing of the tools revealed that the tool was clear, feasible and there was no ambiguity in the language. Modifications were done consequently based on their comments and notes. The tools were tested using Cronbach's Alpha coefficient test was 0.751 & retested 0.720 for 2<sup>nd</sup> tool and 0.738 & retested 0.701 for 3<sup>rd</sup> tool, so it appears to be acceptable with these reliabilities, coefficient suggesting the items have average internal consistency.

#### A Pilot Study

It was carried out on six participant's nurses from the oncology center to measure the feasibility of content validity & time needed for each tool to complete. Finally results help to make the needed modification; the six participant's nurses were excluded from the study.

#### Ethical considerations:

Approval from head of woman's health & midwifery department and the director of oncology center, at MUH then the aim of the study was explained to all the participants before initiation to collect data, in order to build their confidence & trust, informed written consent was obtained from each participant in the study. Also, each nurse has the right to withdrawal at any time.

#### Field Work:

The data was carried out from November 2019 to April 2020. To accomplish the aim of the study the researchers had followed the following phases:

##### 1<sup>st</sup> phase (Preparatory phase):

- The researchers revised the related literatures and the data collection tools concerning the study topic and obtained an official written approval from the head of woman's health and midwifery nursing department and the director of oncology center at Mansoura university hospital, finally the researchers conducted the pilot study to assess practicability of tools and estimate the time allocated for data collection.
- The questionnaire was filled by the nurses and correction was done through educational sessions based on the objectives of educational package, and empower the nurses to be more knowledgeable and competent as a counselor regarding FP issues which fulfills the study hypothesis.

- The educational package sessions schedule was designed and prepared by the researchers. Goals, learning activity, teaching methods and media were prepared. The content of an educational package was divided into 4 sessions; the duration of each session was ranged 30-45 minutes.

##### 2<sup>nd</sup> phase (Assessment phase):

- The researchers introduced themselves to the nurses, clarify the study aim and obtain their approval to participate in the study. Each nurse was interviewed individually for 20 min. for maintaining confidentiality and obtaining their general characteristics data. Then pre-test was conducted to assess nurse's level of knowledge and attitude regarding fertility preservation among female cancer patients by using the pre-mentioned tools and identify the barriers and facilitators for addressing FP education with a patient following a new diagnosis of cancer in oncology settings.

##### 3<sup>rd</sup> phase (Implementation phase):

- Based on pre-test assessment data, the educational package sessions were conducted. Four sessions were provided in Arabic and English language to suit the different educational levels of the nurses.
- The researchers visited the pre-mentioned setting three times/week. At morning and afternoon shift each week alternately for 8 weeks for conducting the sessions.
- The nurses were divided into 6 subgroups, each group contained 8-10 nurses, four planned sessions were implemented for each group according to the nurses shifts, the work load and their physical and intellectual readiness. Each session consumed 30-45 minutes including group discussion and differ according to the nurses' remarks and response.
  - \* 1<sup>st</sup> session started by orientation and clarifying the aim of sessions and covers the basic knowledge about fertility impairment causes and the side effect of cancer treatment on fertility through prioritizing discussion about life-threatening problems.
  - \* 2<sup>nd</sup> session concerned with knowledge related to the concept of fertility preservation and its indications.
  - \* 3<sup>rd</sup> session aimed to discuss the knowledge related to fertility preservation options and methods (e.g., oocyte or semen cryopreservation, ovarian tissue freezing).

\* 4<sup>th</sup> session concerned with discussing the ethical issues, the pre-treatment counselling about fertility preservation in newly cancer patients and timely referral to fertility specialist.

- Different teaching methods were used during the sessions by the researchers (e.g., lectures, interactive group discussion). As well, the teaching media and strategies (e.g., posters and PowerPoint presentation, brainstorming, Inquiry-based instruction & case method). Feedback was given at the beginning of each session.

#### 4<sup>th</sup> phase (Evaluation phase):

- The post-test was conducted two times, immediately and after one month to evaluate the effect of educational package on the nurse's knowledge level and attitude by using the same pre-mentioned tools, also to evaluate their satisfaction level.
- Finally, the researchers compare the collected data to evaluate the effect of the intervention.

### Statistical Analysis

The collected raw data were coded and analyzed by using SPSS version 21. Then, Data were demonstrated applying descriptive statistics in the form of percentages and frequencies for qualitative variables, and means and standard deviations for quantitative variables. Qualitative variables were compared using paired t test, Cronbach's  $\alpha$  (alpha) is used to test score reliability measure of the sample. If p-value <0.05 is considered statistical significance, P< 0.01 is considered highly significant difference and non-significant difference achieved at P > 0.05.

### Results:

The result showed that all of the subjects were female nurses and more than half of them 52.5% aged between 18-25 with 25.4  $\pm$ 5.1. Diploma education was represented that more than two fifth by (42.6%) followed by technical institution level (36.1%). 86.9% of the nurses were married and 63.9% were from rural areas. Regarding their experience years, 57.4% between (1-5) years with 3.9  $\pm$ 1.9 (table 1).

Table 2 shows the nurse's knowledge score regarding FP was improved significantly post-intervention in comparison to pre-intervention. The post-intervention knowledge mean scores were higher than pre-intervention score regarding the causes of Fertility Impairment, general knowledge and Methods of fertility preservation by 5.7  $\pm$ 2.4, 4.0  $\pm$ 1.8 & 2.6  $\pm$ 1.3 compared to 3.8  $\pm$ 1.4, 2.7  $\pm$ 1.0 & 1.8  $\pm$ 0.9 respectively. Also, it was found that the total knowledge score of the study sample about FP was improved significantly from (8.2  $\pm$ 3.1) pre-intervention to (12.3  $\pm$ 5.4) post-intervention with highly significant difference (P= 0.001).

Table (3) shows the comparison of the attitude domains score and total score among study sample pre- & post-intervention. It was found that the average score of confidence, self-awareness, external barriers, time and perceived treatment barriers were highly significantly increased post-intervention compared to pre-intervention (p < 0.001). The total attitude score of the study sample regarding fertility preservation were improved significantly from (26.5  $\pm$ 4.9) pre-intervention to (40.4  $\pm$ 4.6) post-intervention with highly significant difference (P= 0.001).

The response of nurses varies from disagree to strongly agree, the majority of nurses were strongly agreed regarding the satisfaction assessment items with the educational package and their satisfaction level reach 73.8% Figure (2).

**Table 1.** Distribution of the General Characteristics of the studied nurses

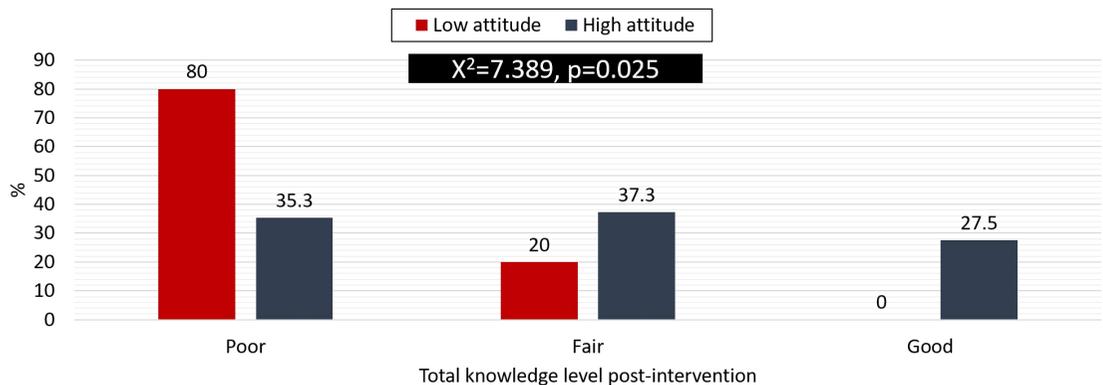
Items	No= 61	%
<b>Age (years)</b>		
18 – 25	32	52.5
26 – 33	26	42.6
34 – 40	3	4.9
<b>Mean <math>\pm</math>SD</b>		25.4 $\pm$ 5.1
<b>Educational level</b>		
Diploma	26	42.6
Technical institute	22	36.1
Bachelor	13	21.3
<b>Marital Status</b>		
Married	53	86.9
Unmarried	8	13.1
<b>Residence</b>		
Rural	39	63.9
Urban	22	36.1
<b>Experience (years)</b>		
<1	12	19.7
1 – 5	35	57.4
>5	14	23.0
<b>Mean <math>\pm</math>SD</b>		3.9 $\pm$ 1.9

**Table 2.** Comparison of knowledge scores by domains and total score among pre-intervention, post-intervention and at follow up

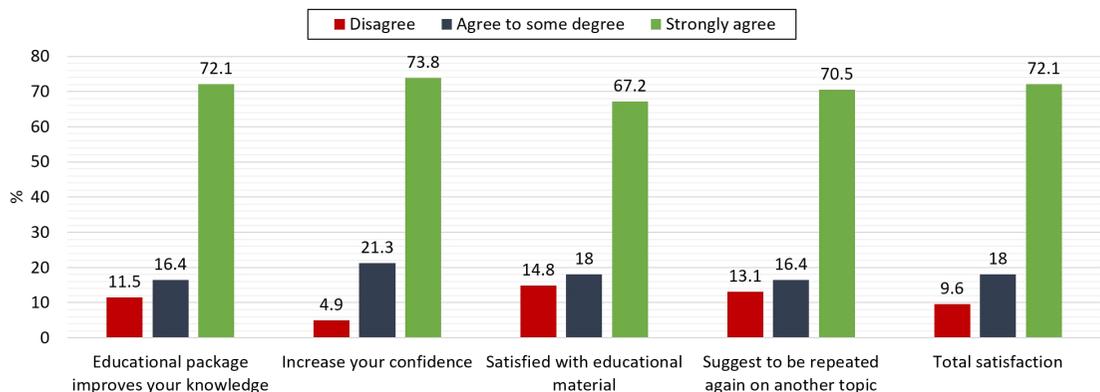
Knowledge Domains	Pre-intervention		Post-intervention		Follow-up		Chi square test	
	No. (61)	%	No. (61)	%	No. (53)	%	X <sup>2</sup>	p
<b>Knowledge Regarding Causes of Infertility</b>								
Poor	53	86.9	26	42.6	38	62.3		
Fair	6	9.8	16	26.2	15	24.6		
Good	2	3.3	19	31.1	8	13.1	29.638	<0.001
Mean ±SD	3.8 ±1.4		5.7 ±2.4		4.8 ±2.1		13.683	<0.001
<b>General Knowledge Regarding Fertility Preservation</b>								
Poor	46	75.4	26	42.6	33	54.1		
Fair	15	24.6	21	34.4	22	36.1		
Good	0	0.0	14	23.0	6	9.8	22.168	<0.001
Mean ±SD	2.7 ±1.0		4.0 ±1.8		3.4 ±1.6		11.955	<0.001
<b>Knowledge Regarding Fertility Preservation Methods</b>								
Poor	47	77.0	26	42.6	33	54.1		
Fair	14	23.0	13	21.3	19	31.1		
Good	0	0.0	22	36.1	9	14.8	31.497	<0.001
Mean ±SD	1.8 ±0.9		2.6 ±1.3		2.2 ±1.1		8.354	<0.001
<b>Total knowledge</b>								
Poor	53	86.9	26	42.6	38	62.3		
Fair	8	13.1	21	34.4	17	27.9		
Good	0	0.0	14	23.0	6	9.8	29.967	<0.001
Mean ±SD	8.2 ±3.1		12.3 ±5.4		10.7 ±4.7		12.913	<0.001

**Table 3.** Comparison of attitude score by domains and total score between the pre-intervention and post-intervention

Attitude Domains	Pre-intervention		Post-intervention		Mean difference 95% CI]	T test	
	Range	Mean ±SD	Range	Mean ±SD		t	p
Confidence	5 – 13	8.2 ±2.7	6 – 14	10.2 ±2.7	2.02 [-2.99, -1.05]	4.111	<0.001
Self-awareness	2 – 13	6.6 ±3.3	8 – 17	12.8 ±2.8	6.28 [-7.38, -5.18]	11.323	<0.001
External barriers	2 – 7	4.0 ±1.5	3 – 8	6.0 ±1.4	-2.45 [-3.38, -1.42]	7.495	<0.001
Time barriers	2 – 6	3.8 ±1.3	3 – 9	6.2 ±1.9	2.34 [-2.93, -1.75]	7.862	<0.001
Perceived treatment barriers	2 – 6	3.9 ±1.4	3 – 8	5.3 ±1.6	1.30 [-1.83, -0.76]	4.788	<0.001
<b>Total score</b>	<b>18 – 37</b>	<b>26.5 ±4.9</b>	<b>31 – 51</b>	<b>40.4 ±4.6</b>	<b>13.87 [-15.57, -12.16]</b>	<b>16.106</b>	<b>&lt;0.001</b>



**Figure (1).** There was a positive significant association between post-intervention total knowledge level and total attitude level among the nurses ( $X^2$  7.389,  $p=0.025$ ),



**Figure 2.** Distribution of the Satisfaction Among the Nurses Regarding the Educational package

### Discussion:

This study aimed to evaluate the effect of educational package for oncology nurses regarding fertility preservation among female cancer patients. The aim was achieved as the research hypothesis had been achieved through study finding results. As the present findings provide a significance insight into nurse's knowledge and attitude about fertility preservation and the salient factor that can affect the decision of newly diagnosed female cancer patients about whether or not to preserve their fertility.

The current study found that the oncology nurse's knowledge score regarding FP was improved significantly post-intervention in comparison to pre-intervention as regard to the causes of fertility impairment, general knowledge about fertility preservation, and methods of fertility preservation. These findings were in concurrence with **Rafiei et al., (2019)** & **Miok et al., (2019)** who stated that nurses had correct knowledge about FP, the current study results may be related to the sufficient fertility preservation knowledge that were conveyed to the nurses after implementation of the educational package as well as before intervention, the nurses were concentrated on the medical treatment rather than the fertility preservation counselling. Also, another cause related to those cancer patients who didn't ask about fertility preservation issues as they didn't have any information and their embarrassment feeling concerned this issue. Moreover, **Hershberger et al. (2013)** stated that the delivery of facts, information about FP and the attitudes of health care personnel are strong-minded by certain issues such as cases preferences, individual values, and the deep appreciative of each patient's situation. Also, **Miok et al., (2019)** who stated that the medical staff often feel uncomfortable when discussing FP with cancer patients, and may even avoid discussion altogether because they lack sufficient knowledge,

have little time to discuss relevant topics, and tend to prioritize treatment to improve the survival rates.

The study revealed that post-intervention knowledge mean scores were higher than pre-intervention score regarding the causes of fertility impairment, general knowledge and Methods of fertility preservation. This may be related to simplest and comprehensive knowledge included in the educational package. Similarly, **Goldfarb et al., (2016)** who stated that only tenth of women receiving information on fertility problems before the health provider was seen; which give an indicator that there is a great lack of knowledge about fertility problems and preservation during the diagnosis. The health team including the nurse is in the best position to present fertility issues ahead of upcoming oncology treatment and make the suitable referral to the patients. So that the treatment plans can be developed to guided care. Moreover, sufficient and advanced knowledge opened the doors for utilizing alternatives method to FP for cancer women.

The study result showed that there was a significant change in oncology nurses total attitude score pre- and post-educational package, which means that post educational package the nurses become more self-preparedness to the issue of fertility preservation. These findings were in agreement with **Grabowski et al., (2017)** which reflects on nurse's attitude about FP as well as to focus their attention to provide the essential education and counseling about fertility preservation rather than providing medical management only. The average score of confidence, self-awareness, external barriers, time and perceived treatment barriers were highly significantly increased post-intervention compared to pre-intervention. This means that their attitude has changed from negative to positive. These results were in congruence with **Grabowski et al., (2017)** who found that there are some factors

influence the attitude towards FP, some of them could be facilitators like confidence and self-awareness, and others could be barriers such as external, time and treatment. These findings may be associated with some factors such as level of knowledge, socioeconomic status and work load as well as the patient concerns about survival chance rather than the future planning for preserving children.

The current study shown that the time barriers is considered "Time constraints limit the ability to bring up FP discussions with the patient" this finding based on the psychological state of cases and their stage of cancer and the appropriate timely counselling as well the work load and time effect for conducting this issue. This was in agreement with **Logan and Anazodo (2019)** who reported that fertility consultation is an important part of the consultation for all cancer patients, and focus the spot on the role of oncology nurses who should provide the cancer patient with proper education about the risk of infertility and other issues with maintaining fertility and actively engage with patients' decisions about their treatment options (**Breit, 2014**).

Concerning the relation between the oncology nurse's attitudes and knowledge, there was a positive significant association between post-intervention total knowledge level and total attitude level among the nurses. These results prove that the nurse's knowledge plays an important role and significance relation for changing the nurse's attitude from negative to positive or low to high attitude, which help in controlling the barriers and constrains. Also, increase confidence, self-awareness and become well preparedness to fertility preservation issues. The current study findings were in the same line with **Peddie et al., (2012)** who found that there is a significance relation between the knowledge and the attitude and reported that lack of knowledge or inaccurate assumptions about FP among cancer patients may be contributing to their negative attitude and the poor uptake in oocyte preservation.

As regard to the satisfaction level, the current study result find that majority of nurses were satisfied and strongly agree that the educational package is an effective to improve their knowledge regarding fertility preservation and increase their feeling of confidence. This finding may be related to clarity and simplicity of the educational materials. Finally, the current study result had directed the attention and highlighted that the educational package can be effective method for improving and enhancing the nurse's knowledge which helps in guidance the cases for her future reproductive life. In addition, educational sessions touch the point

which necessary to cover with cancer female patients from the beginning the journey of treatment.

#### **Limitation of the study**

- The period of some sessions was extended due to the work load and time constrains.
- Eight nurses were dropout from the follow up evaluation due to maternity and sick leaves.

#### **Conclusion:**

The use of educational package was effective and had significantly improved the nurse's knowledge and attitudes toward fertility preservation in female cancer patients. Finally, the study pay attention regarding fertility preservation facilitators and barriers that affect nurse's attitude to be considered and work to dislodge and solve these barriers.

#### **Recommendations:**

- The importance of considering this novel method to sustain fertility preservation in newly diagnosed cancer female patients as one of the main items in the nursing curriculum.
- There is a need for a multidisciplinary collaboration between oncology health team and reproductive health care providers to improve awareness and availability of future fertility preservation in newly diagnosed cancer patients.
- Evolve protocols and pathways to empower timely counselling and communication between health care team and the newly diagnosed cancer patients regarding fertility preservation options.

#### **Further study:**

- Apply study on private health setting and other health sectors.

#### **Conflict of interest**

- No conflict is announced.

#### **Acknowledgment**

The researchers appreciate all participants who recruited in the study and the management system for their participation and cooperation.

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