



# Fertility Preservation for Patients With Cancer

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A key concern for young patients with cancer and survivors is the desire to parent a child. With infertility being a well-established long-term effect of many oncologic regimens, patients who want to have children often become distressed when faced with the possibility of losing their fertility. Several organizations have recommended that oncology professionals discuss options for fertility preservation when planning treatment; however, this does not routinely occur. Oncology nurses play a significant role in filling this practice gap by identifying patients who are interested in future parenting and ensuring they get the information and referrals they need to decide whether to pursue fertility preservation. This article outlines the available options, challenges in discussing fertility, and strategies to incorporate fertility education into practice.

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According to Surveillance, Epidemiology, and End Results ([SEER], 2011a), about 165,000 men and women in the United States younger than age 45 face a diagnosis of cancer every year. With five-year expected survival rates of 68% and 83%, respectively, for adult and childhood cancers, quality-of-life issues for survivors have become increasingly important (American Cancer Society, 2011; SEER, 2011b). Key among those is the desire to parent a child. Many survivors want to be parents after treatment and are distressed about the possibility of infertility (Partridge et al., 2004; Peate, Meiser, Hickey, & Friedlander, 2009; Rosen, Rodriguez-Wallberg, & Rosenzweig, 2009; Schover, 2005; Schover, Brey, Lichtin, Lipschultz, & Jeha, 2002a; Schover, Rybicki, Martin, & Bringelsen, 1999; Tschudin & Bitzer, 2009). Infertility is a well-established long-term or permanent effect of many cancer treatments. Table 1 outlines the

potential effects of cancer treatment on male and female fertility. Advances in reproductive technology enable most postpubertal patients to preserve fertility before treatment. Prepubertal patients also now have options that were not available in the past.

Several leading professional organizations have issued guidelines to address cancer and fertility. Oncology clinicians are recommended to inform patients about the risks of infertility from treatment, discuss options for fertility preservation, and refer interested patients to reproductive specialists as early as possible when planning treatment (Ethics Committee of the American Society for Reproductive Medicine, 2005; Fallat & Hutter, 2008; Lee et al., 2006; Pentheroudakis, Orecchia, Hoekstra, & Pavlidis, 2010). Despite recommendations to include options for fertility preservation when outlining cancer treatment plans, research has shown that oncology clini-

cians do not routinely discuss fertility with patients (King et al., 2008; Kotro-noulas, Papadopoulou, & Petiraki, 2009; Quinn et al., 2007, 2009; Reebals, Brown, & Buckner, 2006; Schover et al., 2002b; Vadaparampil et al., 2007).

## Options for Fertility Preservation

For patients at risk for treatment-related infertility who wish to consider fertility preservation, early referral to appropriate specialists is essential. Collection of sperm or oocytes during treatment is not recommended, as a single treatment with gonadotoxic therapy can affect gamete quality and DNA integrity (Lee et al., 2006). Whereas sperm banking can be accomplished in an hour or two, the time required for ovarian stimulation and egg retrieval prior to embryo or oocyte cryopreservation presents a challenge when female patients need to start cancer treatment without delay. For prepubescent patients enrolled in tissue cryopreservation trials, consent must be obtained as soon as possible after diagnosis, as research protocols may require that tissue be retrieved at the same time as other procedures requiring anesthesia, such as central line placement. Table 2 details fertility preservation options for women and men. Oncology nurses need to keep in mind that timely initiation of any fertility preservation measure is imperative.

## Challenges in Discussing Fertility

Fertility preservation often is addressed in the context of a potentially life-threatening diagnosis (Woodruff, 2010). That creates many real and perceived

challenges for clinicians, patients, families, and healthcare organizations. With a focus on planning cancer treatment, healthcare providers often spend little time preparing patients for issues of survivorship, including fertility (Ginsberg et al., 2008; Goodwin, Oosterhuis, Kiernan, Hudson, & Dahl, 2007; Lee et al., 2006; Reebals et al., 2006; Schover et al., 1999).

Individual assumptions and personal biases may affect clinician willingness to discuss fertility concerns.

Patients and families often are overwhelmed by the cancer diagnosis and may not consider the potential impact of treatment on future fertility. Cost can be a significant barrier limiting fertility-sparing options for many patients. In the United States, the average cost for sperm banking is \$576. Embryo freezing, including associated medications, can cost as much as \$13,750 (LIVESTRONG, 2011). Most insurance carriers do not cover the cost of fertility preservation. Religious, cultural, and ethical beliefs also must be considered. Variability may exist in the interpretation of religious perspectives, and some patients and families will request that clergy be involved in the discussion. Lack of resources and clearly defined processes can result in organizational challenges to discussing fertility preservation. Figure 1 depicts patient, provider, and organizational challenges often faced when discussing fertility preservation.

plan an optimal time to have the discussion. Although the physician, not the nurse, generally informs the patient of infertility as a potential risk of cancer treatment, the nurse has a significant role in following up after the initial discussion. As a member of the care team, the oncology nurse can assess the patient's interest in having children in the future and determine whether they have spoken with anyone or read about the potential impact of cancer treatment on fertility. The nurse can ensure that the patient understands the risk of infertility and, for female patients, the potential for premature menopause, emphasizing that the precise risk is impossible to predict. A description of the options to preserve fertility and provision of resources with more information to review is imperative. If patients are interested in seeing a reproductive specialist, the oncology nurse should ensure that the referral is made.

In conveying information about fertility, use simple, clear language. Recognize that, for many patients, fertility preservation is an act of hope. The oncology nurse must be able to put personal biases aside and respect the right of all patients to be informed of their risks and options, even those who already have children, are older, or who have advanced disease. Nurses must advocate for that right if physicians are reluctant to initiate the discussion. When conveying information that may be hard for patients to hear, be honest and matter of fact. Those discussions often require a significant amount of time and cannot be rushed.

Different approaches are needed, based on age and gender. For teenage boys, encouragement from healthcare providers and parents is important, as they may not value future parenthood at that time in their lives. Older men should not be neglected, particularly if they are in a relationship with a younger woman who may want a child. Decision making is more difficult for women than for men, as most options are invasive, require a delay in treatment of two to three weeks, and are quite costly. The fertility discussion is particularly challenging for teenage girls, who vary widely in their physical and emotional maturity.

Learning of the possibility of infertility can cause significant distress in many patients. Being present and allowing

**TABLE 1. Potential Cancer Treatment Effects on Male and Female Fertility**

Male Organ and Treatment	Effect
<b>Testes</b> Chemotherapy and/or radiation	Depletion or damage of germ cells and developing sperm Leydig cell dysfunction with subsequent reduced testosterone production
<b>Pelvic nerves</b> Surgery and/or radiation	Erectile dysfunction Ejaculatory dysfunction
<b>Ductal system</b> Surgery and/or radiation	Impaired transport of sperm during ejaculation
<b>Pituitary gland</b> Surgery and/or radiation	Impaired hormonal regulation of spermatogenesis by hypothalamic-pituitary-gonadal axis
Female Organ and Treatment	Effect
<b>Ovaries</b> Chemotherapy and/or radiation	Depletion or damage of pool of primordial follicles and oocytes (i.e., lower ovarian reserve) Premature ovarian failure with subsequent infertility and/or early menopause
<b>Uterus</b> Radiation	Fibrosis causing vascular insufficiency, endometrial damage, and loss of elasticity, with subsequent inability to support embryo implantation and/or accommodate a growing fetus
<b>Ovaries and uterus</b> Surgery	Absence of reproductive structures, if resection was needed to ensure eradication of disease
<b>Pituitary gland</b> Surgery and/or radiation	Impaired hormonal regulation of menstrual cycle by hypothalamic-pituitary-gonadal axis

*Note.* Based on information from Agarwal & Allamaneni, 2005; Howell & Shalet, 2005; Lee et al., 2006; Magelssen et al., 2006; Maltaris et al., 2007; Meirrow et al., 2010; Meistrich, 2009; Stroud et al., 2009; Wo & Viswanathan, 2009.

## Incorporating Fertility Education

### In Practice

Addressing fertility preservation with patients requires multidisciplinary collaboration between oncology nurses, oncologists, reproductive specialists, and mental health professionals. When planning care for a patient newly diagnosed with cancer who has reproductive potential, the oncology nurse needs to collaborate with the treating oncologist to clarify the potential impact of treatment on fertility, determine the time frame for initiation of treatment, confirm the safety of fertility preservation based on the patient's situation, and

**TABLE 2. Options for Fertility Preservation for Females and Males**

Option	Discussion
<b>Protective Measures for Women</b>	
Intensity-modulated radiation therapy	<ul style="list-style-type: none"> <li>• Radiation therapy technology to precisely shape the field of treatment to minimize dose to the ovaries</li> <li>• Used for pelvic radiation (e.g., rectal cancer, bladder cancer, lymphoma, cervical cancer)</li> <li>• Ovaries will still be at risk from scatter radiation.</li> <li>• Does not offer protection from gonadotoxic chemotherapy</li> </ul>
Ovarian transposition	<ul style="list-style-type: none"> <li>• Surgical placement of ovaries out of the field of treatment for patients requiring radiation therapy; ovaries usually are placed as high and lateral as possible.</li> <li>• Used for pelvic radiation (e.g., rectal cancer, bladder cancer, lymphoma, cervical cancer)</li> <li>• Ovaries will still be at risk from scatter radiation.</li> <li>• Does not offer protection from gonadotoxic chemotherapy</li> </ul>
Ovarian suppression	<ul style="list-style-type: none"> <li>• Use of gonadotropin-releasing hormone agonists (e.g., leuprolide) to suppress ovarian function, inducing temporary menopause</li> <li>• May help preserve ovarian function, but no data yet to suggest its effectiveness in preserving fertility; adult trials are under way.</li> </ul>
<b>Preservation Methods for Postpubertal Women</b>	
Embryo cryopreservation	<ul style="list-style-type: none"> <li>• Freezing of embryos obtained by ovarian stimulation, egg retrieval, and in vitro fertilization</li> <li>• Requires 2–3 week delay of treatment</li> <li>• Requires use of donor sperm for females without a partner</li> <li>• Theoretical concern of ovarian stimulation for patients with hormone-sensitive tumors, but no data to indicate it actually increases risk</li> </ul>
Oocyte cryopreservation	<ul style="list-style-type: none"> <li>• Freezing of eggs obtained by ovarian stimulation and egg retrieval</li> <li>• Unfertilized eggs frozen by vitrification or slow freeze</li> <li>• Requires 2–3 week delay of treatment</li> <li>• Good option for women who lack a partner and are unwilling to use donor sperm</li> <li>• Theoretical concern of ovarian stimulation for patients with hormone-sensitive tumors, but no data to indicate it actually increases risk</li> <li>• Defined as investigational by the American Society of Reproductive Medicine, but now becoming widely available</li> </ul>
<b>Preservation Methods for Prepubertal Females</b>	
Ovarian tissue cryopreservation	<ul style="list-style-type: none"> <li>• Freezing of ovarian tissue obtained by surgical removal of pieces of an ovary or an entire ovary</li> <li>• Also an option for females with insufficient time for ovarian stimulation and egg retrieval</li> <li>• Only about 15 live human births from reimplantation of tissue to date</li> <li>• Because of risk of reintroducing cancer cells with reimplantation, research is focused on developing techniques for in vitro egg maturation.</li> <li>• Procedure is investigational and may only be carried out as an institutional review board–approved research protocol.</li> </ul>
<b>Protective Measures for Men</b>	
Testicular shielding	<ul style="list-style-type: none"> <li>• Use of external shields to protect the testes from the damaging effects of radiation</li> <li>• Testes will still be at risk from scatter radiation.</li> <li>• Does not offer protection from gonadotoxic chemotherapy</li> </ul>
<b>Preservation Methods for Postpubertal Men</b>	
Sperm banking	<ul style="list-style-type: none"> <li>• Freezing of sperm obtained by masturbation</li> <li>• Specimens most commonly collected and analyzed at sperm banks, but home collection kits are available and inpatient collection may be feasible.</li> </ul>
Electroejaculation	<ul style="list-style-type: none"> <li>• Method of obtaining sperm in males unable to collect through masturbation for physical, emotional, religious, or cultural reasons</li> <li>• Uses a rectal probe to deliver a mild electric current to stimulate ejaculation while under anesthesia</li> </ul>
Testicular sperm extraction or aspiration	<ul style="list-style-type: none"> <li>• Method of obtaining sperm through testicular biopsy or percutaneous aspiration</li> <li>• May be effective for males with pretreatment impaired spermatogenesis and who are azoospermic on semen analysis</li> <li>• May also be used post-treatment to obtain sperm for in vitro fertilization and intracytoplasmic sperm injection</li> </ul>
<b>Preservation Methods for Prepubertal Males</b>	
Testicular tissue cryopreservation	<ul style="list-style-type: none"> <li>• Freezing of testicular tissue obtained by surgical removal of pieces of the testis</li> <li>• No live human births from reimplantation of tissue to date</li> <li>• Because of risk of reintroducing cancer cells with reimplantation, research is focused on developing techniques for in vitro sperm maturation.</li> <li>• Procedure is investigational and may only be carried out as an institutional review board–approved research protocol.</li> </ul>

*Note.* Based on information from Badawy et al., 2009; Donnez et al., 2010; Ginsberg et al., 2008, 2010; Lee et al., 2006; Sella et al., 2005; Silber et al., 2010; West et al., 2009.

### Healthcare Providers' Personal Biases and Assumptions

- Lack of knowledge regarding options
- Lack of time to discuss
- Unsure of where to refer patients
- Belief that a delay in treatment will negatively influence outcome or urgency to start treatment
- Belief that fertility preservation is not important to the patient
- Belief that fertility preservation is too anxiety-provoking and adds stress
- Belief that it is not a worthwhile discussion because of poor prognosis
- Concern about age (i.e., too young or old to think about childbearing)
- Concern about cost for patients and families
- Language or cultural barriers
- Personal discomfort with the topic

### Patient and Family Challenges

- Lack of information
- Concern about safety
- Concern about efficacy
- Concern about cost or insurance coverage
- Lack of support from family or healthcare providers
- Religious, cultural, and ethical beliefs

### Organizational Challenges

- Lack of guidelines or policies
- Lack of education materials
- Lack of a referral network
- Uncertainty regarding which healthcare provider is most appropriate to discuss fertility; lack of role clarification or an interdisciplinary team approach
- Lack of a standardized process for informing patients and making referrals

## FIGURE 1. Challenges to Discussing Fertility Preservation

Note. Based on information from Ginsberg et al., 2008; Lee et al., 2006; Ogle et al., 2008; Patrizio et al., 2005; Reebals et al., 2006; Schover, 1999; Schover et al., 2002b; Vadaparampil et al., 2008; Zebrack et al., 2004.

expression of loss, grief, and anger provides valuable support for many patients. If a patient describes being overwhelmed by these emotions, remains distressed for many weeks, or is unable to make decisions about treatment because of their distress, consider making a referral to a mental health specialist for counseling.

## In the Organization

To improve fertility preservation education within the practice setting, oncology nurses should work with other clinicians who have a shared interest and commitment to the issue. Reach out to colleagues in medical, surgical, and radiation oncology; survivorship, adolescent, and young adult oncology; general gynecology and urology; and reproductive medicine. Working within a larger group optimizes oncology nurses' opportunities to be effective champions of change.

Ensure that educational resources are available for patients to provide more in-depth information than the oncology clinicians may have the knowledge or time to discuss. Although some organizations may want to create customized cards or booklets, a number of free downloadable brochures and fact sheets, as well as Web sites, are available from organizations focused on cancer and fertility (see Figure 2).

Having a local network of reproductive specialists and a clearly defined referral process also is important. Locate sperm banks, reproductive urologists,

and reproductive endocrinologists in the community to whom patients can be referred. Ensure they can accommodate the needs of patients and establish a simple method for making referrals so that patients are seen quickly, relevant medical information is shared, and fertility preservation efforts are coordinated with the planned timing for initiation of the patient's cancer treatment. To assist patients in accessing such services, refer patients to the LIVESTRONG® Sharing Hope program, which provides financial assistance to eligible patients undertaking fertility preservation at a participating center.

Once the resources are in place, educate other clinicians. Invite local reproductive specialists to discuss the technology currently available to provide fertility preservation. Work with nursing and medical leadership on when best to schedule those sessions to ensure the largest possible audience is reached. In addition, choose a relevant article for discussion at a journal club, or select a young patient concerned about infertility to present at a case conference. At

### Cancer and Fertility

- Fertile Hope: [www.fertilehope.org](http://www.fertilehope.org)
- MyOncoFertility: [www.myoncofertility.org](http://www.myoncofertility.org)
- Save My Fertility: [www.savemyfertility.org](http://www.savemyfertility.org)

### Cancer and Fertility for Teenagers

- Cancer Net: [www.cancer.net](http://www.cancer.net)
  - Coping > Age-Specific Information > Cancer in Teens > Cancer and Your Body > Fertility and Reproductive Health
- Center for Young Women's Health: [www.youngwomenshealth.org](http://www.youngwomenshealth.org)
  - Health Guides by Topic > Gynecology & Reproductive Health > Cancer Survivors > Reproductive Questions & Answers
- Cure Search: [www.curesearch.org](http://www.curesearch.org)
  - Search "male reproductive health" and "female reproductive health."
- Kid's Health: [www.kidshealth.org](http://www.kidshealth.org)
  - Under "Teens," search "Can I have children"
- Teen Info on Cancer: [www.click4tic.org.uk](http://www.click4tic.org.uk)
  - Under "deal with it," select "sex and fertility"

### Infertility

- American Fertility Association: [www.theafa.org](http://www.theafa.org)
- American Society for Reproductive Medicine: [www.reproductivefacts.org](http://www.reproductivefacts.org)

- International Council on Infertility Information and Dissemination: [www.inciid.org](http://www.inciid.org)
- RESOLVE: The National Infertility Association: [www.resolve.org](http://www.resolve.org)
- Society for Assisted Reproductive Technology: [www.sart.org](http://www.sart.org)

### Menopause

- National Women's Health Information Center: [www.womenshealth.gov/menopause](http://www.womenshealth.gov/menopause)
- The North American Menopause Society: [www.menopause.org](http://www.menopause.org)

### Reproductive Specialists

- Sperm banks
  - American Association of Tissue Banks: [www.aatb.org](http://www.aatb.org)
  - Sperm Center: [www.spermcenter.com](http://www.spermcenter.com)
- Reproductive urologists
  - Society for Male Reproduction and Urology: [www.smru.org](http://www.smru.org)
- Reproductive endocrinologists
  - American Society for Reproductive Medicine: [www.asrm.org](http://www.asrm.org)
  - Society for Assisted Reproductive Technology: [www.sart.org](http://www.sart.org)
- All reproductive services
  - LIVESTRONG's FertileHope Fertility Resource Guide: [www.fertilehope.org/tool-bar/referral-guide.cfm](http://www.fertilehope.org/tool-bar/referral-guide.cfm)

## FIGURE 2. Resources for Patient Education on Fertility



the same time, disseminate information about the resources developed and the process for making referrals.

## Conclusion

Oncology nurses can play a significant role in overcoming barriers to discussing fertility. Identifying patients who are interested in future childbearing, ensuring they are informed of risks and options, providing them with appropriate resources, and assisting with making referrals will increase the likelihood that all patients have the necessary information and opportunities to decide whether or not to pursue fertility preservation.

## References

- Agarwal, A., & Allamaneni, S.S. (2005). Disruption of spermatogenesis by the cancer disease process. *Journal of the National Cancer Institute. Monographs*, 2005(34), 9-12. doi:10.1093/jncimono-graphs/lgi005
- American Cancer Society. (2011). *Cancer facts and figures 2011*. Atlanta, GA: Author.
- Badawy, A., Elnashar, A., El-Ashry, M., & Shahat, M. (2009). Gonadotropin-releasing hormone agonists for prevention of chemotherapy-induced ovarian damage: Prospective randomized study. *Fertility and Sterility*, 91, 694-697. doi:10.1016/j.fertnstert.2007.12.044
- Donnez, J., Jadoul, P., Squifflet, J., Van Langendonck, A., Donnez, O., Van Eyck, A.S., . . . Dolmans, M.M. (2010). Ovarian tissue cryopreservation and transplantation in cancer patients. *Best Practice and Research. Clinical Obstetrics and Gynaecology*, 24, 87-100.
- Ethics Committee of the American Society for Reproductive Medicine. (2005). Fertility preservation and reproduction in cancer patients. *Fertility and Sterility*, 83, 1622-1628. doi:10.1016/j.fertnstert.2005.03.013
- Fallat, M.E., & Hutter, J. (2008). Preservation of fertility in pediatric and adolescent patients with cancer. *Pediatrics*, 121(5), e1461-e1469.
- Ginsberg, J.P., Carlson, C.A., Lin, K., Hobbie, W.L., Wigo, E., Wu, X., . . . Kolon, T.F. (2010). An experimental protocol for fertility preservation in prepubertal boys recently diagnosed with cancer: A report of acceptability and safety. *Human Reproduction*, 25(1), 37-41.
- Ginsberg, J.P., Ogle, S.K., Tuchman, L.K., Carlson, C.A., Reilly, M.M., Hobbie, W.L., . . . Meadows, A.T. (2008). Sperm banking for adolescent and young adult cancer patients: Sperm quality, patient, and parent perspectives. *Pediatric Blood and Cancer*, 50, 594-598. doi:10.1002/pbc.21257
- Goodwin, T., Oosterhuis, B., Kiernan, M., Hudson, M.M., & Dahl, G.V. (2007). Attitudes and practices of pediatric oncology providers regarding fertility issues. *Pediatric Blood and Cancer*, 48, 80-85. doi:10.1002/pbc.20814
- Howell, S.J., & Shalet, S.M. (2005). Spermatogenesis after cancer treatment: Damage and recovery. *Journal of the National Cancer Institute. Monographs*, 2005(34), 12-17. doi:10.1093/jncimono-graphs/lgi003
- King, L., Quinn, G.P., Vadapampil, S.T., Gwede, C.K., Miree, C.A., Wilson, C., . . . Perrin, K. (2008). Oncology nurses' perceptions of barriers to discussion of fertility preservation with patients with cancer. *Clinical Journal of Oncology Nursing*, 12, 467-476. doi:10.1188/08.CJON.467-476
- Kotronoulas, G., Papadopoulou, C., & Petraki, E. (2009). Nurses' knowledge, attitudes, and practices regarding provision of sexual health care in patients with cancer: Critical review of the evidence. *Supportive Care in Cancer*, 17, 479-501. doi:10.1007/s00520-008-0563-5
- Lee, S.J., Schover, L.R., Partridge, A.H., Patrizio, P., Wallace, W.H., Hagerty, K., . . . Oktay, K. (2006). American Society of Clinical Oncology recommendations on fertility preservation in cancer patients. *Journal of Clinical Oncology*, 24, 2917-2931. doi:10.1200/JCO.2006.06.5888
- LIVESTRONG. (2011). *Position statement: Health insurance coverage for iatrogenic infertility*. Retrieved from <http://www.livestrong.org/pdfs/3-0/LIVESTRONG-CLRC-Position-Statement-Iatrogenic-Inf>
- Magelssen, H., Brydøy, M., & Fosså, S.D. (2006). The effects of cancer and cancer treatments on male reproductive function. *Nature Clinical Practice. Urology*, 3, 312-322. doi:10.1038/ncpuro0508
- Maltaris, T., Seufert, R., Fischl, F., Schaf-frath, M., Follow, K., Koelbl, H., & Ditrach, R. (2007). The effect of cancer treatment on female fertility and strategies for preserving fertility. *European Journal of Obstetrics, Gynecology, and Reproductive Biology*, 130, 148-155. doi:10.1016/j.ejogrb.2006.08.006
- Meirow, D., Biederman, H., Anderson, R.A., & Wallace, W.H. (2010). Toxicity of chemotherapy and radiation on female reproduction. *Clinical Obstetrics and Gynecology*, 53, 727-739. doi:10.1097/GRF.0b013e3181f96b54
- Meistrich, M.L. (2009). Male gonadal toxicity. *Pediatric Blood and Cancer*, 53, 261-266. doi:10.1002/pbc.22004
- Ogle, S.K., Hobbie, W.L., Carlson, C.A., Meadows, A.T., Reilly, M.M., & Ginsberg, J.P. (2008). Sperm banking for adolescents with cancer. *Journal of Pediatric Oncology Nursing*, 25, 97-101. doi:10.1177/1043454207311922
- Partridge, A.H., Gelber, S., Peppercorn, J., Sampson, E., Knudsen, K., Laufer, M., . . . Winer, E.P. (2004). Web-based survey of fertility issues in young women with breast cancer. *Journal of Clinical Oncology*, 22, 4174-4183. doi:10.1200/JCO.2004.01.159
- Patrizio, P., Butts, S., & Caplan, A. (2005). Ovarian tissue preservation and future fertility: Emerging technologies and ethical considerations. *Journal of the National Cancer Institute. Monographs*, 2005(34), 107-110. doi:10.1093/jnci-mono-graphs/lgi023
- Peate, M., Meiser, B., Hickey, M., & Friedlander, M. (2009). The fertility-related concerns, needs and preferences of younger women with breast cancer: A systematic review. *Breast Cancer Research and Treatment*, 116, 215-223. doi:10.1007/s10549-009-0401-6
- Pentheroudakis, G., Orecchia, R., Hoekstra, H.J., & Pavlidis, N. (2010). Cancer, fertility, and pregnancy: ESMO Clinical Practice Guidelines for diagnosis, treatment and follow-up. *Annals of Oncology*, 21(Suppl. 5), v266-v273. doi:10.1093/annonc/mdq198
- Quinn, G.P., Vadapampil, S.T., Gwede, C.K., Miree, C., King, L.M., Clayton, H.B., . . . Munster, P. (2007). Discussion of fertility preservation with newly diagnosed patients: Oncologists' views. *Journal of Cancer Survivorship*, 1, 146-155. doi:10.1007/s11764-007-0019-9
- Quinn, G.P., Vadapampil, S.T., Lee, J.H., Jacobsen, P.B., Bepler, G., Lancaster, J., . . . Albrecht, T.L. (2009). Physician referral for fertility preservation in oncology patients: A national study of practice behaviors. *Journal of Clinical Oncology*, 27, 5952-5957. doi:10.1200/JCO.2009.23.0250
- Reebals, J.F., Brown, R., & Buckner, E.B. (2006). Nurse practice issues regarding sperm banking in adolescent male cancer patients. *Journal of Pediatric Oncology Nursing*, 23, 182-188. doi:10.1177/1043454206289868

- Rosen, A., Rodriguez-Wallberg, K.A., & Rosenzweig, L. (2009). Psychosocial distress in young cancer survivors. *Seminars in Oncology Nursing*, 25, 268–277. doi:10.1016/j.soncn.2009.08.004
- Schover, L.R. (1999). Psychosocial aspects of infertility and decisions about reproduction in young cancer survivors: A review. *Medical and Pediatric Oncology*, 33(1), 53–59. doi:10.1002/(SICI)1096-911X(199907)33:1<53::AID-MPO10>3.0.CO;2-K
- Schover, L.R. (2005). Motivation for parenthood after cancer: A review. *Journal of the National Cancer Institute. Monographs*, 2005(34), 2–5. doi:10.1093/jncimonographs/lgi010
- Schover, L.R., Brey, K., Lichtin, A., Lipschultz, L.I., & Jeha, S. (2002a). Knowledge and experience regarding cancer, infertility, and sperm banking in younger male survivors. *Journal of Clinical Oncology*, 20, 1880–1889. doi:10.1200/JCO.2002.07.175
- Schover, L.R., Brey, K., Lichtin, A., Lipschultz, L.I., & Jeha, S. (2002b). Oncologists' attitudes and practices regarding banking sperm before cancer treatment. *Journal of Clinical Oncology*, 20, 1890–1897. doi:10.1200/JCO.2002.07.174
- Schover, L.R., Rybicki, L.A., Martin, B.A., & Bringelsen, K.A. (1999). Having children after cancer. A pilot survey of survivors' attitudes and experiences. *Cancer*, 86, 697–709. doi:10.1002/(SICI)1097-0142(19990815)86:4<697::AID-CNCR20>3.CO;2-J
- Sella, T., Mironov, S., & Hricak, H. (2005). Imaging of transposed ovaries in patients with cervical carcinoma. *American Journal of Roentgenology*, 184, 1602–1610.
- Silber, S., Kagawa, N., Kuwayama, M., & Gosden, R. (2010). Duration of fertility after fresh and frozen ovary transplantation. *Fertility and Sterility*, 94, 2191–2196. doi:10.1016/j.fertnstert.2009.12.073
- Stroud, J.S., Mutch, D., Rader, J., Powell, M., Thaker, P.H., & Grigsby, P.W. (2009). Effects of cancer treatment on ovarian function. *Fertility and Sterility*, 92, 417–427. doi:10.1016/j.fertnstert.2008.07.1714
- Surveillance, Epidemiology, and End Results (SEER). (2011a). *Table 1.10: Age-distribution of incidence cases: SEER cancer statistics review 1975–2008*. Retrieved from [http://seer.cancer.gov/csr/1975\\_2008/browse\\_csr.php?section=1&page=sect\\_01\\_table.10.html](http://seer.cancer.gov/csr/1975_2008/browse_csr.php?section=1&page=sect_01_table.10.html)
- Surveillance, Epidemiology, and End Results (SEER). (2011b). *Table 28.8: Childhood cancer: 5-year relative survival by site: SEER cancer statistics review 1975–2008*. Retrieved from [http://seer.cancer.gov/csr/1975\\_2008/browse\\_csr.php?section=28&page=sect\\_28\\_table.08.html](http://seer.cancer.gov/csr/1975_2008/browse_csr.php?section=28&page=sect_28_table.08.html)
- Tschudin, S., & Bitzer, J. (2009). Psychological aspects of fertility preservation in men and women affected by cancer and other life-threatening diseases. *Human Reproduction Update*, 15, 587–597. doi:10.1093/humupd/dmp015
- Vadaparampil, S., Quinn, G., King, L., Wilson, C., & Nieder, M. (2008). Barriers to fertility preservation among pediatric oncologists. *Patient Education and Counseling*, 72, 402–410. doi:10.1016/j.pec.2008.05.013
- Vadaparampil, S.T., Clayton, H., Quinn, G.P., King, L.M., Nieder, M., & Wilson, C. (2007). Pediatric oncology nurses' attitudes related to discussing fertility preservation with pediatric cancer patients and their families. *Journal of Pediatric Oncology Nursing*, 24, 255–263. doi:10.1177/1043454207303878
- West, E.R., Zelinski, M.B., Kondapalli, L.A., Gracia, C., Chang, J., Coutifaris, C., . . . Woodruff, T.K. (2009). Preserving female fertility following cancer treatment: Current options and future possibilities. *Pediatric Blood and Cancer*, 53, 289–295.
- Wo, J.Y., & Viswanathan, A.N. (2009). Impact of radiotherapy on fertility, pregnancy, and neonatal outcomes in female cancer patients. *International Journal of Radiation Oncology, Biology, and Physics*, 73, 1304–1312. doi:10.1016/j.ijrobp.2008.12.016
- Woodruff, T.K. (2010). The Oncofertility Consortium—Addressing fertility in young people with cancer. *Nature Reviews. Clinical Oncology*, 7, 466–475.
- Zebrack, B.J., Casillas, J., Nohr, L., Adams, H., & Zeltzer, L.K. (2004). Fertility issues for young adult survivors of childhood cancer. *Psycho-Oncology*, 13, 689–699.

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With the simple click of your computer mouse, listen as *Clinical Journal of Oncology Nursing* Associate Editor Mallori Hooker, RN, MSN, NP-C, AOCNP®, interviews Joanne Frankel Kelvin, RN, MSN, AOCNP®, about the options for fertility preservation available to patients with cancer, regardless of their age, and the importance of having these discussions with patients early on in the cancer journey.

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4. Does your institution have a specific plan for fertility education? Whose initial responsibility is it to discuss fertility issues? Do you as nurses feel comfortable or have the time to address fertility issues if they have not been addressed by the patient's physician?
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