

Oncolactation

Purpose

- Describe guidelines for breast cancer screening and diagnosis during pregnancy and lactation
- Define oncolactation and outline the management of patients with:
 - Breast cancer diagnosed during pregnancy or lactation or
 - A history of breast cancer treatment who desire to breastfeed

Methods

The literature review included large national and international datasets, clinical trials, basic science publications, and recent guidelines from professional societies in pertinent fields. This document represents a comprehensive collection of the most impactful and recent literature on this important but understudied topic.

Approval

Please see the list of authors and disclosures at the end of this resource guide. This document was developed with guidance from the ASBrS Research Committee and approved by the ASBrS Board of Directors.

Background/Rationale

Oncolactation is defined as the intersection of lactation and oncology care in women diagnosed with cancer during pregnancy, postpartum mothers diagnosed with cancer while breastfeeding, and survivors who wish to breastfeed after treatment. At present, limited recommendations exist for managing oncolactation. A recent survey of breast surgeons demonstrated strong ASBrS member interest in expanding formal education for lactation and developing evidence-based management guidelines.¹

Pregnancy-related breast cancer (PrBC) and postpartum breast cancer (PPBC) rates have increased, partly due to women delaying childbearing.^{2,3} In addition, young women with breast cancer may desire childbearing after treatment. Healthcare providers should understand and communicate the impact of each breast cancer treatment modality on future lactation.⁴

ASBrS Recommendations for Oncolactation Management

Screening and Diagnostic Evaluation

- Breast cancer screening should not be delayed or forgone during pregnancy and lactation if indicated based on the patient's age or risk profile.
- During pregnancy, mammography without fetal shielding and breast ultrasonography are safe; however, breast magnetic resonance imaging (MRI) with gadolinium contrast is not recommended.
- All breast imaging modalities, including MRI, are safe during lactation and do not require interruption of breastfeeding.
- Patients should breastfeed or express breastmilk (e.g. pump) immediately prior to imaging studies to optimize sensitivity.
- Percutaneous core needle biopsy is safe in pregnancy and lactation. Patients should resume breastfeeding normally after the procedure.

Surgery

- Do not delay non-elective breast surgery in the postpartum period for weaning. Milk fistulae are rare when lactation is managed appropriately, and complication rates are no higher than average.
- While data are limited, patients should express and discard milk for 24 hours following receipt of blue dye (i.e. methylene blue, isosulfan blue) and/or radiotracer for sentinel lymph node surgery. No breastfeeding interruption is needed after use of indocyanine green. There are no lactational safety data for superparamagnetic iron oxide.
- Due to the potential teratogenicity of methylene blue and anaphylactic risk associated with isosulfan blue, single tracer lymphatic mapping with radioactive colloid is preferred during pregnancy. Limited data support the safety of indocyanine green during pregnancy, but similar data do not exist for the use of superparamagnetic iron oxide.
- Follow evidence-based recommendations for the perioperative management of lactating women, including avoidance of unsafe medications and minimization of breastfeeding interruptions.
- Women of childbearing age considering contralateral prophylactic mastectomy (CPM) or risk reducing mastectomy (RRM) should receive comprehensive counseling, including discussion about oncolactation. Shared decision-making principles should guide decisions about CPM and RRM, focusing on the patient's risk of primary or contralateral breast cancer, lack of survival benefit, and risks of not breastfeeding. Women can consider delaying RRM/CPM until after completion of childbearing, with high-risk screening pursued in the interim.

Radiation

- Women should not breastfeed or express milk (e.g. pump) from the affected breast while undergoing radiotherapy; however, they may safely feed from the unaffected breast.

Systemic Therapy

- Cytotoxic chemotherapy and endocrine therapy transfer into breastmilk and make it unsafe for infant consumption.
- There are currently no data on the safety of anti-HER2 agents, immunotherapy, and CDK4/6 inhibitors during lactation.

Lactation Support for Breast Cancer Patients

- Breast cancer survivors, patients with pregnancy-related breast cancer (PrBC), and patients with postpartum breast cancer (PPBC) who are breastfeeding at diagnosis should receive prompt referrals to a breastfeeding medicine physician or board-certified lactation consultant. Oncolactation is a critical component of multidisciplinary care and survivorship for these patients.
- Breastfeeding is possible from the contralateral breast for many breast cancer survivors. It should be avoided on the affected breast after breast conserving therapy and is not possible after a mastectomy. Prior chemotherapy may decrease milk production. Patients who are unable to produce sufficient milk for healthy infant growth should be counseled about utilizing donor breastmilk.

Summary of Data Reviewed

Breast Cancer Screening and Diagnosis During Pregnancy and Lactation

Lactational status affects breast cancer screening and diagnosis.⁵ Pregnancy and lactation induce physiological changes in the breast, altering its imaging appearance. Therefore, examinations must be interpreted contextually, and lactating women may require supplemental imaging modalities. While statements by the American College of Radiology (ACR)⁶ and the American College of Obstetricians and Gynecologists⁷ describe the safety of breast imaging during pregnancy and lactation, delays in breast cancer diagnosis and treatment may occur due to avoidance of imaging during these periods and lack of clinical suspicion for malignancy. It is crucial that women not forgo or delay indicated imaging due to pregnancy or lactational status, particularly given the aggressive nature of PPBC.²

Imaging Modalities

Mammography and ultrasonography are safe during pregnancy and lactation. Contrary to past recommendations, the ACR now advises against the use of fetal shielding as it causes

scatter and increases fetal radiation dose; without a shield, the exposure is otherwise negligible.^{8,9}

Magnetic resonance imaging (MRI) with gadolinium is not recommended during pregnancy as gadolinium crosses the placenta and may be teratogenic.^{5,6} Lactation may reduce the sensitivity of breast MRI, but it is a safe and effective screening and diagnostic modality in the postpartum population.⁹

To optimize sensitivity, patients should breastfeed or express breastmilk (e.g. pump) immediately prior to breast imaging. They can breastfeed normally after any study, including MRI with gadolinium contrast.⁹

Screening

Although there are limited data on screening pregnant and lactating women, expert guidelines recommend that women undergo screening mammography during pregnancy and lactation as indicated based on age and risk profile. Pregnant and lactating high-risk women of any age and those over 40 years of age may benefit from supplemental screening breast ultrasound.⁶ For patients in the process of weaning, it is reasonable to defer screening for 1-2 months.

High-risk women for whom screening breast MRI is indicated should forgo breast MRI during pregnancy, and resume MRI after delivery. High-risk women who plan to breastfeed for longer than 6 months should not alter their screening MRI schedule; for high-risk women in the process of weaning, MRI should be postponed until 6-8 weeks after weaning.^{6,10}

Diagnostic Evaluation

Ultrasonography is the first-line diagnostic imaging study for pregnant and breastfeeding women with a palpable mass or other concerning symptoms; mammography can provide additional information as indicated.⁶

Percutaneous core needle biopsy with local anesthetic and titanium clip placement is safe in pregnancy and lactation. No interruption of lactation is needed. There is a minimally increased risk of bleeding due to the vascularity of the lactating breast.¹¹ The risk of milk fistula is very low and should not preclude necessary biopsies.¹² This risk may be decreased by positioning the biopsy tract as far from the nipple areolar complex as possible. It is normal for biopsy sites to leak milk for several days before self-resolving; they should not be closed with suture or surgical adhesive due to risks of fluid collection and mastitis.

Breast Cancer Management During Lactation

Staging Studies

Staging studies such as computed tomography (CT) with iodinated contrast and bone scan do not require interruption of breastfeeding. Fluorodeoxyglucose (FDG)-positron emission

tomography with CT (PET-CT) requires 12 hours of separation of mother and infant due to external radioactivity, but FDG is not excreted in breastmilk. The mother should express milk during this time and another person can feed it to the infant.^{13,14}

Treatment

It is safe to breastfeed from the affected breast until treatments begin, though subsequent therapies will impact lactation. Lactating patients diagnosed with PPBC require attention for maintaining or ceasing breastmilk production based on individual clinical considerations. If surgery or radiation is anticipated early postpartum, consider augmenting milk production in the unaffected breast and reducing production in the affected breast.⁴ Autocrine and paracrine mechanisms regulate milk synthesis in each breast individually, so continued feeding from one breast does not promote persistent milk production in the other.¹⁵

I. Surgery

Do not delay surgery for cancer due to concern for complications such as milk fistula, which is rare when patients continue to breastfeed normally after invasive procedures.^{12,16} The lactating breast has excellent blood flow and contains antimicrobial factors that may protect against infection.¹⁷ Surgery should also not be delayed for weaning, as post-lactation involution is a complex process that can take months to years.^{18,19}

- Breast conserving surgery
 - There are minimal data on the use of wire and non-wire localization methods during lactation. Breastfeeding or pumping with a wire in place may risk displacement. However, radioactive I-125 seeds, magnetic seeds, radar reflectors, and other localizing devices are embedded in tissue and are not known to be at increased risk of migration during lactation. To prevent exposure of the infant to radioactivity, breastfeeding should be avoided after insertion of a radioactive seed and can resume after its removal.²⁰
 - To prevent fluid collection in the setting of high milk production, consider leaving a short-term drain to *gravity*. Drains should not be left to suction, as this will promote excessive stimulation of milk removal and prolong the need for a drain.¹⁵ If a patient is further postpartum and/or has baseline low production, a drain may not be necessary.
 - For patients desiring continued or future breastfeeding, minimize the extent of surgery and parenchymal disruption (e.g. large-volume local tissue rearrangement or oncoplastic reconstruction) and place the incision far from the nipple areolar complex if possible.²¹
- Mastectomy
 - This procedure removes 95% or more of functional breast tissue; therefore, postoperative drains can be placed to suction.

- Skin and/or nipple-sparing mastectomy with reconstruction can be performed safely.
- Axillary staging
 - Radiotracer (Tc 99 sulfur colloid) lactational safety information is limited. Expert guidelines and prescribing information advise that patients express and discard milk for 24 hours after sentinel lymph node surgery with radiotracer.^{22,23} This may be a conservative estimate, given that no interruption in breastfeeding is recommended after intravenous injection.²⁴ While Tc 99 crosses the placenta, modeled fetal radiation exposure from lymphatic mapping (1.4 μ Gy-4.3 mGy) is well below the threshold of concern for fetal harm (100-200 mGy);^{25,26} available data in pregnant women have not identified specific drug-related risks of major birth defects, miscarriage, or adverse maternal or fetal outcomes.²³ Same-day administration of radiotracer is recommended to facilitate use of the lowest possible dose and minimize maternal, neonatal, and infant exposure.^{25,26,27}
 - There are no data on the relative infant dose of methylene blue or isosulfan blue after intradermal or intraparenchymal injection in a lactating breast. Infant ingestion of methylene blue has been associated with hemolytic anemia; no safety data are available for isosulfan blue in children.^{28,29,30,31} InfantRisk advises that patients express and discard milk for 24 hours after receipt of intravenous methylene blue.³² Isosulfan blue is generally avoided during pregnancy due to the 2% risk of life-threatening anaphylactic reactions.²⁸ When used intra-amniotically, methylene blue can cause serious adverse prenatal and neonatal complications; however it is unknown whether this translates to fetal risk when administered at the significantly lower dose and via the subareolar route used for lymphatic mapping.^{25,26,27} While small series have reported safe and feasible administration of both blue dyes during pregnancy, single tracer mapping with radioactive colloid is preferred to minimize maternal and fetal risks, and is supported by several international societies' guidelines.^{25,26,33}
 - Indocyanine green (ICG) is safe in lactation and no breastfeeding interruption is required.³⁴ ICG does not appear to cross the placenta and is safe after intravenous administration, though there are no specific data on lymphatic mapping during pregnancy.^{35,36}
 - The safety of superparamagnetic iron oxide during pregnancy and lactation is unknown.³⁷
- Perioperative considerations
 - Avoid narcotics, as all opioids transfer to breastmilk. If necessary, morphine and hydromorphone are preferred due to poor oral bioavailability. Codeine, tramadol, and meperidine are not recommended in lactation.³⁸

- Use intravenous fluids judiciously to minimize breast edema, which can interfere with latching and effective pumping.³⁹
- Advise patients to pump the unaffected breast prior to surgery to maintain milk production. However, patients should not pump the affected breast as milk removal stimulates increased milk production.¹⁵
- Minimize separation of mother and child.⁴⁰
- Breastfeeding is safe after anesthesia when the patient is alert enough to hold and latch her baby or utilize a breast pump.³⁸
- Local anesthetics are safe and do not require interruption of breastfeeding.^{38,41}

II. Radiation Therapy

Patients should not breastfeed from or pump the affected breast while undergoing partial or whole breast radiation due to risks of wounds and abscess, interference with radiation volumetric plans, and apoptosis of functional cells.⁴² Patients can breastfeed without interruption from the unaffected breast while undergoing radiation therapy.

III. Systemic Therapy

- Endocrine therapy is contraindicated during lactation as agents readily transfer to breastmilk and may inhibit milk production and impact estrogen metabolism in infants.^{4,20,43,44,45,46,47}
- Cytotoxic chemotherapy agents are excreted in breastmilk, which is not safe for infant consumption and should be discarded. Cabergoline, an indirect prolactin antagonist, can be used off-label to halt milk production when chemotherapy begins. Most commonly, 0.25-0.5 mg by mouth every 72 hours is used; most patients require one to three doses for reduction of engorgement and milk flow.

Women who desire to express breastmilk to maintain production should be advised about the high rate of complications, including mastitis, nipple injury, decreased milk volume, change in breastmilk microbiome, and infant disinterest in return to nursing at the breast after completion of chemotherapy.²¹ If women still desire to pump milk, they should follow recommendations from an oncologic pharmacist regarding the safety of feeding any milk to their child.^{48,49}

- Targeted anti-HER2 agents and immunotherapies such as pembrolizumab likely are minimally excreted in breastmilk due to their large molecular weight; however, no safety data exist and breastfeeding is not recommended for women receiving these drugs.^{50,51,52}
- Breastfeeding is not recommended for women taking cyclin-dependent kinase 4 and 6 (CDK 4/6) inhibitors due to the lack of safety data.^{53,54,55}

Lactation Following Breast Cancer Treatment

Breastfeeding does not increase breast cancer recurrence risk.⁵⁶ In fact, breastfeeding reduces the risk of a primary breast cancer, and so could reduce recurrence risk in women diagnosed with breast cancer⁵⁷; more studies are needed.

Treatment for breast cancer will impact future lactation, but breastfeeding is possible for many breast cancer survivors.⁵⁸

Surgery

The affected breast will not be functional after a mastectomy, regardless of technique (including nipple-sparing). A supplemental nursing system (feeding tube at the breast) or non-nutritive suckling after nipple-sparing mastectomy should be avoided due to risk of nipple and/or skin trauma and subsequent wound formation. If significant engorgement or milk production is noted after mastectomy, the patient should be referred to a surgeon for discussion regarding the volume of residual breast parenchyma. Partial mastectomy has limited impact on breastfeeding unless central retroareolar ducts are excised.

Radiation Therapy

Radiation therapy causes apoptosis and fibrosis in the breast parenchyma, precluding normal mammogenesis and lactogenesis during pregnancy. Therefore, the affected breast will be unable to synthesize milk normally. Some breasts are completely unable to produce milk, whereas others may produce a limited quantity. Counsel patients against feeding or expressing milk from a previously irradiated breast due to the risk of skin maceration and wound formation, as well as changes in breastmilk composition.^{4,42,59} Similarly, counsel patients against using a supplemental nursing system on a previously irradiated breast.

Systemic Therapy

Systemic chemotherapy may alter the functional capacity of residual breast tissue.⁶⁰

The POSITIVE trial provides short-term evidence supporting the oncologic safety of interrupting endocrine therapy for pregnancy and/or breastfeeding.⁶¹

Risk reducing mastectomy (RRM) and contralateral prophylactic mastectomy (CPM)

Women of childbearing age considering contralateral prophylactic mastectomy (CPM) or risk reducing mastectomy (RRM) should receive comprehensive counseling, including discussion about oncolactation. Shared decision-making principles should guide the discussion regarding RRM and CPM, focusing on the patient's individualized risk of contralateral breast cancer, respectively. Surgeons should educate patients that CPM does not improve survival.^{62,63} Women should be counseled that not breastfeeding increases maternal and infant morbidity and mortality in acute and chronic health conditions.⁶⁴ In addition,

breastfeeding significantly reduces ovarian cancer risk in BRCA carriers.⁶⁵ Therefore, patients can consider postponing CPM until after childbearing and continue appropriate cancer screening in the interim. Indeed, the risk of metastatic recurrence after PPBC is greater than that of a new contralateral breast cancer in the short duration of a woman's childbearing years.^{66,67}

Lactation Support and Resources

Physicians trained in breastfeeding medicine, a specialty dedicated to all aspects of lactation care, can play a significant role in the multidisciplinary breast oncology team and offer patients prenatal and postpartum support. They can be located through the Academy of Breastfeeding Medicine⁶⁸ or the Institute for the Advancement of Breastfeeding and Lactation.⁶⁹ If a breastfeeding medicine physician is not available, a non-physician provider with lactation training, such as an International Board-Certified Lactation Consultant⁷⁰, may be consulted.

Strategies to increase breastmilk production include hand expression, pumping, frequent feedings, and galactogogues; the latter should be discussed with breastfeeding providers and oncology survivorship due to potential interactions with endocrine therapy and/or phytoestrogen mechanism of action.^{21,71} Patients unable to produce adequate volumes of breastmilk or those who require weaning for treatment may benefit from donor milk through milk banks⁷² or informal milk sharing.⁷³

As systemic therapy agents evolve, safety profiles for agents during lactation are available at the National Institute of Health's LactMed database⁷⁴ or by consulting the InfantRisk Center,⁷⁵ which also offers an app for healthcare providers (InfantRisk HCP).

The resource guide was reviewed by the Research Committee and approved by the Board of Directors on May 21, 2024.

Lead Authors: Helen Johnson, MD, IBCLC, Megan Miller, MD, and Katrina Mitchell, MD, IBCLC
(There are no relevant author disclosures.)

The Society recognizes the following members of the Research Committee for their contributions to the development of the resource guide: Zahraa Al-Hilli, MD, MBA, Amanda Amin, MD, MS, Carinne W. Anderson, MD, Anna C. Beck, MD, Mehran Habibi, MD, MBA, E. Shelley Hwang, MD, MPH, Ismail Jatoi, MD, PhD, FACS, Swati Kulkarni, MD, David W. Lim, MDCM, MEd, PhD, FRCSC, Kandice K. Ludwig, MD, Heather B. Neuman, MD, Samilia Obeng-Gyasi, MD, MPH, Lerna C. Ozcan, MD, Ko Un Park, MD, Roshni Rao, MD, Shayna L. Showalter, MD, Linda A. Smith, MD, Marios Konstantinos Tasoulis, MD, PhD, FRCS, FEBS, Sarah Tevis, MD, and Barbara A. Wexelman, MD, MBA. The Society also acknowledges Amy Cyr, MD, who served as the medical editor for the resource guide.

- References -

1. Johnson HM, Teshome M, Singh P, Mitchell KB. Lactation Education for Surgeons: American Society of Breast Surgeons (ASBrS) Survey Demonstrates Strong Member Interest in Expanded Training. *Ann Surg Oncol*. 2023 Oct;30(10):6125-6132. doi: [10.1245/s10434-023-13882-w](https://doi.org/10.1245/s10434-023-13882-w). Epub 2023 Jul 14. PMID: 37452168.
2. Lefrère H, Lenaerts L, Borges VF, Schedin P, Neven P, Amant F. Postpartum breast cancer: mechanisms underlying its worse prognosis, treatment implications, and fertility preservation. *Int J Gynecol Cancer*. 2021 Mar;31(3):412-422. doi: [10.1136/ijgc-2020-002072](https://doi.org/10.1136/ijgc-2020-002072). PMID: 33649008; PMCID: PMC7925817.
3. Cottreau CM, Dashevsky I, Andrade SE, Li DK, Nekhlyudov L, Raebel MA, Ritzwoller DP, Partridge AH, Pawloski PA, Toh S. Pregnancy-Associated Cancer: A U.S. Population-Based Study. *J Womens Health (Larchmt)*. 2019 Feb;28(2):250-257. doi: [10.1089/jwh.2018.6962](https://doi.org/10.1089/jwh.2018.6962). Epub 2018 Oct 10. PMID: 30307780; PMCID: PMC6390809.
4. Johnson HM, Mitchell KB. Breastfeeding and Breast Cancer: Managing Lactation in Survivors and Women with a New Diagnosis. *Ann Surg Oncol*. 2019 Oct;26(10):3032-3039. doi: [10.1245/s10434-019-07596-1](https://doi.org/10.1245/s10434-019-07596-1). Epub 2019 Jul 24. PMID: 31342385.
5. Johnson HM, Lewis TC, Mitchell KB. Breast Cancer Screening During Lactation: Ensuring Optimal Surveillance for Breastfeeding Women. *Obstet Gynecol*. 2020 Jan;135(1):194-198. doi: [10.1097/AOG.0000000000003600](https://doi.org/10.1097/AOG.0000000000003600). PMID: 31809436.
6. Expert Panel on Breast Imaging; diFlorio-Alexander RM, Slanetz PJ, Moy L, Baron P, Didwania AD, Heller SL, Holbrook AI, Lewin AA, Lourenco AP, Mehta TS, Niell BL, Stuckey AR, Tuscano DS, Vincoff NS, Weinstein SP, Newell MS. ACR Appropriateness Criteria® Breast Imaging of Pregnant and Lactating Women. *J Am Coll Radiol*. 2018 Nov;15(11S):S263-S275. doi: [10.1016/j.jacr.2018.09.013](https://doi.org/10.1016/j.jacr.2018.09.013). PMID: 30392595.
7. Committee Opinion No. 723: Guidelines for Diagnostic Imaging During Pregnancy and Lactation. *Obstet Gynecol*. 2017 Oct;130(4):e210-e216. doi: [10.1097/AOG.0000000000002355](https://doi.org/10.1097/AOG.0000000000002355). Erratum in: *Obstet Gynecol*. 2018 Sep;132(3):786. PMID: 28937575.
8. ACR-SPR practice parameter for imaging pregnant or potentially pregnant patients with ionizing radiation. Resolution 31. Revised 2023. Accessed January 30, 2024. <https://www.acr.org/-/media/acr/files/practice-parameters/pregnant-pts.pdf>.
9. Kieturakis AJ, Wahab RA, Vijapura C, Mahoney MC. Current Recommendations for Breast Imaging of the Pregnant and Lactating Patient. *AJR Am J Roentgenol*. 2021 Jun;216(6):1462-1475. doi: [10.2214/AJR.20.23905](https://doi.org/10.2214/AJR.20.23905). Epub 2020 Aug 5. PMID: 32755376.
10. Carmichael H, Matsen C, Freer P, Kohlmann W, Stein M, Buys SS, Colonna S. Breast cancer screening of pregnant and breastfeeding women with BRCA mutations. *Breast Cancer Res Treat*. 2017 Apr;162(2):225-230. doi: [10.1007/s10549-017-4122-y](https://doi.org/10.1007/s10549-017-4122-y). Epub 2017 Jan 30. PMID: 28138892.
11. Sabate JM, Clotet M, Torrubia S, Gomez A, Guerrero R, de las Heras P, Lerma E. Radiologic evaluation of breast disorders related to pregnancy and lactation. *Radiographics*. 2007 Oct;27 Suppl 1:S101-24. doi: [10.1148/rg.27si075505](https://doi.org/10.1148/rg.27si075505). PMID: 18180221.
12. Johnson HM, Mitchell KB. Low incidence of milk fistula with continued breastfeeding following radiologic and surgical interventions on the lactating breast. *Breast Dis*. 2021;40(3):183-189. doi: [10.3233/BD-201000](https://doi.org/10.3233/BD-201000). PMID: 33935049.
13. Administration of contrast media to women who are breast-feeding. In: *ACR Committee on Drugs and Contrast Media. American College of Radiology Manual on Contrast Media, Version 10.3*. 11th ed.: American College of Radiology; 2018:99-100.
14. Mitchell KB, Fleming MM, Anderson PO, Giesbrandt JG; Academy of Breastfeeding Medicine. ABM Clinical Protocol #30: Radiology and Nuclear Medicine Studies in Lactating Women. *Breastfeed Med*. 2019 Jun;14(5):290-294. doi: [10.1089/bfm.2019.29128.kbm](https://doi.org/10.1089/bfm.2019.29128.kbm). Epub 2019 May 20. PMID: 31107104.
15. Weaver SR, Hernandez LL. Autocrine-paracrine regulation of the mammary gland. *J Dairy Sci*. 2016 Jan;99(1):842-53. doi: [10.3168/jds.2015-9828](https://doi.org/10.3168/jds.2015-9828). Epub 2015 Aug 20. PMID: 26299162.
16. Dominici LS, Kuerer HM, Babiera G, Hahn KM, Perkins G, Middleton L, Ramirez MM, Yang W, Hortobagyi GN, Theriault RL, Litton JK. Wound complications from surgery in pregnancy-associated breast cancer (PABC). *Breast Dis*. 2010;31(1):1-5. doi: [10.3233/BD-2009-0289](https://doi.org/10.3233/BD-2009-0289). PMID: 20519803.
17. Hill DR, Newburg DS. Clinical applications of bioactive milk components. *Nutr Rev*. 2015 Jul;73(7):463-76. doi: [10.1093/nutrit/nuv009](https://doi.org/10.1093/nutrit/nuv009). PMID: 26011900; PMCID: PMC4560033.
18. Jindal S, Narasimhan J, Borges VF, Schedin P. Characterization of weaning-induced breast involution in women: implications for young women's breast cancer. *NPJ Breast Cancer*. 2020 Oct 16;6:55. doi: [10.1038/s41523-020-00196-3](https://doi.org/10.1038/s41523-020-00196-3). PMID: 33083533; PMCID: PMC7568540.
19. Jindal S, Gao D, Bell P, Albrektsen G, Edgerton SM, Ambrosone CB, Thor AD, Borges VF, Schedin P. Postpartum breast involution reveals regression of secretory lobules mediated by tissue-remodeling. *Breast Cancer Res*. 2014 Mar 28;16(2):R31. doi: [10.1186/bcr3633](https://doi.org/10.1186/bcr3633). PMID: 24678808; PMCID: PMC4053254.

20. Dilsizian V, Metter D, Palestro C, Zanzonico P. Advisory Committee on Medical Uses of Isotopes (ACMUI) sub-committee on nursing mother guidelines for the medical administration of radioactive materials. Accessed January 29, 2024. <https://www.nrc.gov/docs/ML1817/ML18177A451.pdf>.
21. Johnson HM, Mitchell KB; Academy of Breastfeeding Medicine. ABM Clinical Protocol #34: Breast Cancer and Breastfeeding. *Breastfeed Med*. 2020 Jul;15(7):429-434. doi: [10.1089/bfm.2020.29157.hmj](https://doi.org/10.1089/bfm.2020.29157.hmj). Epub 2020 Jun 9. PMID: 32516007.
22. Giammarile F, Alazraki N, Aarsvold JN, Audisio RA, Glass E, Grant SF, Kunikowska J, Leidenius M, Moncayo VM, Uren RF, Oyen WJ, Valdés Olmos RA, Vidal Sicart S. The EANM and SNMMI practice guideline for lymphoscintigraphy and sentinel node localization in breast cancer. *Eur J Nucl Med Mol Imaging*. 2013 Dec;40(12):1932-47. doi: [10.1007/s00259-013-2544-2](https://doi.org/10.1007/s00259-013-2544-2). Epub 2013 Oct 2. PMID: 24085499.
23. Highlights of prescribing information: Technetium Tc 99m Sulfur Colloid Injection. Accessed January 29, 2024. https://www.accessdata.fda.gov/drugsatfda_docs/label/2019/017858s049lbl.pdf.
24. Mattsson S, Johansson L, Leide Svegborn S, Liniecki J, Noßke D, Riklund KÅ, Stabin M, Taylor D, Bolch W, Carlsson S, Eckerman K, Giussani A, Söderberg L, Valind S; ICRP. Radiation Dose to Patients from Radiopharmaceuticals: a Compendium of Current Information Related to Frequently Used Substances. *Ann ICRP*. 2015 Jul;44(2 Suppl):7-321. doi: [10.1177/0146645314558019](https://doi.org/10.1177/0146645314558019). Erratum in: *Ann ICRP*. 2019 Sep;48(1):96. Erratum in: *Ann ICRP*. 2019 Sep;48(1):97. PMID: 26069086.
25. Gropper AB, Calvillo KZ, Dominici L, Troyan S, Rhei E, Economy KE, Tung NM, Schapira L, Meisel JL, Partridge AH, Mayer EL. Sentinel lymph node biopsy in pregnant women with breast cancer. *Ann Surg Oncol*. 2014 Aug;21(8):2506-11. doi: [10.1245/s10434-014-3718-2](https://doi.org/10.1245/s10434-014-3718-2). Epub 2014 Apr 23. PMID: 24756813.
26. Han SN, Amant F, Cardonick EH, Loibl S, Peccatori FA, Gheysens O, Sangalli CA, Nekljudova V, Steffensen KD, Mhallem Gziri M, Schröder CP, Lok CAR, Verest A, Neven P, Smeets A, Pruneri G, Cremonesi M, Gentilini O; International Network on Cancer, Infertility and Pregnancy. Axillary staging for breast cancer during pregnancy: feasibility and safety of sentinel lymph node biopsy. *Breast Cancer Res Treat*. 2018 Apr;168(2):551-557. doi: [10.1007/s10549-017-4611-z](https://doi.org/10.1007/s10549-017-4611-z). Epub 2017 Dec 12. PMID: 29235045.
27. Pandit-Taskar N, Dauer LT, Montgomery L, St Germain J, Zanzonico PB, Divgi CR. Organ and fetal absorbed dose estimates from 99mTc-sulfur colloid lymphoscintigraphy and sentinel node localization in breast cancer patients. *J Nucl Med*. 2006 Jul;47(7):1202-8. PMID: 16818956.
28. Highlights of prescribing information: Lymphazurin™ 1%. Accessed January 29, 2024. https://www.accessdata.fda.gov/drugsatfda_docs/label/2007/018310s011lbl.pdf.
29. Allegaert K, Miserez M, Lerut T, Naulaers G, Vanhole C, Devlieger H. Methemoglobinemia and hemolysis after enteral administration of methylene blue in a preterm infant: relevance for pediatric surgeons. *J Pediatr Surg*. 2004 Jan;39(1):E35-7. doi: [10.1016/j.jpedsurg.2003.09.045](https://doi.org/10.1016/j.jpedsurg.2003.09.045). PMID: 14694406.
30. Sills MR, Zinkham WH. Methylene blue-induced Heinz body hemolytic anemia. *Arch Pediatr Adolesc Med*. 1994;148(3):306-310.
31. Albert M, Lessin MS, Gilchrist BF. Methylene blue: dangerous dye for neonates. *J Pediatr Surg*. 2003 Aug;38(8):1244-5. doi: [10.1016/s0022-3468\(03\)00278-1](https://doi.org/10.1016/s0022-3468(03)00278-1). PMID: 12891503.
32. Infantrisk. Breastfeeding challenges with G6PD: not as bad as it looks. Accessed January 28, 2024. <https://www.infantrisk.com/content/breastfeeding-challenges-g6pd-not-bad-it-looks>.
33. Bothou A, Margioulas-Siarkou C, Petousis S, Margioulas-Siarkou G, Zervoudis S, Sotiriadis A, Amant F, Dinas K. Sentinel lymph node biopsy for breast cancer during pregnancy: A comprehensive update. *Eur J Clin Invest*. 2024 Mar;54(3):e14134. doi: [10.1111/eci.14134](https://doi.org/10.1111/eci.14134). Epub 2023 Dec 14. PMID: 38095225.
34. Drugs and Lactation Database (LactMed®) [Internet]. Bethesda (MD): National Institute of Child Health and Human Development; 2006-. Indocyanine Green. [Updated 2021 Feb 15]. Accessed January 22, 2024. <https://www.ncbi.nlm.nih.gov/books/NBK566937/>.
35. Highlights of prescribing information: IC-GREEN. Accessed March 26, 2024. https://www.accessdata.fda.gov/drugsatfda_docs/label/2006/011525s017lbl.pdf.
36. Wang X, Zhang Y, Yang H, Xu Y. Maternal-fetal transfer of indocyanine green: a systematic review. *J Matern Fetal Neonatal Med*. 2022 Dec;35(25):8181-8185. doi: [10.1080/14767058.2021.1966410](https://doi.org/10.1080/14767058.2021.1966410). Epub 2021 Sep 26. PMID: 34565270.
37. Highlights of instructions for use: Magtrace™ and Sentimag® Magnetic Localization System. Accessed January 29, 2024. https://www.accessdata.fda.gov/cdrh_docs/pdf16/P160053D.pdf.
38. Reece-Stremtan S, Campos M, Kokajko L; Academy of Breastfeeding Medicine. ABM Clinical Protocol #15: Analgesia and Anesthesia for the Breastfeeding Mother, Revised 2017. *Breastfeed Med*. 2017 Nov;12(9):500-506. doi: [10.1089/bfm.2017.29054.srt](https://doi.org/10.1089/bfm.2017.29054.srt). Epub 2017 Aug 8. PMID: 29624435.
39. Martin E, Vickers B, Landau R, Reece-Stremtan S. ABM Clinical Protocol #28, Peripartum Analgesia and Anesthesia for the Breastfeeding Mother. *Breastfeed Med*. 2018 Apr;13(3):164-171. doi: [10.1089/bfm.2018.29087.ejm](https://doi.org/10.1089/bfm.2018.29087.ejm). Epub 2018 Mar 29. PMID: 29595994.

40. Bartick M, Hernández-Aguilar MT, Wight N, Mitchell KB, Simon L, Hanley L, Meltzer-Brody S, Lawrence RM. ABM Clinical Protocol #35: Supporting Breastfeeding During Maternal or Child Hospitalization. *Breastfeed Med.* 2021 Sep;16(9):664-674. doi: [10.1089/bfm.2021.29190.mba](https://doi.org/10.1089/bfm.2021.29190.mba). Epub 2021 Sep 6. Erratum in: *Breastfeed Med.* 2021 Nov;16(11):928. PMID: 34516777.
41. Mitchell J, Jones W, Winkley E, Kinsella SM. Guideline on anaesthesia and sedation in breastfeeding women 2020: Guideline from the Association of Anaesthetists. *Anaesthesia.* 2020 Nov;75(11):1482-1493. doi: [10.1111/anae.15179](https://doi.org/10.1111/anae.15179). Epub 2020 Aug 1. PMID: 32737881.
42. Shachar SS, Gallagher K, McGuire K, Zagar TM, Faso A, Muss HB, Sweeting R, Anders CK. Multidisciplinary Management of Breast Cancer During Pregnancy. *Oncologist.* 2017 Mar;22(3):324-334. doi: [10.1634/theoncologist.2016-0208](https://doi.org/10.1634/theoncologist.2016-0208). Epub 2017 Feb 23. Erratum in: *Oncologist.* 2018 Jun;23(6):746. PMID: 28232597; PMCID: PMC5344634.
43. Drugs and Lactation Database (LactMed®) [Internet]. Bethesda (MD): National Institute of Child Health and Human Development; 2006-. Tamoxifen. [Updated 2021 Feb 15]. Accessed February 18, 2024. <https://www.ncbi.nlm.nih.gov/books/NBK501106/>.
44. Drugs and Lactation Database (LactMed®) [Internet]. Bethesda (MD): National Institute of Child Health and Human Development; 2006-. Letrozole. [Updated 2021 Jun 21]. Accessed February 18, 2024. <https://www.ncbi.nlm.nih.gov/books/NBK500937/>.
45. Arimidex. Highlights of prescribing information. Accessed February 18, 2024. https://www.accessdata.fda.gov/drugsatfda_docs/lab/2011/020541s026lbl.pdf.
46. Drugs and Lactation Database (LactMed®) [Internet]. Bethesda (MD): National Institute of Child Health and Human Development; 2006-. Exemestane. [Updated 2018 Dec 3]. Accessed February 18, 2024. <https://www.ncbi.nlm.nih.gov/books/NBK500933/>.
47. Faslodex. Highlights of prescribing information. Accessed February 18, 2024. https://www.accessdata.fda.gov/drugsatfda_docs/lab/2021/021344s044lbl.pdf.
48. Pistilli B, Bellettini G, Giovannetti E, Codacci-Pisanelli G, Azim HA Jr, Benedetti G, Sarno MA, Peccatori FA. Chemotherapy, targeted agents, antiemetics and growth-factors in human milk: how should we counsel cancer patients about breastfeeding? *Cancer Treat Rev.* 2013 May;39(3):207-11. doi: [10.1016/j.ctrv.2012.10.002](https://doi.org/10.1016/j.ctrv.2012.10.002). Epub 2012 Nov 28. PMID: 23199900.
49. Anderson PO. Cancer Chemotherapy. *Breastfeed Med.* 2016 May;11(4):164-5. doi: [10.1089/bfm.2016.0042](https://doi.org/10.1089/bfm.2016.0042). Epub 2016 Mar 30. PMID: 27027799; PMCID: PMC4860651.
50. Drugs and Lactation Database (LactMed®) [Internet]. Bethesda (MD): National Institute of Child Health and Human Development; 2006-. Trastuzumab. [Updated 2023 Mar 18]. Accessed February 18, 2024. <https://www.ncbi.nlm.nih.gov/books/NBK500579/>.
51. Drugs and Lactation Database (LactMed®) [Internet]. Bethesda (MD): National Institute of Child Health and Human Development; 2006-. Pertuzumab. [Updated 2023 Nov 15]. Accessed February 18, 2024. <https://www.ncbi.nlm.nih.gov/books/NBK500590/>.
52. Drugs and Lactation Database (LactMed®) [Internet]. Bethesda (MD): National Institute of Child Health and Human Development; 2006-. Pembrolizumab. [Updated 2023 Nov 15]. Accessed January 30, 2024. <https://www.ncbi.nlm.nih.gov/books/NBK500739/>.
53. Drugs and Lactation Database (LactMed®) [Internet]. Bethesda (MD): National Institute of Child Health and Human Development; 2006-. Palbociclib. [Updated 2018 Dec 3]. Accessed January 30, 2024. <https://www.ncbi.nlm.nih.gov/books/NBK500860/>.
54. Drugs and Lactation Database (LactMed®) [Internet]. Bethesda (MD): National Institute of Child Health and Human Development; 2006-. Abemaciclib. [Updated 2018 Dec 3]. Accessed February 18, 2024. <https://www.ncbi.nlm.nih.gov/sites/books/NBK500939/>.
55. Drugs and Lactation Database (LactMed®) [Internet]. Bethesda (MD): National Institute of Child Health and Human Development; 2006-. Ribociclib. [Updated 2018 Dec 3]. Accessed February 18, 2024. <https://www.ncbi.nlm.nih.gov/books/NBK500944/>.
56. Azim HA Jr, Bellettini G, Liptrott SJ, Armeni ME, Dell'Acqua V, Torti F, Di Nubila B, Galimberti V, Peccatori F. Breastfeeding in breast cancer survivors: pattern, behaviour and effect on breast cancer outcome. *Breast.* 2010 Dec;19(6):527-31. doi: [10.1016/j.breast.2010.05.018](https://doi.org/10.1016/j.breast.2010.05.018). PMID: 21078487.
57. Collaborative Group on Hormonal Factors in Breast Cancer. Breast cancer and breastfeeding: collaborative reanalysis of individual data from 47 epidemiological studies in 30 countries, including 50302 women with breast cancer and 96973 women without the disease. *Lancet.* 2002 Jul 20;360(9328):187-95. doi: [10.1016/S0140-6736\(02\)09454-0](https://doi.org/10.1016/S0140-6736(02)09454-0). PMID: 12133652.
58. Bhurosy T, Niu Z, Heckman CJ. Breastfeeding is Possible: A Systematic Review on the Feasibility and Challenges of Breastfeeding Among Breast Cancer Survivors of Reproductive Age. *Ann Surg Oncol.* 2021 Jul;28(7):3723-3735. doi: [10.1245/s10434-020-09094-1](https://doi.org/10.1245/s10434-020-09094-1). Epub 2020 Sep 11. PMID: 32915334; PMCID: PMC7947020.
59. Leal SC, Stuart SR, Carvalho Hde A. Breast irradiation and lactation: a review. *Expert Rev Anticancer Ther.* 2013 Feb;13(2):159-64. doi: [10.1586/era.12.178](https://doi.org/10.1586/era.12.178). PMID: 23406557.
60. Stopenski S, Aslam A, Zhang X, Cardonick E. After Chemotherapy Treatment for Maternal Cancer During Pregnancy, Is Breastfeeding Possible? *Breastfeed Med.* 2017 Mar;12:91-97. doi: [10.1089/bfm.2016.0166](https://doi.org/10.1089/bfm.2016.0166). Epub 2017 Feb 7. PMID: 28170295.

61. Partridge AH, Niman SM, Ruggeri M, Peccatori FA, Azim HA Jr, Colleoni M, Saura C, Shimizu C, Sætersdal AB, Kroep JR, Mailliez A, Warner E, Borges VF, Amant F, Gombos A, Kataoka A, Rousset-Jablonski C, Borstnar S, Takei J, Lee JE, Walshe JM, Ruiz-Borrego M, Moore HCF, Saunders C, Bjelic-Radisic V, Susnjar S, Cardoso F, Smith KL, Ferreiro T, Ribí K, Ruddy K, Kammler R, El-Abed S, Viale G, Piccart M, Korde LA, Goldhirsch A, Gelber RD, Pagani O; International Breast Cancer Study Group; POSITIVE Trial Collaborators. Interrupting Endocrine Therapy to Attempt Pregnancy after Breast Cancer. *N Engl J Med*. 2023 May 4;388(18):1645-1656. doi: [10.1056/NEJMoa2212856](https://doi.org/10.1056/NEJMoa2212856). PMID: 37133584; PMCID: PMC10358451.
62. Hunt KK, Euhus DM, Boughey JC, Chagpar AB, Feldman SM, Hansen NM, Kulkarni SA, McCready DR, Mamounas EP, Wilke LG, Van Zee KJ, Morrow M. Society of Surgical Oncology Breast Disease Working Group Statement on Prophylactic (Risk-Reducing) Mastectomy. *Ann Surg Oncol*. 2017 Feb;24(2):375-397. doi: [10.1245/s10434-016-5688-z](https://doi.org/10.1245/s10434-016-5688-z). Epub 2016 Dec 8. PMID: 27933411.
63. Boughey JC, Attai DJ, Chen SL, Cody HS, Dietz JR, Feldman SM, Greenberg CC, Kass RB, Landercasper J, Lemaine V, MacNeill F, Margenthaler JA, Song DH, Staley AC, Wilke LG, Willey SC, Yao KA. Contralateral Prophylactic Mastectomy Consensus Statement from the American Society of Breast Surgeons: Additional Considerations and a Framework for Shared Decision Making. *Ann Surg Oncol*. 2016 Oct;23(10):3106-11. doi: [10.1245/s10434-016-5408-8](https://doi.org/10.1245/s10434-016-5408-8). Epub 2016 Jul 28. PMID: 27469118; PMCID: PMC4999472.
64. Stuebe A. The risks of not breastfeeding for mothers and infants. *Rev Obstet Gynecol*. 2009 Fall;2(4):222-31. PMID: 20111658; PMCID: PMC2812877.
65. Kotsopoulos J, Gronwald J, McCuaig JM, Karlan BY, Eisen A, Tung N, Bordeleau L, Senter L, Eng C, Couch F, Fruscio R, Weitzel JN, Olopade O, Singer CF, Pal T, Foulkes WD, Neuhausen SL, Sun P, Lubinski J, Narod SA; Hereditary Ovarian Cancer Clinical Study Group. Breastfeeding and the risk of epithelial ovarian cancer among women with a BRCA1 or BRCA2 mutation. *Gynecol Oncol*. 2020 Dec;159(3):820-826. doi: [10.1016/j.ygyno.2020.09.037](https://doi.org/10.1016/j.ygyno.2020.09.037). Epub 2020 Sep 30. PMID: 33010967.
66. Goddard ET, Bassale S, Schedin T, Jindal S, Johnston J, Cabral E, Latour E, Lyons TR, Mori M, Schedin PJ, Borges VF. Association Between Postpartum Breast Cancer Diagnosis and Metastasis and the Clinical Features Underlying Risk. *JAMA Netw Open*. 2019 Jan 4;2(1):e186997. doi: [10.1001/jamanetworkopen.2018.6997](https://doi.org/10.1001/jamanetworkopen.2018.6997). PMID: 30646210; PMCID: PMC6484560.
67. Giannakeas V, Lim DW, Narod SA. The risk of contralateral breast cancer: a SEER-based analysis. *Br J Cancer*. 2021 Aug;125(4):601-610. doi: [10.1038/s41416-021-01417-7](https://doi.org/10.1038/s41416-021-01417-7). Epub 2021 May 26. PMID: 34040177; PMCID: PMC8368197.
68. American Academy of Breastfeeding Medicine. Accessed January 30, 2024. <https://www.bfmed.org/>.
69. Institute for the Advancement of Breastfeeding and Lactation. Accessed January 30, 2024. <https://lacted.org/>.
70. International Board-Certified Lactation Consultant Commission. Accessed January 30, 2024. <https://ibclc-commission.org/>.
71. Foong SC, Tan ML, Foong WC, Marasco LA, Ho JJ, Ong JH. Oral galactagogues (natural therapies or drugs) for increasing breast milk production in mothers of non-hospitalised term infants. *Cochrane Database Syst Rev*. 2020 May 18;5(5):CD011505. doi: [10.1002/14651858.CD011505.pub2](https://doi.org/10.1002/14651858.CD011505.pub2). PMID: 32421208; PMCID: PMC7388198.
72. Human Milk Banking Association of North America (HMBANA). Accessed January 30, 2024. <https://www.hmbana.org/>.
73. Sriraman NK, Evans AE, Lawrence R, Noble L; Academy of Breastfeeding Medicine's Board of Directors. Academy of Breastfeeding Medicine's 2017 Position Statement on Informal Breast Milk Sharing for the Term Healthy Infant. *Breastfeed Med*. 2018 Jan/Feb;13(1):2-4. doi: [10.1089/bfm.2017.29064.nks](https://doi.org/10.1089/bfm.2017.29064.nks). Epub 2018 Jan 8. PMID: 29634294.
74. Drugs and Lactation Database (LactMed®) [Internet]. Bethesda (MD): National Institute of Child Health and Human Development; 2006-. Accessed January 30, 2024. <https://www.ncbi.nlm.nih.gov/books/NBK501922/>.
75. InfantRisk Center at Texas Tech University Health Sciences Center. Accessed January 30, 2024. <https://infantrisk.com/>.