

# Fertility Preservation in Cancer Patients: Evaluation of Knowledge, Attitude, and Practice of Health Practitioners Towards Fertility Preservation in Makkah Region of Saudi Arabia



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**Abstract** Cancer patients face multiple challenges, such as infertility which may result from exposure to irradiation during cancer treatment. Little is known about the health practitioners' knowledge and practice regarding fertility preservation and its available options in Saudi Arabia. This study aimed to assess healthcare practitioners' knowledge, attitudes, and practices (KAP) toward fertility preservation among cancer patients in Makkah, Saudi Arabia. A cross-sectional study was conducted among 100 health practitioners from September 2022 to January 2023. A self-administered questionnaire was used to assess KAP. The Chi-square ( $\chi^2$ ) test and Student's t-test were used for categorical data and continuous variables as appropriate. Most participants (90%) lacked knowledge about fertility preservation. Cost and clinic availability significantly influenced the health practitioners' attitude toward fertility preservation discussions with cancer patients ( $P < 0.05$ ). Most of the study participants (87%) were familiar with sperm and egg freezing, while other techniques were less well-known. There were significant associations between health practitioners' attitudes in discussing fertility preservation with their cancer patients with significant influence ( $P < 0.05$ ). The results revealed that 92% of the participants agreed that the Saudi

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509

Ministry of Health should establish practice guidelines and provide fertility preservation services for cancer patients. Healthcare practitioners in Makkah, Saudi Arabia, have limited knowledge about fertility preservation. Educational interventions and improved access to fertility preservation services are needed.

**Keywords** Fertility preservation · Fertility · Cancer · Gonadotoxic agents · Chemotherapy

## 1 Introduction

Cancer is the second-highest cause of death globally, resulting in millions of deaths all over the world. According to the Global Cancer Observatory (GCO), a platform that follows The World Health Organization (WHO), approximately about 19 million new cancer cases worldwide were recorded in 2020, with 9.9 million deaths across both genders [1]. In Saudi Arabia, 27,885 patients were diagnosed, and 13,069 deaths were reported from both genders in 2020. Among females, the most common types of cancer were breast cancer, followed by thyroid cancer and colorectal cancer. In contrast, among male patients, colorectal cancer was the most prevalent, followed by Non-Hodgkin lymphoma (NHL) and leukemia [2]. Cancer patient faces multiple challenges, along with being diagnosed with cancer. In the past, the main priority for cancer patients was to survive cancer despite any other complications. However, the focus now has changed from treating cancer alone to providing treatment and avoiding long-term consequences, which resulted from cancer therapy such as infertility [3]. According to The World Health Organization (WHO), infertility is defined as the inability or failure to establish pregnancy after one year of trying with regular unprotected sexual intercourse [4]. Infertility rises among cancer survivors, and it is usually associated with significant social, psychological, and economical effects. Preserving cancer patients' fertility before being treated for cancer is highly recommended [5].

The American Society of Clinical Oncology (ASCO) recommended that the possibility of infertility and fertility preservation options must be discussed with a cancer patient. In addition, a cancer patient should be referred to a fertility preservation clinic for consultation before cancer treatment [6]. Despite these fertility preservations guidelines and regulations, a large number of previous studies reported that some health practitioners including oncologists are lacking awareness regarding fertility preservation options before cancer treatments. Therefore, the number of patients' referrals to fertility preservation clinics remains low [6–9].

In Saudi Arabia, the patient bill of Rights and Responsibilities by the Saudi Ministry of Health (MOH) righted that the patient must be informed regarding the possibility of infertility due to cancer and its negative effects and referred to an infertility consultant before undergoing cancer therapy [10, 11]. However, fertility preservation of cancer patients is still a challenging issue, and the practice of referral and consulting is not yet fully adopted among Saudi health practitioners. Fertility

preservation is usually defined as a process of preserving reproductive cells including oocytes, sperm, and embryos, or reproductive tissues including ovarian and testicular tissues to enable individuals to start a family at a time of their choice when their fertility is compromised [12]. The main objective of fertility preservation intervention is to minimize the primary disease burden and more importantly to ensure maintaining or preserving reproductive health [13]. Oncofertility is a common term for fertility preservation in cancer patients. For individuals who are diagnosed with cancer, fertility preservation is a significant thought when there is a chance that cancer treatment may influence their fertility. Fortunately, there are currently tremendous fertility preservation options that are accessible to cancer patients, and there are numerous individuals who have had the option to begin a family after cancer treatment [14].

With regard to fertility preservation in Saudi Arabia, the Islamic Fatwas were in good agreement with the Saudi System of Fertilization and Embryology Units. In 21-11-1424 H, the system declares that the intervention of third-party reproduction such as sperm, oocytes, and embryo donor/banking is prohibited by law and religion. In addition, it states that fertility preservation options such as embryo freezing can only be offered to married couples, and in case of divorce or death, the frozen embryos must be destroyed [15]. The current study aims to assess healthcare practitioners' knowledge, attitudes, and practices (KAP) toward fertility preservation among cancer patients in Makkah, Saudi Arabia.

## 2 Methods

### 2.1 Study Design

This cross-sectional was conducted to evaluate the level of knowledge about, attitude, and practice toward, fertility preservation in cancer patients among health practitioners who work closely with cancer patients in the Makkah region. The study was conducted between September 2022 to January 2023. Ethical approval (AMSEC 27/1-3-2020) for the study was obtained from the Institutional Ethics Committee at Umm Al-Qura University. The instrument of the study was a self-administered closed-ended questionnaire with a brief introduction to explain the objectives of the survey. The study's questionnaires were randomly distributed to 100 health practitioners from a variety of specialties such as medical and clinical oncologists, surgeons, hematologists, nurses, laboratory specialists, anesthesiologists, pharmacists, and radiologists. In addition, the study participants were asked to sign the written informed consent form to maintain the privacy of their information and were informed that their participation was voluntary and that they could withdraw from the questionnaire at any time.

The current questionnaire was designed and developed by the authors of this study using the Google Forms tool. It was provided in the English language only. The link

to the questionnaire was generated and sent as a WhatsApp message to the participated health practitioners' phone numbers or as a Twitter message on their personal Twitter social media accounts. The questionnaire consisted of 18 closed-ended questions which were divided into four main sections. These include the knowledge, attitude, and practice of health practitioners toward fertility preservation among cancer patients. Followed by a final section about socio-demographic information, such as participants' age, gender, and workplace. To validate the study questionnaire, a pilot study was performed to test the reliability and acceptability of the study and to confirm that the participants were able to understand each question in the same manner. In addition, to test the duration of time required to answer the questionnaire. For this, ten healthcare practitioners, who were experienced in treating cancer patients in Makkah region, were randomly selected and kindly asked to answer the same questionnaire. Their answers were then checked to detect if any variations might arise from the translation of the questions. According to the results of the pilot study, there were no modifications or omissions of unnecessary or repeated questions. Health practitioners who participated in the pilot study were excluded from the study subjects.

## 2.2 Statistical Analysis

Data entry and statistical analysis were done using the Statistical Package for Social Sciences software version 20.0 (SPSS Inc. Chicago, Illinois, USA). Mean and standard deviation were used to describe numerical data, and the percentage was used for categorical data. Frequencies of correct knowledge answers and various attitudes and practices were described. The Chi-square ( $\chi^2$ ) test and Student's-t-test were used for categorical data and continuous variables as appropriate. Results with a P-value of  $<0.05$  were considered statistically significant.

## 3 Results

One hundred healthcare practitioners who work with cancer patients in Makkah region agreed to participate in this study. The participants' age ranged from 25 to 65 years. The targeted population included both male and female practitioners (51% and 49%), respectively. Most of the study participants (75%) are working in Jeddah city, while 24% and 1% are working in Makkah and Taif city, respectively (Table 1). As shown in Table 1, the demographic findings show a variety of cancer sub-specialties among the study respondents of which, 30% were sub-specialized in gynecological cancer, followed by 24% in hematological cancer and other specialties.

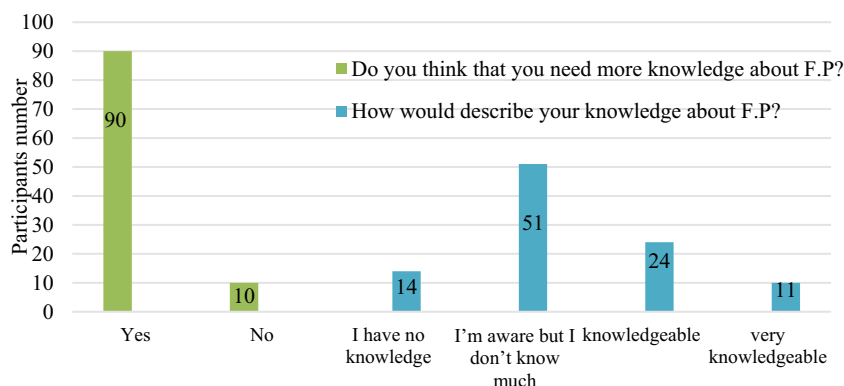
Figure 1 illustrates the knowledge level of health practitioners regarding fertility preservation of cancer patients. The study reveals that 90% of the respondents need to raise their knowledge about fertility preservation in comparison to 10% who declared

**Table 1** Distribution of study participants according to their demographic characteristics

Characteristics	Participants number	
	No	%
<i>Gender</i>		
Female	49	49
Male	51	51
<i>Age</i>		
25–35	38	38
36–45	31	31
46–55	15	15
55–65	16	16
<i>Workplace</i>		
Makkah	24	24
Jeddah	75	75
Taif	1	1
<i>Cancer sub-specialty</i>		
Gynecological	30	30
Hematological	24	24
Breast	16	16
Pediatric	13	13
Lung	4	4
CNS	3	3
Urological	3	3
Gastrointestinal	3	3
Sarcomas/soft tissue	3	3
Head and neck	1	1

that they are knowledgeable. In addition, 51% of the participating health practitioners confirmed that they might be aware of fertility preservation, but they need to be knowledgeable about it. In contrast, 35% of respondents declared that they were knowledgeable or had adequate knowledge regarding fertility preservation. Among hundred participants, 14% declared that they did not know about fertility preservation. There was no significant association between health practitioners' knowledge and gender, age, workplace, and cancer sub-specialty (all P-values >0.05).

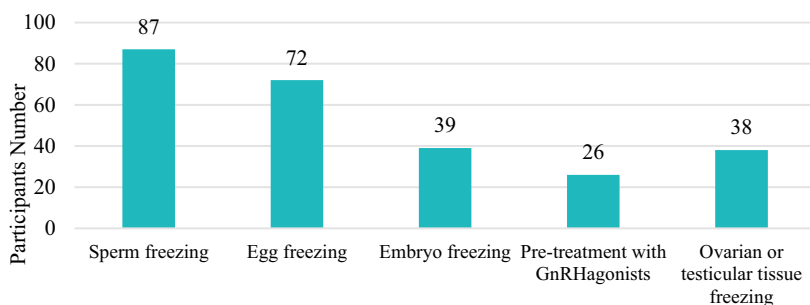
The bar chart shows that 90% needed more knowledge about fertility preservation, and 51% were aware of fertility preservation but they need to be knowledgeable about it. Regarding fertility preservation procedures and options, data presented in Fig. 2 reflect that most of the study participants ( $n = 87$ ) were familiar with sperm freezing. The second, most known option by health practitioners was egg freezing ( $n = 72$ ). On the other hand, embryo, ovarian or testicular tissue freezing, and GnRH-agonists pre-treatment were the least fertility preservation options known to study



**Fig. 1** Health practitioners' distribution according to their knowledge about fertility preservation

respondents, ( $n = 39, 38,$  and  $26,$  respectively). The bar chart shows that 87% of study participants were familiar with sperm freezing. The second, most known option by health practitioners was egg freezing. On the other hand, embryo, ovarian or testicular tissue freezing, and GnRH-agonists pre-treatment were the least fertility preservation options known to study respondents.

The attitude of health practitioners towards fertility preservation discussion is demonstrated in Table 2. It appears that 66% of them agreed that fertility preservation was a high priority to be discussed with newly diagnosed cancer patients. In addition, 58% of study participants declared that they feel comfortable discussing fertility preservation with their patients. In contrast, a few respondents disagreed with both statements (15% and 21%), respectively. The study survey also included some questions about the success rates of fertility preservation and whether treating primary cancer is more important than fertility preservation. Around 54% of health practitioners agreed that treating cancer had a higher priority than fertility preservation. On the other hand, 21% disagreed with this statement. Nonetheless, the percentages of



**Fig. 2** Health practitioners' distribution according to their knowledge about fertility preservation available options

agreeing (36%) and disagreeing (41%) participants with the statement that fertility preservation is not a viable procedure for cancer patients due to its low success rates were nearly similar (Table 2).

The factors that influenced health practitioners' attitudes towards fertility preservation discussion with cancer patients were summarized in Table 3. It appears that more than 90% of health practitioners would discuss fertility preservation unless their cancer patient has a poor prognosis and/or cannot afford the expenses of fertility preservation. Other health practitioners declared further reasons that could affect their decision to discuss fertility preservation with their patients such as lack of fertility services in the patients' area (85%), the patient being too ill to delay treatment to pursue fertility preservation (85%), the patient is being diagnosed with hormonal sensitive malignancy (84%), or the patient already had a child or children (78%). On the other hand, factors related to patients such as the inability to afford fertility preservation procedures or poor prognosis were among the least chosen reasons by study respondents that may affect their potential discussion with cancer patients (Table 3). There were significant associations between health practitioners' attitudes in discussing fertility preservation with their cancer patients and the influenced discussion factors (all P-values < 0.05).

Figure 3 displays participants' attitudes towards fertility preservation practice guidelines. It appeared that among one hundred participants, 97% agreed with the need for fertility preservation practice guidelines ( $P < 0.001$ ) compared to only 3% of participants who disagreed with the importance of creating fertility preservation practice guidelines (Fig. 3).

Regarding the most important factor for referring patients to fertility preservation, it appeared that many health practitioners ( $n = 25$ ) consider the type of cancer, and ( $n = 22$ ) select patient prognosis as the second most important factor affecting their decision in referring the cancer patients. The cost and the patient's desire were among the most important factors for cancer patient referral, ( $n = 20$  and 18) respectively. The bar chart also showed other less important factors such as the logistic issues, gender, time, and patient's marital status (Fig. 4). In terms of participants' desire to have a free fertility preservation service for cancer patients provided by the Saudi

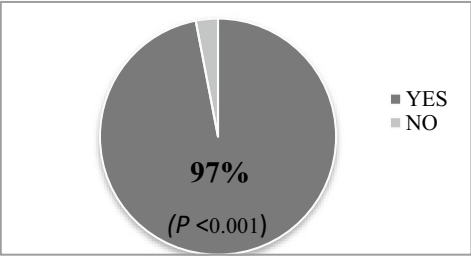
**Table 2** Health practitioners' attitude in discussing fertility preservation with their cancer patients

Health practitioners' attitude	Agreement No. (%)	Neither No. (%)	Disagreement No. (%)
Fertility Preservation is a high priority for me to discuss with newly diagnosed cancer patients	66 (66%) ( $P < 0.05$ )	19 (19%)	15 (15%)
I feel comfortable discussing fertility preservation with my patients	58 (58%) ( $P < 0.05$ )	21 (21%)	21 (21%)
Treating the primary cancer is more important than fertility preservation	54 (54%) ( $P < 0.05$ )	25 (25%)	21 (21%)
The success rates of fertility preservation are not as yet good enough to make it a viable option	35 (36%)	24 (24%)	41 (41%)

**Table 3** Factors that influence health practitioners’ discussion about fertility preservation with their cancer patients

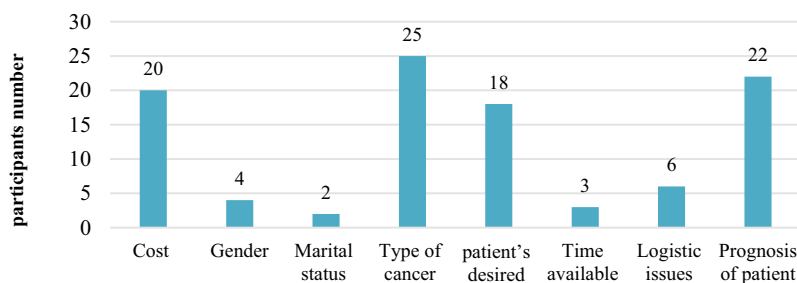
Factors	Agreement No. (%)	Disagreement No. (%)
The patient cannot afford fertility preservation	92 (92%) ( <i>P</i> < 0.001)	8 (8%)
The patient has a poor prognosis	91 (91%) ( <i>P</i> < 0.001)	9 (9%)
Lack of fertility services in the area	85 (85%) ( <i>P</i> < 0.01)	15 (15%)
The patient is too ill to delay treatment to pursue fertility preservation	85 (85%) ( <i>P</i> < 0.01)	15 (15%)
The patient has a hormonally—sensitive malignancy	84 (84%) ( <i>P</i> < 0.01)	16 (16%)
The patient already has a child or children	78 (78%) ( <i>P</i> < 0.01)	22 (22%)
The patient does not want to discuss fertility preservation	77 (77%) ( <i>P</i> < 0.01)	23 (23%)
Constraints on my time	72 (72%) ( <i>P</i> < 0.01)	28 (28%)
Someone else within my practice discusses fertility preservation with my patients	70 (70%) ( <i>P</i> < 0.01)	30 (30%)
My limited knowledge of fertility preservation options	69 (69%) ( <i>P</i> < 0.01)	31 (31%)
The patient is single	57 (57%) ( <i>P</i> < 0.05)	43 (43%)

**Fig. 3** Health practitioners’ attitude towards fertility preservation practice guidelines



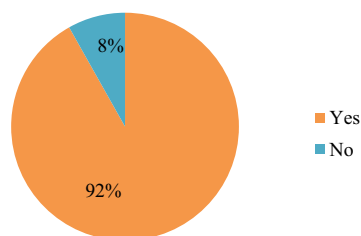
Ministry of Health. It showed that most of the study participants (92%) agreed with the statement, compared to 8% who disagreed with this notion (Fig. 5).





**Fig. 4** The most important factors in terms of patients' referrals according to the study participants

**Fig. 5** Health practitioners' opinions regarding fertility preservation service



## 4 Discussion

This study was conducted to assess the level of knowledge, attitude, and practice of health practitioners towards fertility preservation in cancer patients in Makkah region. The study indicates several significant findings. Firstly, the insufficient knowledge of health practitioners regarding fertility preservation could be mainly due to the lack of fertility preservation topics in medical education. Moreover, the national and private healthcare system in Saudi Arabia has focused only limited attention on fertility preservation. This highlighted the need to increase the knowledge regarding fertility preservation. The current finding was similar to previous studies, which reported a lack of fertility preservation knowledge among health practitioners in France and Hong Kong [7, 8].

Secondly, fertility preservation options such as sperm and oocyte cryopreservation appeared to be the most known procedures among health practitioners. This is because these two techniques are the most recommended options by ASCO and the most used by doctors worldwide. For males, sperm cryopreservation is an effective and simple technique, which requires the production of a semen sample at any time before commencing the cancer treatment [8]. However, in the female population, fertility preservation is more complex, costly, and time-consuming than in men. Oocyte or embryo freezing was more popular than ovarian tissue freezing among health practitioners. These findings were consistent with a previous study in Hong Kong, which found that the majority of health practitioners were familiar with sperm and oocyte freezing [8]. Thirdly, most participating health practitioners declared

that they are very likely to discuss fertility preservation with their cancer patients. However, many factors may significantly affect their attitude towards fertility preservation discussion such as poor patient prognosis or that the patient cannot afford the expenses of fertility preservation. These findings were in agreement with previous studies, which reported that the poor patient prognosis and the cost were among the factors that affected health practitioners' attitudes to discussing fertility preservation with cancer patients [7, 8]. Moreover, the current study illustrates a low referring rate to fertility preservation. The reasons behind this could be related to the cancer type, patient prognosis, the cost, and the lack of fertility preservation centers in the patient area. Similar findings were also reported in a previous study conducted in Lebanon, where the clinicians had no choice but to not refer patients for fertility preservation due to the absence of well-developed fertility preservation centres [9].

Furthermore, the majority of study participants agreed that fertility preservation and referring patients to such services should be associated with clear practice guidelines. This attitude can be explained by the lack of fertility preservation topics in general medical education and thus the need to increase the professional practical knowledge of fertility preservation. This result was consistent with a previous study in Hong Kong, which demonstrated a positive attitude and a great desire of health practitioners to establish fertility preservation practice guidelines [8].

In addition, most health practitioners in Makkah region agreed on the need for national fertility preservation services for cancer patients provided by the Saudi Ministry of Health. The cost of fertility preservation for a cancer patient plays an important role in the health practitioner's decision to discuss and refer the patient. In Saudi Arabia, the cryopreservation of sperms, oocytes, embryos, and other fertility preservation options are only available at private hospitals and a limited number of patients can afford it. Therefore, the Saudi Ministry of Health should consider providing these services to for cancer patients at affordable cost. Likewise, clinicians in Hong Kong also agreed that patients have difficulties in paying for fertility preservation and suggested providing free clinics or centers for fertility preservation [8].

## 5 Conclusions

To our knowledge, this is the first study that assesses the knowledge, attitudes, and awareness of healthcare practitioners toward fertility preservation in cancer patients in Saudi Arabia, particularly in the Makkah region. As a result, healthcare practitioners' knowledge remains insufficient. Hence, further efforts are required to be conducted to ensure that practitioners are discussing fertility preservation, its available options, and patients' referrals to fertility preservation clinics before cancer treatments. This includes education, training programs, and increasing awareness campaigns regarding fertility preservation. Additionally, the establishment of well-developed fertility preservation services, referral centers, and practice guidelines are recommended. Moreover, national fertility preservation services should be provided

to patients suffering from cancer. Further studies in terms of cancer treatment risks and fertility preservation rights in Saudi Arabia are recommended.

## References

1. The Global Cancer Observatory. Retrieved January 24, 2021, from <https://gco.iarc.fr/today/data/factsheets/cancers/39-All-cancers-fact-sheet.pdf>.
2. The Global Cancer Observatory. Retrieved January 24, 2021, from <https://gco.iarc.fr/today/data/factsheets/populations/682-saudi-arabia-fact-sheets.pdf>.
3. Simon, B., Lee, S. J., Partridge, A. H., & Runowicz, C. D. (2005). Preserving fertility after cancer. *CA: A Cancer Journal for Clinicians*, 55(4), 211–224.
4. World Health Organisation. Retrieved September 21, 2021, from <https://www.who.int/news-room/fact-sheets/detail/infertility>.
5. Amoudi, S. (2017). *Reproductive health rights for cancer patients* (1st ed.). Jurisprudence rulings and legal controls for sterility and fertilization, and modern reproductive techniques. Health empowerment and health rights Unit Faculty of Medicine, King Abdulaziz University.
6. Shnorhavorian, M., Harlan, L. C., Smith, A. W., Keegan, T. H., Lynch, C. F., et al. (2015). Fertility preservation knowledge, counseling, and actions among adolescent and young adult patients with cancer: A population-based study. *Cancer*, 121(19), 3499–3506.
7. Sallem, A., Shore, J., Ray-Coquard, I., Ferreux, L., Bourdon, M., et al. (2018). Fertility preservation in women with cancer: A national study about French oncologist's awareness, experience, and feelings. *Journal of Assisted Reproduction and Genetics*, 35(10), 1843–1850.
8. Chung, J. P., Lao, T. T., & Li, T. C. (2017). Evaluation of the awareness of, attitude to, and knowledge about fertility preservation in cancer patients among clinical practitioners in Hong Kong. *Hong Kong Medical Journal = Xianggang Yi Xue Za Zhi*, 23(6), 556–561.
9. Ghazeeri, G., Zebian, D., Nassar, A. H., Harajly, S., Abdallah, A., et al. (2016). Knowledge, attitudes, and awareness regarding fertility preservation among oncologists and clinical practitioners in Lebanon. *Human Fertility (Cambridge, England)*, 19(2), 127–133.
10. Ministry of Health. (2020). Patient bill of rights and responsibilities. Retrieved January 22, 2021, from <https://www.moh.gov.sa/HealthAwareness/EducationalContent/HealthTips/Documents/Patient-Bill-of-Rights-and-Responsibilities.pdf>.
11. Ministry of Health. What is cancer? Retrieved March 23, 2021, from <https://www.moh.gov.sa/en/awarenessplatform/ChronicDisease/Pages/Cancer.aspx>.
12. Mahajan, N. (2015). Fertility preservation in female cancer patients: An overview. *Journal of Human Reproductive Sciences*, 8(1), 3–13.
13. Hussein, R. S., Khan, Z., & Zhao, Y. (2020). Fertility preservation in women: Indications and options for therapy. *Mayo Clinic Proceedings*, 95(4), 770–783.
14. Melan, K., Amant, F., Veronique-Baudin, J., Joachim, C., & Janky, E. (2018). Fertility preservation healthcare circuit and networks in cancer patients worldwide: What are the issues? *BMC Cancer*, 18(1), 192–x.
15. Amoudi, S. (2018). *Jurisprudence rulings and legal controls for sterility and fertilization, and modern reproductive techniques* (1st ed.). Health empowerment and health rights Unit Faculty of Medicine, King Abdulaziz University.

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