

Technical Brief

Imaging Techniques for Treatment Evaluation for Metastatic Breast Cancer

Appendixes

Appendix A. Search Terms for Published Literature Review

Search #	Query	Number of Items Found
1	exp Diagnostic Imaging	1748368
2	exp Breast Neoplasms/dh, dt, pc, rt, su, th [Diet Therapy, Drug Therapy, Prevention & Control, Radiotherapy, Surgery, Therapy]	101694
3	exp Neoplasm Metastasis	158648
4	secondary.fs.	127910
5	(stag\$ adj3 (four or iv)).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept, rare disease supplementary concept, unique identifier]	33298
6	3 or 4 or 5	286043
7	exp Prognosis	1108191
8	exp "Outcome and Process Assessment (Health Care)"	733807
9	exp Mortality	285802
10	mo.fs.	424456
11	exp survival analysis	192862
12	7 or 8	1173716
13	1 and 2 and 6 and 12	667
14	exp *Breast Neoplasms/dh, dt, pc, rt, su, th	65064
15	1 and 6 and 12 and 14	265
16	exp "Outcome Assessment (Health Care)"	710469
17	1 and 6 and 14 and 16	131
18	((treat\$ or therap\$ or interven\$ or regimen\$ or pharmacother\$ or chemother\$ or radiother\$ or surger\$ or surgic\$) adj7 (effectiv\$ or success\$ or outcom\$ or result\$ or respons\$ or reduc\$ or remission\$ or shrink\$ or shrank or shrunk)).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept, rare disease supplementary concept, unique identifier]	1753900
19	1 and 6 and 14 and 18	297
20	19 not 17	166
21	Limit 20 to English language	114
22	((assess\$ or determin\$ or establish\$ or confirm\$ or evaluat\$ or monitor\$ or discover\$ or determin\$ or learn\$ or discern\$) adj7 (effectiv\$ or success\$ or outcom\$ or result\$ or respons\$ or reduc\$ or remission\$ or shrink\$ or shrank or shrunk)).mp.	963765
23	1 and 6 and 14 and 22	92
24	Limit 23 to English language	86
26	1 and 6 and 14 and 25	266
27	17 or 21 or 24 or 26	365
28	Limit 27 to yr="2003-Current"	256
29	Limit 28 to English language	197
30	Delete duplicates	158

Appendix B. Summary of Key Informant Interviews

What are the most commonly used imaging modalities to evaluate treatment of metastatic breast cancer?

- Choice of imaging strongly depends on where metastases are. If there are no boney metastases, would probably follow up with chest/abdomen/pelvis CT, but patients who had a baseline PET-CT are usually followed up with PET-CT also.
- MRI might be used on a patient with brain metastases, especially if they had a baseline scan.
- Most people use the Response Evaluation Criteria in Solid Tumors (RECIST) criteria to determine how well patients are responding to treatment, but the PET Response Criteria in Solid Tumors (PERCIST) is also used and may be more accurate.
- Use of PET-CT is extremely common because machines have been purchased and, once owned, might as well use them.

How often is imaging for treatment evaluation of metastatic breast cancer conducted?

- Usual assessment of metastatic disease involves a baseline PET-CT scan that could be repeated every 2-4 months, but if staging PET-CT is not covered by insurance, a bone scan or chest/abdomen/pelvis CT (or both) are often used.
- Imaging may be avoided if patient is displaying symptoms.
- The choice of imaging and intervals are often dictated by insurance coverage. PET-CT is not covered earlier than 2 month follow up. Also, some plans require peer-to-peer discussions about whether PET-CT is warranted which can take a lot of time, so that discourages doctors from ordering it.
- Intervals of imaging depend on treatment cycles. Also, unlikely to see clinical progression before 2-3 months of treatment so most imaging is not ordered earlier than that.
- Patients can also experience anxiety about imaging so that's a reason to limit tests, but on the other hand, if tests show treatment is working, that is very heartening for patients.

When is PET-CT used versus bone scan?

- At baseline, find more lesions on PET-CT; this usually doesn't affect treatment choice unless a bone lesion is found, since treating bone lesions has large effect on the patient's quality of life.
- PET-CT can help visualize follow-up of disease in difficult to visualize areas, such as nodes, or if anatomic alterations have occurred to the patient as a results of treatment.

Which imaging modalities are being over/under utilized?

- PET-CT probably less appropriately utilized because it is a newer technology. This is an active area of research.
- Some imaging is driven by pharmaceutical trials that dictate certain types of follow up. This tends to become a familiar/usual approach in practice.

Differences in imaging use between academic versus community settings?

- Community practice seems to be more variable.
- Patient preparation and physician interpretation is often inferior in the community setting.
- Patient insurance status might come into play more often in community setting, e.g., patient without adequate insurance might be steered toward less expensive imaging.

- Physicians in academic settings may feel more pressure to use the most recent (and therefore most expensive) technologies. May have a greater fear of lawsuits if they fail to order a test.

What policies do payers put in place to influence use of imaging for treatment evaluation of metastatic breast cancer?

- Payers use Radiology Benefit Managers (RBMs) to encourage providers to minimize use of imaging, but not a lot of evidence behind their decisions.
- Payers require peer-to-peer consultations. Often does discourage imaging from being ordered but again, unclear whether this is appropriate.

How are decisions to purchase imaging equipment used to evaluate treatment for metastatic breast cancer made?

- Most cancer centers have CT and PET-CT because they are used for many cancers and they want to promote themselves as having the latest and greatest technology to attract patients.

What types of imaging is most commonly reimbursed for treatment evaluation of metastatic breast cancer? What are the advantages and disadvantages of these types of imaging?

- CT and PET-CT pretty readily reimbursed. For other types of imaging, depends where the metastases are, e.g. if a woman has liver metastases, liver ultrasound would be readily reimbursed.
- The frequency of imaging is variable among payers.
- Patient anxiety: sometimes imaging is useful for reassuring the patient, but other times waiting for the results is very stressful for them.

Other guidelines used to determine choice of imaging besides NCCN?

- No. Even NCCN guidelines concluded there was not enough data to make suggestions about use of imaging for assessing response to therapy.
- NCCN guidelines heavily influenced by medical oncologists and other nonimagers.

Do accreditation programs influence the type of imaging chosen?

- For devices, the American College of Radiology (ACR) provides accreditation. Most centers maintain that accreditation, but it does not cover patient preparation, which is important.
- No accreditation for who reads PET-CT scans. Guidelines for minimum training to read scans exist but are not enforced.
- Even at major cancer centers, only 10 percent of PET-CTs done in a facility would be related to breast cancer so difficult for physicians at smaller centers to gain experience interpreting breast images.

What is the role of patient choice?

- Patient preferences usually push clinicians to do more tests and more expensive tests.
- For some physicians, it is easier to just order a test than take the time to argue about it with patients.
- Patients usually don't want to reduce their imaging. For example, once they have had PET-CT, they don't want to only CT.
- Patients often don't have tests explained to them, particularly the pros/cons, etc. Patients don't get enough information about the reasons for tests, what they mean, etc. because person

interpreting scans rarely interacts with patient. They get much better explanations about treatment.

- Patients don't grasp the use of tests, their accuracy, interpretation, etc. Their research about their disease tends to focus on treatment.
- Patients often willing to take extreme risks to avoid the smallest chance of dying of breast cancer.

What factors related to imaging are most important to patients?

- Patients often do not realize several imaging modalities exist and they have options.
- Patients expect their tests to show them if treatment has been successful.
- Out-of-pocket expenses vary: patients who have good insurance coverage or Medicaid generally don't think about costs but patients with other types of insurance often have high copays and deductibles, requiring them to make decisions based on cost rather than what's best for their health.
- Many patients reach out-of-pocket maximum because of expense of treatment so during treatment are usually not concerned about out-of-pocket costs.
- Some patients have claustrophobia or reactions to contrast when receiving imaging, but in general the discomfort from imaging is much easier to tolerate than that from treatment.
- Imagers generally do not interact with patients. Communication is directed to the referring physicians but they don't necessarily communicate information about the images as well as the imager might.
- Patients discuss the inconvenience of tests, especially PET since it involves long waiting times.
- A lot of imaging reassures patients (not a trivial issue) but provides no clinical benefit. Alternative ways to reassure patient might be less expensive and potentially have fewer risks.
- Patients discuss which imaging facilities are the most comfortable and offer them the most perks (e.g. warm blankets and herbal tea).
- Most patients do not consider the accuracy of imaging tests and usually do not research imaging on their own the way they research treatment options.

What are emerging technologies we can expect in next five years or so?

- PET-MRI might become relevant for brain metastases because MR does a better job imaging the brain than CT.
- Emerging data show that if tests are done in a certain order, patient may avoid some (e.g. PET can obviate the need for a bone scan).
- Imaging with PET using ¹⁸F-fluoroestradiol (FES) as a tracer, may be available in 3-5 years.
- Patients would prefer blood test over imaging if it were accurate.
- So far for breast cancer, tumor markers and circulating malignant cells in blood samples are unreliable tests because breast cancer is such a heterogeneous disease. Hopefully in the next 10-15 years these tests will have improved so much that they will drastically curtail imaging.
- Quantitation of treatment effect using FDG-PET after the first course of treatment would allow clinicians to know how the tumors are responding so they could adjust the doses of chemotherapies. Still many hurdles to performing reproducible quantitative PET.

What are some important research needs?

- New tracers for PET imaging
- Accurate tumor markers that could show whether patient is responding to treatment using a blood test instead of imaging.
- No studies of long-term outcomes. Do these technologies actually change outcomes, quality of life, or treatment selection? Current studies are generally single center, no clinical outcomes (especially long term). These could be embedded in therapeutic trials.

- Studies of communication with patients. The most knowledgeable person (the one interpreting the image) is often not available to patients for questions, especially in nonacademic settings.
- Studies that allow better understanding of tumor biology.
- Imaging technologies that identify smallest tumors possible to reduce breast cancer recurrence.
- Imaging that is more specific to each patient's type of cancer so a particular tumor could be characterized by the genetic or even proteomic level and then treated without damaging healthy tissue.
- Increased accuracy is needed to make a better treatment decisions.
- Use of imaging to evaluate side effects of treatment, e.g., women taking Herceptin (which can affect cardiac function) might have better outcomes if they received echocardiography during their treatment to determine whether their heart function was being affected. If it were, they could be put on medications that would minimize cardiac side effects. Most imaging currently focuses solely on the cancer and metastases, rather than other parts of the body that might be affected by toxic treatments.
- After baseline scan, how often should imaging be repeated?

What are barriers that inhibit research on imaging for treatment evaluation for metastatic breast cancer?

- New technologies are not used if there is no reimbursement for development.
- Regulatory barriers also exist. Time and cost for approval may deter development of product.

Appendix C. List of Abstracted Published Literature Studies

Number	Citation
1	Buijs M. Kamel IR. Vossen JA. Georgiades CS. Hong K. Geschwind JF. Assessment of metastatic breast cancer response to chemoembolization with contrast agent enhanced and diffusion-weighted MR imaging. <i>Journal of Vascular & Interventional Radiology</i> . 18(8):957-63, 2007 Aug.
2	Cachin F. Prince HM. Hogg A. Ware RE. Hicks RJ. Powerful prognostic stratification by [18F]fluorodeoxyglucose positron emission tomography in patients with metastatic breast cancer treated with high-dose chemotherapy. <i>Journal of Clinical Oncology</i> . 24(19):3026-31, 2006 Jul 1.
3	Cheng J. Lei L. Xu J. Sun Y. Zhang Y. Wang X. Pan L. Shao Z. Zhang Y. Liu G. 18F-fluoromisonidazole PET/CT: a potential tool for predicting primary endocrine therapy resistance in breast cancer. <i>Journal of Nuclear Medicine</i> . 54(3):333-40, 2013 Mar.
4	Contractor KB. Kenny LM. Stebbing J. Rosso L. Ahmad R. Jacob J. Challapalli A. Turkheimer F. Al-Nahhas A. Sharma R. Coombes RC. Aboagye EO. [18F]-3'Deoxy-3'-fluorothymidine positron emission tomography and breast cancer response to docetaxel. <i>Clinical Cancer Research</i> . 17(24):7664-72, 2011 Dec 15.
5	Contractor K. Aboagye EO. Jacob J. Challapalli A. Coombes RC. Stebbing J. Monitoring early response to taxane therapy in advanced breast cancer with circulating tumor cells and [(18)F] 3'-deoxy-3'-fluorothymidine PET: a pilot study. <i>Biomarkers in Medicine</i> . 6(2):231-3, 2012 Apr.
6	De Giorgi U. Valero V. Rohren E. Dawood S. Ueno NT. Miller MC. Doyle GV. Jackson S. Andreopoulou E. Handy BC. Reuben JM. Fritsche HA. Macapinlac HA. Hortobagyi GN. Cristofanilli M. Circulating tumor cells and [18F]fluorodeoxyglucose positron emission tomography/computed tomography for outcome prediction in metastatic breast cancer. <i>J Clin Oncol</i> 27 (20) 3303-11, 2009.
7	Dose Schwarz J. Bader M. Jenicke L. Hemminger G. Janicke F. Avril N. Early prediction of response to chemotherapy in metastatic breast cancer using sequential 18F-FDG PET. <i>Journal of Nuclear Medicine</i> . 46(7):1144-50, 2005 Jul.
8	Haug AR. Tiega Donfack BP. Trumm C. Zech CJ. Michl M. Laubender RP. Uebleis C. Bartenstein P. Heinemann V. Hacker M. 18F-FDG PET/CT predicts survival after radioembolization of hepatic metastases from breast cancer. <i>Journal of Nuclear Medicine</i> . 53(3):371-7, 2012 Mar.
9	Huyge V. Garcia C. Alexiou J. Ameye L. Vanderlinden B. Lemort M. Bergmann P. Awada A. Body JJ. Flamen P. Heterogeneity of metabolic response to systemic therapy in metastatic breast cancer patients. <i>Clinical Oncology (Royal College of Radiologists)</i> . 22(10):818-27, 2010 Dec.
10	Kenny L. Coombes RC. Vigushin DM. Al-Nahhas A. Shousha S. Aboagye EO. Imaging early changes in proliferation at 1 week post chemotherapy: a pilot study in breast cancer patients with 3'-deoxy-3'-[18F]fluorothymidine positron emission tomography. <i>European Journal of Nuclear Medicine & Molecular Imaging</i> . 34(9):1339-47, 2007 Sep.
11	Linden HM. Stekhova SA. Link JM. Gralow JR. Livingston RB. Ellis GK. Petra PH. Peterson LM. Schubert EK. Dunnwald LK. Krohn KA. Mankoff DA. Quantitative fluoroestradiol positron emission tomography imaging predicts response to endocrine treatment in breast cancer. <i>Journal of Clinical Oncology</i> . 24(18):2793-9, 2006 Jun 20.
12	Linden HM. Kurland BF. Peterson LM. Schubert EK. Gralow JR. Specht JM. Ellis GK. Lawton TJ. Livingston RB. Petra PH. Link JM. Krohn KA. Mankoff DA. Fluoroestradiol positron emission tomography reveals differences in pharmacodynamics of aromatase inhibitors, tamoxifen, and fulvestrant in patients with metastatic breast cancer. <i>Clinical Cancer Research</i> . 17(14):4799-805, 2011 Jul 15.
13	Mortazavi-Jehanno N. Giraudet AL. Champion L. Lerebours F. Le Stanc E. Edeline V. Madar O. Bellet D. Pecking AP. Alberini JL. Assessment of response to endocrine therapy using FDG PET/CT in metastatic breast cancer: a pilot study. <i>European Journal of Nuclear Medicine & Molecular Imaging</i> . 39(3):450-60, 2012 Mar.
14	Pio, B. S. Park, C. K. Pietras, R. Hsueh, W. A. Satyamurthy, N. Pegram, M. D. Czernin, J. Phelps, M. E. Silverman, D. H. Usefulness of 3'-[F-18]fluoro-3'-deoxythymidine with positron emission tomography in predicting breast cancer response to therapy. <i>Mol Imaging Biol</i> 8 (1) 36-42, 2006.
15	Specht, J. M. Tam, S. L. Kurland, B. F. Gralow, J. R. Livingston, R. B. Linden, H. M. Ellis, G. K. Schubert, E. K. Dunnwald, L. K. Mankoff, D. A. Serial 2-[18F] fluoro-2-deoxy-D-glucose positron emission tomography (FDG-PET) to monitor treatment of bone-dominant metastatic breast cancer predicts time to progression (TTP). <i>Breast Cancer Res Treat</i> 105 (1) 2007.
16	Tateishi U. Gamez C. Dawood S. Yeung H.W. Cristofanilli M. Macapinlac H.A. Bone metastases in patients with metastatic breast cancer: morphologic and metabolic monitoring of response to systemic therapy with integrated PET/CT. <i>Radiology</i> . 247, 2008.

Appendix D. List of Excluded Published Literature Studies

Number	Citation	Reason for Exclusion
1	Agarwal A. Munoz-Najar U. Klueh U. Shih SC. Claffey KP. N-acetyl-cysteine promotes angiostatin production and vascular collapse in an orthotopic model of breast cancer. <i>American Journal of Pathology</i> . 164(5):1683-96, 2004 May.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
2	Akazawa K. Tamaki Y. Taguchi T. Tanji Y. Miyoshi Y. Kim SJ. Shimazu K. Ueda S. Yanagisawa T. Okishiro N. Imazato M. Yasuyuki K. Sato Y. Tamura S. Noguchi S. Potential of reduction in total tumor volume measured with 3D-MRI as a prognostic factor for locally-advanced breast cancer patients treated with primary chemotherapy. <i>Breast Journal</i> . 14(6):523-31, 2008 Nov-Dec.	Article did not include metastatic breast cancer patients.
3	Ali AM. Ueno T. Tanaka S. Takada M. Ishiguro H. Abdellah AZ. Toi M. Determining circulating endothelial cells using CellSearch system during preoperative systemic chemotherapy in breast cancer patients. <i>European Journal of Cancer</i> . 47(15):2265-72, 2011 Oct.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
4	Altenburg JD. Siddiqui RA. Omega-3 polyunsaturated fatty acids down-modulate CXCR4 expression and function in MDA-MB-231 breast cancer cells. <i>Molecular Cancer Research: MCR</i> . 7(7):1013-20, 2009 Jul.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
5	Apple SK. Matin M. Olsen EP. Moatamed NA. Significance of lobular intraepithelial neoplasia at margins of breast conservation specimens: a report of 38 cases and literature review. [Review] <i>Diagnostic Pathology</i> . 5:54, 2010.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
6	Asakura H. Takashima H. Mitani M. Haba R. Seo R. Yokoe K. Toyama Y. Ohkawa M. Unknown primary carcinoma, diagnosed as inflammatory breast cancer, and successfully treated with trastuzumab and vinorelbine. <i>International Journal of Clinical Oncology</i> . 10(4):285-8, 2005 Aug.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
7	Bangash AK. Atassi B. Kaklamani V. Rhee TK. Yu M. Lewandowski RJ. Sato KT. Ryu RK. Gates VL. Newman S. Mandal R. Gradishar W. Omary RA. Salem R. 90Y radioembolization of metastatic breast cancer to the liver: toxicity, imaging response, survival. <i>Journal of Vascular & Interventional Radiology</i> . 18(5):621-8, 2007 May.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
8	Barth RJ Jr. Gibson GR. Carney PA. Mott LA. Becher RD. Poplack SP. Detection of breast cancer on screening mammography allows patients to be treated with less-toxic therapy. <i>AJR. American Journal of Roentgenology</i> . 184(1):324-9, 2005 Jan.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
9	Bauerle T. Bartling S. Berger M. Schmitt-Graff A. Hilbig H. Kauczor HU. Delorme S. Kiessling F. Imaging anti-angiogenic treatment response with DCE-VCT, DCE-MRI and DWI in an animal model of breast cancer bone metastasis. <i>European Journal of Radiology</i> . 73(2):280-7, 2010 Feb.	Non-human study.
10	Bauerle T. Hilbig H. Bartling S. Kiessling F. Kersten A. Schmitt-Graff A. Kauczor HU. Delorme S. Berger MR. Bevacizumab inhibits breast cancer-induced osteolysis, surrounding soft tissue metastasis, and angiogenesis in rats as visualized by VCT and MRI. <i>Neoplasia (New York)</i> . 10(5):511-20, 2008 May.	Non-human study.
11	Biersack HJ. Bender H. Palmedo H. FDG-PET in monitoring therapy of breast cancer. [Review] [36 refs] <i>European Journal of Nuclear Medicine & Molecular Imaging</i> . 31 Suppl 1:S112-7, 2004 Jun.	Review article. Reviewed citations for additional relevant articles.
12	Boccardo FM. Casabona F. Friedman D. Puglisi M. De Cian F. Ansaldi F. Campisi C. Surgical prevention of arm lymphedema after breast cancer treatment. <i>Annals of Surgical Oncology</i> . 18(9):2500-5, 2011 Sep.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
13	Bondareva A. Downey CM. Ayres F. Liu W. Boyd SK. Hallgrimsson B. Jirik FR. The lysyl oxidase inhibitor, beta-aminopropionitrile, diminishes the metastatic colonization potential of circulating breast cancer cells.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.

Number	Citation	Reason for Exclusion
14	Bricou A. Duval MA. Charon Y. Barranger E. Mobile gamma cameras in breast cancer care - a review. [Review]. <i>European Journal of Surgical Oncology</i> . 39(5):409-16, 2013 May.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
15	Brown-Glaberman U. Graham A. Stopeck A. A case of metaplastic carcinoma of the breast responsive to chemotherapy with Ifosfamide and Etoposide: improved antitumor response by targeting sarcomatous features. <i>Breast Journal</i> . 16(6):663-5, 2010 Nov-Dec.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
16	Bullitt E. Lin NU. Ewend MG. Zeng D. Winer EP. Carey LA. Smith JK. Tumor therapeutic response and vessel tortuosity: preliminary report in metastatic breast cancer. <i>Medical Image Computing & Computer-Assisted Intervention: MICCAI</i> . 9(Pt 2):561-8, 2006.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
17	Caralt M. Bilbao I. Cortes J. Escartin A. Lazaro JL. Dopazo C. Olsina JJ. Balsells J. Charco R. Hepatic resection for liver metastases as part of the "oncosurgical" treatment of metastatic breast cancer. <i>Annals of Surgical Oncology</i> . 15(10):2804-10, 2008 Oct.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
18	Castro Pena P. Kirova YM. Campana F. Dendale R. Bollet MA. Fournier-Bidoz N. Fourquet A. Anatomical, clinical and radiological delineation of target volumes in breast cancer radiotherapy planning: individual variability, questions and answers. <i>British Journal of Radiology</i> . 82(979):595-9, 2009 Jul.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
19	Chen JH. Mehta RS. Nalcioglu O. Su MY. Inflammatory breast cancer after neoadjuvant chemotherapy: can magnetic resonance imaging precisely diagnose the final pathological response?. <i>Annals of Surgical Oncology</i> . 15(12):3609-13, 2008 Dec.	Article about diagnostic breast imaging, not imaging for treatment evaluation.
20	Cheung YC. Chen SC. Ueng SH. Ko SF. Wan YL. Dynamic enhanced computed tomography values of locally advanced breast cancers predicting axilla nodal metastasis after neoadjuvant chemotherapy.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
21	Conrado-Abrao F. Das-Neves-Pereira JC. Fernandes A. Jatene FB. Thoracoscopic approach in the treatment of breast cancer relapse in the internal mammary lymph node. <i>Interactive Cardiovascular & Thoracic Surgery</i> . 11(3):328-30, 2010 Sep.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
22	Dalus K. Reitsamer R. Holzmannhofer J. Rendl G. Pirich C. Kronberger C. Rettenbacher L. Lymphoscintigraphy in breast cancer patients after neoadjuvant chemotherapy. Diagnostic value and the work-up of sentinel node negative patients. <i>Nuclear-Medizin</i> . 50(1):33-8, 2011.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
23	De Los Santos J. Bernreuter W. Keene K. Krontiras H. Carpenter J. Bland K. Cantor A. Forero A. Accuracy of breast magnetic resonance imaging in predicting pathologic response in patients treated with neoadjuvant chemotherapy. <i>Clinical Breast Cancer</i> . 11(5):312-9, 2011 Oct.	Article did not include metastatic breast cancer patients.
24	Donadio M. Ardine M. Berruti A. Beano A. Bottini A. Mistrangelo M. Bonardi S. Castiglione F. Generali D. Polimeni MA. Bretti S. Alabiso O. Bertetto O. Weekly cisplatin plus capecitabine in metastatic breast cancer patients heavily pretreated with both anthracycline and taxanes. <i>Piemonte Oncology Network. Oncology</i> . 69(5):408-13, 2005.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
25	Driul L. Bernardi S. Bertozzi S. Schiavon M. Londero AP. Petri R. New surgical trends in breast cancer treatment: conservative interventions and oncoplastic breast surgery. <i>Minerva Ginecologica</i> . 65(3):289-96, 2013 Jun.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
26	Dunnwald LK. Gralow JR. Ellis GK. Livingston RB. Linden HM. Specht JM. Doot RK. Lawton TJ. Barlow WE. Kurland BF. Schubert EK. Mankoff DA. Tumor metabolism and blood flow changes by positron emission tomography: relation to survival in patients treated with neoadjuvant chemotherapy for locally advanced breast cancer. <i>Journal of Clinical Oncology</i> . 26(27):4449-57, 2008 Sep 20.	Article did not include metastatic breast cancer patients.

Number	Citation	Reason for Exclusion
27	El-Mabhouh AA. Nation PN. Abele JT. Riauka T. Postema E. McEwan AJ. Mercer JR. A conjugate of gemcitabine with bisphosphonate (Gem/BP) shows potential as a targeted bone-specific therapeutic agent in an animal model of human breast cancer bone metastases. <i>Oncology Research</i> . 19(6):287-95, 2011.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
28	Eubank WB. Mankoff DA. Evolving role of positron emission tomography in breast cancer imaging. [Review] [166 refs] <i>Seminars in Nuclear Medicine</i> . 35(2):84-99, 2005 Apr.	Review article. Reviewed citations for additional relevant articles.
29	Fanale MA. Uyei AR. Theriault RL. Adam K. Thompson RA. Treatment of metastatic breast cancer with trastuzumab and vinorelbine during pregnancy. <i>Clinical Breast Cancer</i> . 6(4):354-6, 2005 Oct.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
30	Fischer U. Baum F. Luftner-Nagel S. Preoperative MR imaging in patients with breast cancer: preoperative staging, effects on recurrence rates, and outcome analysis. [Review] [38 refs] <i>Magnetic Resonance Imaging Clinics of North America</i> . 14(3):351-62, vi, 2006 Aug.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
31	Fong S. Itahana Y. Sumida T. Singh J. Coppe JP. Liu Y. Richards PC. Bennington JL. Lee NM. Debs RJ. Desprez PY. Id-1 as a molecular target in therapy for breast cancer cell invasion and metastasis. <i>Proceedings of the National Academy of Sciences of the United States of America</i> .	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
32	Gatcombe HG. Olson TA. Esiashvili N. Metastatic primary angiosarcoma of the breast in a pediatric patient with a complete response to systemic chemotherapy and definitive radiation therapy: case report and review of the literature. <i>Journal of Pediatric Hematology/Oncology</i> . 32(3):192-4, 2010 Apr.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
33	Gennari A. Piccardo A. Altrinetti V. Corradengo D. Villavecchia G. De Censi A. Whither the PET scan? The role of PET imaging in the staging and treatment of breast cancer. <i>Current Oncology Reports</i> . 14(1):20-6, 2012 Feb.	Review article. Reviewed citations for additional relevant articles.
34	Gerber B. Heintze K. Stubert J. Dieterich M. Hartmann S. Stachs A. Reimer T. Axillary lymph node dissection in early-stage invasive breast cancer: is it still standard today?. [Review] <i>Breast Cancer Research & Treatment</i> . 128(3):613-24, 2011 Aug.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
35	Giacalone PL. Bourdon A. Trinh PD. Taourel P. Rathat G. Sainmont M. Perocchia H. Rossi M. Rouleau C. Radioguided occult lesion localization plus sentinel node biopsy (SNOLL) versus wire-guided localization plus sentinel node detection: a case control study of 129 unifocal pure invasive non-palpable breast cancers. <i>European Journal of Surgical Oncology</i> . 38(3):222-9, 2012 Mar.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
36	Giglio P. Tremont-Lukats IW. Groves MD. Response of neoplastic meningitis from solid tumors to oral capecitabine.[Erratum appears in <i>J Neurooncol</i> . 2004 Jul;68(3):295] <i>Journal of Neuro-Oncology</i> . 65(2):167-72, 2003 Nov.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
37	Gilardi L. Paganelli G. Is a SUV cut-off necessary in the evaluation of the response of axillary lymph node metastases to neoadjuvant therapy?. <i>European Journal of Nuclear Medicine & Molecular Imaging</i> . 37(11):2202, 2010 Nov.	Letter to the editor.
38	Goldoni S. Seidler DG. Heath J. Fassan M. Baffa R. Thakur ML. Owens RT. McQuillan DJ. Iozzo RV. An antimetastatic role for decorin in breast cancer. <i>American Journal of Pathology</i> . 173(3):844-55, 2008 Sep.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
39	Goyal S. Puri T. Julka PK. Rath GK. Excellent response to letrozole in brain metastases from breast cancer. <i>Acta Neurochirurgica</i> . 150(6):613-4; discussion 614-5, 2008 Jun.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
40	Grabau D. Dihge L. Ferno M. Ingvar C. Ryden L. Completion axillary dissection can safely be omitted in screen detected breast cancer patients with micrometastases. A decade's experience from a single institution. <i>European Journal of Surgical Oncology</i> . 39(6):601-7, 2013 Jun.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.

Number	Citation	Reason for Exclusion
41	Gralow JR. Biermann JS. Farooki A. Fornier MN. Gagel RF. Kumar RN. Shapiro CL. Shields A. Smith MR. Srinivas S. Van Poznak CH. NCCN Task Force Report: Bone Health in Cancer Care. [223 refs] Journal of the National Comprehensive Cancer Network. 7 Suppl 3:S1-32; quiz S33-5, 2009 Jun.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
42	Hayashi H. Kimura M. Yoshimoto N. Tsuzuki M. Tsunoda N. Fujita T. Yamashita T. Iwata H. A case of HER2-positive male breast cancer with lung metastases showing a good response to trastuzumab and paclitaxel treatment. Breast Cancer. 16(2):136-40, 2009.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
43	Hill KL Jr. Lipson AC. Sheehan JM. Brain magnetic resonance imaging changes after sorafenib and sunitinib chemotherapy in patients with advanced renal cell and breast carcinoma. Journal of Neurosurgery. 111(3):497-503, 2009 Sep.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
44	Hiraga T. Williams PJ. Ueda A. Tamura D. Yoneda T. Zoledronic acid inhibits visceral metastases in the 4T1/luc mouse breast cancer model. Clinical Cancer Research. 10(13):4559-67, 2004 Jul 1.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
45	Horn JS. Biderman MD. Breast surgery techniques: preoperative bracketing wire localization by surgeons. Burkholder HC. Witherspoon LE. Burns RP. American Surgeon. 73(6):574-8; discussion 578-9, 2007 Jun.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
46	Hsiang DJ. Yamamoto M. Mehta RS. Su MY. Baick CH. Lane KT. Butler JA. Predicting nodal status using dynamic contrast-enhanced magnetic resonance imaging in patients with locally advanced breast cancer undergoing neoadjuvant chemotherapy with and without sequential trastuzumab. Archives of Surgery. 142(9):855-61; discussion 860-1, 2007 Sep.	Article did not include metastatic breast cancer patients.
47	Hu Z. Gerseny H. Zhang Z. Chen YJ. Berg A. Zhang Z. Stock S. Seth P. Oncolytic adenovirus expressing soluble TGF receptor II-Fc-mediated inhibition of established bone metastases: a safe and effective systemic therapeutic approach for breast cancer. Molecular Therapy: the Journal of the American Society of Gene Therapy. 19(9):1609-18, 2011 Sep.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
48	Hua F. Feng X. Guan Y. Zhao J. Huang Z. Non-Hodgkin's lymphoma of supraclavicular lymph nodes can mimic metastasis of breast cancer during chemotherapy on FDG PET/CT. Clinical Nuclear Medicine. 34(9):594-5, 2009 Sep.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
49	Huyn ST. Burton JB. Sato M. Carey M. Gambhir SS. Wu L. A potent, imaging adenoviral vector driven by the cancer-selective mucin-1 promoter that targets breast cancer metastasis. Clinical Cancer Research. 15(9):3126-34, 2009 May 1.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
50	Intra M. Trifiro G. Viale G. Rotmensz N. Gentilini OD. Soteldo J. Galimberti V. Veronesi P. Luini A. Paganelli G. Veronesi U. Second biopsy of axillary sentinel lymph node for reappearing breast cancer after previous sentinel lymph node biopsy. Annals of Surgical Oncology. 12(11):895-9, 2005 Nov.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
51	Isola V. Pece A. Pierro L. Photodynamic therapy with verteporfin of choroidal malignancy from breast cancer. American Journal of Ophthalmology. 142(5):885-7, 2006 Nov.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
52	Javid S. Segara D. Lotfi P. Raza S. Golshan M. Can breast MRI predict axillary lymph node metastasis in women undergoing neoadjuvant chemotherapy. Annals of Surgical Oncology. 17(7):1841-6, 2010 Jul.	Article about diagnostic breast imaging, not imaging for treatment evaluation.
53	Jones MD. Liu JC. Barthel TK. Hussain S. Lovria E. Cheng D. Schoonmaker JA. Mulay S. Ayers DC. Bouxsein ML. Stein GS. Mukherjee S. Lian JB. A proteasome inhibitor, bortezomib, inhibits breast cancer growth and reduces osteolysis by downregulating metastatic genes. Clinical Cancer Research. 16(20):4978-89, 2010 Oct 15.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.

Number	Citation	Reason for Exclusion
54	Jones RL. Berry GJ. Rubens RD. Miles DW. Clinical and pathological absence of cardiotoxicity after liposomal doxorubicin. <i>Lancet Oncology</i> . 5(9):575-7, 2004 Sep.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
55	Kaliki S. Shields CL. Al-Dahmash SA. Mashayekhi A. Shields JA. Photodynamic therapy for choroidal metastasis in 8 cases. <i>Ophthalmology</i> . 119(6):1218-22, 2012 Jun.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
56	Katalinic D. Stern-Padovan R. Ivanac I. Aleric I. Tentor D. Nikolac N. Santek F. Juretic A. Plestina S. Symptomatic cardiac metastases of breast cancer 27 years after mastectomy: a case report with literature review--pathophysiology of molecular mechanisms and metastatic pathways, clinical aspects, diagnostic procedures and treatment modalities. <i>World Journal of Surgical Oncology</i> . 11:14, 2013.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
57	Kelemen G. Uhercsak G. Ormandi K. Eller J. Thurzo L. Kahan Z. Long-term efficiency and toxicity of adjuvant dose-dense sequential adriamycin-Paclitaxel-cyclophosphamide chemotherapy in high-risk breast cancer. <i>Oncology</i> . 78(3-4):271-3, 2010.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
58	Khalili P. Arakelian A. Chen G. Plunkett ML. Beck I. Parry GC. Donate F. Shaw DE. Mazar AP. Rabbani SA. A non-RGD-based integrin binding peptide (ATN-161) blocks breast cancer growth and metastasis in vivo. <i>Molecular Cancer Therapeutics</i> . 5(9):2271-80, 2006 Sep.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
59	Kilbride KE. Lee MC. Nees AV. Cimmino VM. Diehl KM. Sabel MS. Hayes DF. Schott AF. Kleer CG. Chang AE. Newman LA. Axillary staging prior to neoadjuvant chemotherapy for breast cancer: predictors of recurrence. <i>Annals of Surgical Oncology</i> . 15(11):3252-8, 2008 Nov.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
60	Kinhikar RA. Deshpande SS. Mahantshetty U. Sarin R. Shrivastava SK. Deshpande DD. HDR brachytherapy combined with 3-D conformal vs. IMRT in left-sided breast cancer patients including internal mammary chain: comparative analysis of dosimetric and technical parameters. <i>Journal of Applied Clinical Medical Physics</i> . 6(3):1-12, 2005.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
61	Kodack DP. Chung E. Yamashita H. Incio J. Duyverman AM. Song Y. Farrar CT. Huang Y. Ager E. Kamoun W. Goel S. Snuderl M. Lussiez A. Hiddingh L. Mahmood S. Tannous BA. Eichler AF. Fukumura D. Engelman JA. Jain RK. Combined targeting of HER2 and VEGFR2 for effective treatment of HER2-amplified breast cancer brain metastases. <i>Proceedings of the National Academy of Sciences of the United States of America</i> . 109(45):E3119-27, 2012 Nov 6.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
62	Koehler KE. Ohlinger R. Sensitivity and specificity of preoperative ultrasonography for diagnosing nodal metastases in patients with breast cancer. <i>Journal of Ultrasound in Medicine</i> . 32(4):393-9, 2011 Aug.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
63	Kogure K. Sakurai T. Tsuzuki Y. Ishizaki M. Nemoto M. Fukusato T. Kuwano H. Makuuchi M. Long-term survival after hepatectomy for large metastatic breast cancer: a case report. <i>Hepato-Gastroenterology</i> . 50(51):827-9, 2003 May-Jun.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
64	Kokke MC. Jannink I. Barneveld PC. van der Linden JC. Gelderman WA. Wissing JC. Bosscha K. Incidence of axillary recurrence in 113 sentinel node negative breast cancer patients: a 3-year follow-up study. <i>European Journal of Surgical Oncology</i> . 31(3):221-5, 2005 Apr.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
65	Koolen BB. Valdes Olmos RA. Elkhuizen PH. Vogel WV. Vrancken Peeters MJ. Rodenhuis S. Rutgers EJ. Locoregional lymph node involvement on 18F-FDG PET/CT in breast cancer patients scheduled for neoadjuvant chemotherapy. <i>Breast Cancer Research & Treatment</i> . 135(1):231-40, 2012 Aug.	Article about diagnostic breast imaging, not imaging for treatment evaluation.
66	Kothari MS. Rusby JE. Agusti AA. MacNeill FA. Sentinel lymph node biopsy after previous axillary surgery: A review. [Review] <i>European Journal of Surgical Oncology</i> . 38(1):8-15, 2012 Jan.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.

Number	Citation	Reason for Exclusion
67	Krainick-Strobel UE. Lichtenegger W. Wallwiener D. Tulusan AH. Janicke F. Bastert G. Kiesel L. Wackwitz B. Paepke S. Neoadjuvant letrozole in postmenopausal estrogen and/or progesterone receptor positive breast cancer: a phase IIb/III trial to investigate optimal duration of preoperative endocrine therapy. <i>BMC Cancer</i> . 8:62, 2008.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
68	Krak NC. Hoekstra OS. Lammertsma AA. Measuring response to chemotherapy in locally advanced breast cancer: methodological considerations. [Review] [78 refs] <i>European Journal of Nuclear Medicine & Molecular Imaging</i> . 31 Suppl 1:S103-11, 2004 Jun.	Article did not include metastatic breast cancer patients.
69	Krukemeyer MG. Wagner W. Jakobs M. Krenn V. Tumor regression by means of magnetic drug targeting. <i>Nanomedicine</i> . 4(8):875-82, 2009 Dec.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
70	Kubota K. Ogawa Y. Nishigawa T. Yoshida S. Tissue harmonic imaging sonography of the axillary lymph nodes: evaluation of response to neoadjuvant chemotherapy in breast cancer patients. <i>Oncology Reports</i> . 10(6):1911-4, 2003 Nov-Dec.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
71	Kumar R. Alavi A. Fluorodeoxyglucose-PET in the management of breast cancer. [Review] [76 refs] <i>Radiologic Clinics of North America</i> . 42(6):1113-22, ix, 2004 Nov.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
72	Labidi SI. Bachelot T. Ray-Coquard I. Mosbah K. Treilleux I. Fayette J. Favier B. Galy G. Blay JY. Guastalla JP. Bevacizumab and paclitaxel for breast cancer patients with central nervous system metastases: a case series.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
73	Latif N. Rana F. Guthrie T. Breast cancer and HIV in the era of highly active antiretroviral therapy: two case reports and review of the literature. [Review] <i>Breast Journal</i> . 17(1):87-92, 2011 Jan-Feb.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
74	Leonard GD. Swain SM. Ductal carcinoma in situ, complexities and challenges. [Review] [226 refs] <i>Journal of the National Cancer Institute</i> . 96(12):906-20, 2004 Jun 16.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
75	Leung JW. Screening mammography reduces morbidity of breast cancer treatment. <i>AJR. American Journal of Roentgenology</i> . 184(5):1508-9, 2005 May.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
76	Li X. Ferrel GL. Guerra MC. Hode T. Lunn JA. Adalsteinsson O. Nordquist RE. Liu H. Chen WR. Preliminary safety and efficacy results of laser immunotherapy for the treatment of metastatic breast cancer patients. <i>Photochemical & Photobiological Sciences</i> . 10(5):817-21, 2011 May.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
77	Liljegren A. Bergh J. Castany R. Early experience with sunitinib, combined with docetaxel, in patients with metastatic breast cancer. <i>Breast</i> . 18(4):259-62, 2009 Aug.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
78	Lindholm P. Lapela M. Nagren K. Lehikoinen P. Minn H. Jyrkkio S. Preliminary study of carbon-11 methionine PET in the evaluation of early response to therapy in advanced breast cancer. <i>Nuclear Medicine Communications</i> . 30(1):30-6, 2009 Jan.	Although article published in 2009, PET scans done 1990-1994 using tracer MET, which is now obsolete.
79	Littrup PJ. Jallad B. Chandiwala-Mody P. D'Agostini M. Adam BA. Bouwman D. Cryotherapy for breast cancer: a feasibility study without excision. <i>Journal of Vascular & Interventional Radiology</i> . 20(10):1329-41, 2009 Oct.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
80	Lu CY. Srasuebkul P. Drew AK. Ward RL. Pearson SA. Positive spillover effects of prescribing requirements: increased cardiac testing in patients treated with trastuzumab for HER2+ metastatic breast cancer. <i>Internal Medicine Journal</i> . 42(11):1229-35, 2012 Nov.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.

Number	Citation	Reason for Exclusion
81	MacDonald SM. Harisinghani MG. Katkar A. Napolitano B. Wolfgang J. Taghian AG. Nanoparticle-enhanced MRI to evaluate radiation delivery to the regional lymphatics for patients with breast cancer. <i>International Journal of Radiation Oncology, Biology, Physics</i> . 77(4):1098-104, 2010 Jul 15	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
82	Macia Escalante S. Rodriguez Lescure A. Pons Sanz V. Martinez Banaclocha N. Guillen Ponce C. Carrato Mena A. A patient with breast cancer with hepatic metastases and a complete response to herceptin as monotherapy. <i>Clinical & Translational Oncology: Official Publication of the Federation of Spanish Oncology Societies & of the National Cancer Institute of Mexico</i> . 8(10):761-3, 2006 Oct.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
83	Maffioli L. Florimonte L. Pagani L. Butti I. Roca I. Current role of bone scan with phosphonates in the follow-up of breast cancer. [Review] [53 refs] <i>European Journal of Nuclear Medicine & Molecular Imaging</i> . 31 Suppl 1:S143-8, 2004 Jun.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
84	Malmstrom P. Holmberg L. Anderson H. Mattsson J. Jonsson PE. Tennvall-Nittby L. Balldin G. Loven L. Svensson JH. Ingvar C. Moller T. Holmberg E. Wallgren A. Swedish Breast Cancer Group. Breast conservation surgery, with and without radiotherapy, in women with lymph node-negative breast cancer: a randomised clinical trial in a population with access to public mammography screening. <i>European Journal of Cancer</i> . 39(12):1690-7, 2003 Aug.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
85	Mariani G. Erba P. Villa G. Gipponi M. Manca G. Boni G. Buffoni F. Castagnola F. Paganelli G. Strauss HW. Lymphoscintigraphic and intraoperative detection of the sentinel lymph node in breast cancer patients: the nuclear medicine perspective. [Review] [95 refs] <i>Journal of Surgical Oncology</i> . 85(3):112-22, 2004 Mar.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
86	Menes TS. Kerlikowske K. Jaffer S. Seger D. Miglioretti DL. Rates of atypical ductal hyperplasia have declined with less use of postmenopausal hormone treatment: findings from the Breast Cancer Surveillance Consortium. <i>Cancer Epidemiology, Biomarkers & Prevention</i> . 18(11):2822-8, 2009 Nov.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
87	Moadel RM. Nguyen AV. Lin EY. Lu P. Mani J. Blaufox MD. Pollard JW. Dadachova E. Positron emission tomography agent 2-deoxy-2-[18F]fluoro-D-glucose has a therapeutic potential in breast cancer. <i>Breast Cancer Research</i> . 5(6):R199-205, 2003.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
88	Montemurro F. Russo F. Martincich L. Cirillo S. Gatti M. Aglietta M. Regge D. Dynamic contrast enhanced magnetic resonance imaging in monitoring bone metastases in breast cancer patients receiving bisphosphonates and endocrine therapy. <i>Acta Radiologica</i> . 45(1):71-4, 2004 Feb.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
89	Montgomery DA. Krupa K. Cooke TG. Follow-up in breast cancer: does routine clinical examination improve outcome? A systematic review of the literature. [Review] [36 refs] <i>British Journal of Cancer</i> . 97(12):1632-41, 2007 Dec 17.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
90	Moon HJ. Kim MJ. Kim EK. Park BW. Youk JH. Kwak JY. Sohn J. Kim SI. US surveillance of regional lymph node recurrence after breast cancer surgery. <i>Radiology</i> . 252(3):673-81, 2009 Sep.	Article about imaging to monitor cancer recurrence, not treatment evaluation.
91	Moss S. Waller M. Anderson TJ. Cuckle H. Trial Management Group. Randomised controlled trial of mammographic screening in women from age 40: predicted mortality based on surrogate outcome measures. <i>British Journal of Cancer</i> . 92(5):955-60, 2005 Mar 14.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
92	Nagashima T. Sakakibara M. Kadowaki M. Suzuki TH. Yokomizo J. Ohki Y. Miyoshi T. Kazama T. Nakatani Y. Miyazaki M. Response rate to neoadjuvant chemotherapy measured on imaging predicts early recurrence and death in breast cancer patients with lymph node involvements. <i>Acta Radiologica</i> . 52(3):241-6, 2011 Apr 1.	Article did not include metastatic breast cancer patients.
93	Nakamura H. Kawasaki N. Taguchi M. Kitaya T. Reconstruction of the anterior chest wall after subtotal sternectomy for metastatic breast cancer: report of a case. <i>Surgery Today</i> . 37(12):1083-6, 2007.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.

Number	Citation	Reason for Exclusion
94	Newman LA. Local control of ductal carcinoma in situ based on tumor and patient characteristics: the surgeon's perspective. [Review] Journal of the National Cancer Institute. Monographs. 2010(41):152-7, 2010.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
95	Newstead GM. MR imaging in the management of patients with breast cancer. [Review] [46 refs] Seminars in Ultrasound, CT & MR. 27(4):320-32, 2006 Aug.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
96	Newton-Northup JR. Dickerson MT. Ma L. Besch-Williford CL. Deutscher SL. Inhibition of metastatic tumor formation in vivo by a bacteriophage display-derived galectin-3 targeting peptide. Clinical & Experimental Metastasis. 30(2):119-32, 2013 Feb.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
97	Ngo C. Pollet AG. Laperrelle J. Ackerman G. Gomme S. Thibault F. Fouchotte V. Salmon RJ. Intraoperative ultrasound localization of nonpalpable breast cancers. Annals of Surgical Oncology. 14(9):2485-9, 2007 Sep.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
98	Nirmala S. Krishnaswamy M. Janaki MG. Kaushik KS. Unilateral solitary choroid metastasis from breast cancer: rewarding results of external radiotherapy. Journal of Cancer Research & Therapeutics. 4(4):206-8, 2008 Oct-Dec.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
99	Ono M. Ando M. Yunokawa M. Nakano E. Yonemori K. Matsumoto K. Kouno T. Shimizu C. Tamura K. Katsumata N. Fujiwara Y. Brain metastases in patients who receive trastuzumab-containing chemotherapy for HER2-overexpressing metastatic breast cancer. International Journal of Clinical Oncology. 14(1):48-52, 2009 Feb.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
100	Orgera G. Curigliano G. Krokidis M. Bonomo G. Monfardini L. Della Vigna P. Zampino MG. Orsi F. High-intensity focused ultrasound effect in breast cancer nodal metastasis. Cardiovascular & Interventional Radiology. 33(2):447-9, 2010 Apr.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
101	Park SH. Kim MJ. Park BW. Moon HJ. Kwak JY. Kim EK. Impact of preoperative ultrasonography and fine-needle aspiration of axillary lymph nodes on surgical management of primary breast cancer. Annals of Surgical Oncology. 18(3):738-44, 2011 Mar.	Article about diagnostic breast imaging, not imaging for treatment evaluation.
102	Pass H. Vicini FA. Kestin LL. Goldstein NS. Decker D. Pettinga J. Ingold J. Benitez P. Neumann K. Rebner M. Dekhne N. Martinez A. Changes in management techniques and patterns of disease recurrence over time in patients with breast carcinoma treated with breast-conserving therapy at a single institution. Cancer. 101(4):713-20, 2004 Aug 15.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
103	Pavic D. Koomen MA. Kuzmiak CM. Lee YH. Pisano ED. The role of magnetic resonance imaging in diagnosis and management of breast cancer. [Review] [121 refs] Technology in Cancer Research & Treatment. 3(6):527-41, 2004 Dec.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
104	Port ER. Yeung H. Gonen M. Liberman L. Caravelli J. Borgen P. Larson S. 18F-2-fluoro-2-deoxy-D-glucose positron emission tomography scanning affects surgical management in selected patients with high-risk, operable breast carcinoma. Annals of Surgical Oncology. 13(5):677-84, 2006 May.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
105	Pusztai L. Wagner P. Ibrahim N. Rivera E. Theriault R. Booser D. Symmans FW. Wong F. Blumenschein G. Fleming DR. Rouzier R. Boniface G. Hortobagyi GN. Phase II study of tariquidar, a selective P-glycoprotein inhibitor, in patients with chemotherapy-resistant, advanced breast carcinoma. Cancer. 104(4):682-91, 2005 Aug 15.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
106	Qamri Z. Preet A. Nasser MW. Bass CE. Leone G. Barsky SH. Ganju RK. Synthetic cannabinoid receptor agonists inhibit tumor growth and metastasis of breast cancer. Molecular Cancer Therapeutics. 8(11):3117-29, 2009 Nov.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
107	Rades D. Douglas S. Veninga T. Stalpers LJ. Bajrovic A. Rudat V. Schild SE. Prognostic factors in a series of 504 breast cancer patients with metastatic spinal cord compression. Strahlentherapie und Onkologie. 188(4):340-5, 2012 Apr.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.

Number	Citation	Reason for Exclusion
108	Rebollo-Aguirre AC. Gallego-Peinado M. Menjon-Beltran S. Garcia-Garcia J. Pastor-Pons E. Chamorro-Santos CE. Ramos-Font C. Salamanca-Ballesteros A. Llamas-Elvira JM. Olea-Serrano N. Sentinel lymph node biopsy in patients with operable breast cancer treated with neoadjuvant chemotherapy. <i>Revista Espanola de Medicina Nuclear e Imagen Molecular</i> . 31(3):117-23, 2012 May-Jun.	Article did not include metastatic breast cancer patients.
109	Rimner A. Rosenzweig KE. Palliative radiation for lung cancer metastases to the breast: two case reports. <i>Journal of Thoracic Oncology: Official Publication of the International Association for the Study of Lung Cancer</i> . 2(12):1133-5, 2007 Dec.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
110	Roddiger SJ. Kolotas C. Filipowicz I. Kurek R. Kuner RP. Martin T. Baltas D. Rogge B. Kontova M. Hoffmann G. Pollow B. Zamboglou N. Neoadjuvant interstitial high-dose-rate (HDR) brachytherapy combined with systemic chemotherapy in patients with breast cancer. <i>Strahlentherapie und Onkologie</i> . 182(1):22-9, 2006 Jan.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
111	Roos DE. Brophy BP. Taylor J. Lessons from a 17-year radiosurgery experience at the Royal Adelaide Hospital. <i>International Journal of Radiation Oncology, Biology, Physics</i> . 82(1):102-6, 2012 Jan 1.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
112	Rousseau C. Devillers A. Campone M. Campion L. Ferrer L. Sagan C. Ricaud M. Bridji B. Kraeber-Bodere F. FDG PET evaluation of early axillary lymph node response to neoadjuvant chemotherapy in stage II and III breast cancer patients. <i>European Journal of Nuclear Medicine & Molecular Imaging</i> . 38(6):1029-36, 2011 Jun.	Article did not include metastatic breast cancer patients.
113	Ruhl R. Ludemann L. Czarnecka A. Streitparth F. Seidensticker M. Mohnike K. Pech M. Wust P. Ricke J. Radiobiological restrictions and tolerance doses of repeated single-fraction HDR-irradiation of intersecting small liver volumes for recurrent hepatic metastases. <i>Radiation Oncology</i> . 5:44, 2010.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
114	Ruhstaller T. von Moos R. Rufibach K. Ribi K. Glaus A. Spaeti B. Koeberle D. Mueller U. Hoefliger M. Hess D. Boehme C. Thuerlimann B. Breast cancer patients on endocrine therapy reveal more symptoms when self-reporting than in pivotal trials: an outcome research study. <i>Oncology</i> . 76(2):142-8, 2009.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
115	Saito AI. Lightsey J. Li JG. Copeland EM 3rd. Karasawa K. Vargas CE. Mendenhall NP. Accuracy of breast cancer axillary lymph node treatment plans based on 2-dimensional imaging: what we should know before interpreting 2-dimensional treatment-planning era studies. <i>American Journal of Clinical Oncology</i> . 32(4):387-95, 2009 Aug.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
116	Salloum RG. Hornbrook MC. Fishman PA. Ritzwoller DP. O'Keeffe Rossetti MC. Elston Lafata J. Adherence to surveillance care guidelines after breast and colorectal cancer treatment with curative intent. <i>Cancer</i> . 118(22):5644-51, 2012 Nov 15.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
117	Sato K. Shigenaga R. Ueda S. Shigekawa T. Krag DN. Sentinel lymph node biopsy for breast cancer. [Review] [34 refs] <i>Journal of Surgical Oncology</i> . 96(4):322-9, 2007 Sep 15.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
118	Seemann MD. Diagnostic value of PET/CT for predicting of neoadjuvant chemotherapy response. <i>European Journal of Medical Research</i> . 12(2):90-1, 2007 Feb 26.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
119	Servais EL. Colovos C. Kachala SS. Adusumilli PS. Pre-clinical mouse models of primary and metastatic pleural cancers of the lung and breast and the use of bioluminescent imaging to monitor pleural tumor burden. <i>Current Protocols in Pharmacology</i> . Chapter 14:Unit14.21, 2011 Sep.	Non-human study.
120	Sethi RA. No HS. Jozsef G. Ko JP. Formenti SC. Comparison of three-dimensional versus intensity-modulated radiotherapy techniques to treat breast and axillary level III and supraclavicular nodes in a prone versus supine position. <i>Radiotherapy & Oncology</i> . 102(1):74-81, 2012 Jan.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.

Number	Citation	Reason for Exclusion
121	Souchon R. Wenz F. Sedlmayer F. Budach W. Dunst J. Feyer P. Haase W. Harms W. Sautter-Bihl ML. Sauer R. DEGRO practice guidelines for palliative radiotherapy of metastatic breast cancer: bone metastases and metastatic spinal cord compression (MSSC). German Society of Radiation Oncology (DEGRO). <i>Strahlentherapie und Onkologie</i> . 185(7):417-24, 2009 Jul.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
122	Spear SL. Clemens MW. Dayan JH. Considerations of previous augmentation in subsequent breast reconstruction. <i>Aesthetic Surgery Journal</i> . 28(3):285-93, 2008 May-Jun.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
123	Sperber F. Weinstein Y. Sarid D. Ben Yosef R. Shalmon A. Yaal-Hahoshen N. Preoperative clinical, mammographic and sonographic assessment of neoadjuvant chemotherapy response in breast cancer. <i>Israel Medical Association Journal: Imaj</i> . 8(5):342-6, 2006 May.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
124	Stranzl H. Zurl B. Langsenlehner T. Kapp KS Wide tangential fields including the internal mammary lymph nodes in patients with left-sided breast cancer. Influence of respiratory-controlled radiotherapy (4D-CT) on cardiac exposure. <i>Strahlentherapie und Onkologie</i> . 185(3):155-60, 2009 Mar.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
125	Straver ME. Loo CE. Alderliesten T. Rutgers EJ. Vrancken Peeters MT. Marking the axilla with radioactive iodine seeds (MARI procedure) may reduce the need for axillary dissection after neoadjuvant chemotherapy for breast cancer. <i>British Journal of Surgery</i> . 97(8):1226-31, 2010 Aug.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
126	Sun G. Jin P. Li M. Liu X. Li F. Yu AK. Lu Y. Percutaneous vertebroplasty for treatment of osteolytic metastases of the C2 vertebral body using anterolateral and posterolateral approach. <i>Technology in Cancer Research & Treatment</i> . 9(4):417-22, 2010 Aug.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
127	Tisman G. Inhibition of HER2/estrogen receptor cross-talk, probable relation to prolonged remission of stage IV breast cancer: a case report. <i>Tumori</i> . 95(6):804-7, 2009 Nov-Dec.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
128	Tolentino PJ. Brain metastases secondary to breast cancer: treatment with surgical resection and stereotactic radiosurgery. <i>Missouri Medicine</i> . 106(6):428-31, 2009 Nov-Dec.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
129	Tomasevic ZI. Rakocevic Z. Tomasevic ZM. Milovanovic Z. Inic M. Kolarevic D. Lukic V. Kovac Z. Incidence of brain metastases in early stage HER2 3+ breast cancer patients; is there a role for brain CT in asymptomatic patients?. <i>Journal of B.U.On.</i> 17(2):249-53, 2012 Apr-Jun.	Article addressed diagnosing brain metastases, not evaluating treatment of metastatic breast cancer
130	Trumm CG. Jakobs TF. Zech CJ. Helmberger TK. Reiser MF. Hoffmann RT. CT fluoroscopy-guided percutaneous vertebroplasty for the treatment of osteolytic breast cancer metastases: results in 62 sessions with 86 vertebrae treated. <i>Journal of Vascular & Interventional Radiology</i> . 19(11):1596-606, 2008 Nov.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
131	Tsai SH. Chen CY. Ku CH. Jancikla AJ. Yam LT. Yu JC. Chuang KW. Chao TY. The semiquantitative bone scintigraphy index correlates with serum tartrate-resistant acid phosphatase activity in breast cancer patients with bone metastasis. <i>Mayo Clinic Proceedings</i> . 82(8):917-26, 2007 Aug.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
132	Wallace AM. Comstock C. Hoh CK. Vera DR. Breast imaging: a surgeon's prospective. <i>Nuclear Medicine & Biology</i> . 32(7):781-92, 2005 Oct.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
133	Wang X. Zhang W. Xu Z. Luo Y. Mitchell D. Moss RW. Sonodynamic and photodynamic therapy in advanced breast carcinoma: a report of 3 cases. <i>Integrative Cancer Therapies</i> . 8(3):283-7, 2009 Sep.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
134	Wang X. Zhao Y. Cao X. Clinical benefits of mastectomy on treatment of occult breast carcinoma presenting axillary metastases. <i>Breast Journal</i> . 16(1):32-7, 2010 Jan-Feb.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.

Number	Citation	Reason for Exclusion
135	Wieners G. Mohnike K. Peters N. Bischoff J. Kleine-Tebbe A. Seidensticker R. Seidensticker M. Gademann G. Wust P. Pech M. Ricke J. Treatment of hepatic metastases of breast cancer with CT-guided interstitial brachytherapy - a phase II-study. <i>Radiotherapy & Oncology</i> . 100(2):314-9, 2011 Aug.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
136	Wiggenraad R. Verbeek-de Kanter A. Mast M. Molenaar R. Kal HB. Lycklama a Nijeholt G. Vecht C. Struikmans H. Local progression and pseudo progression after single fraction or fractionated stereotactic radiotherapy for large brain metastases. A single centre study. <i>Strahlentherapie und Onkologie</i> . 188(8):696-701, 2012 Aug.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
137	Wilbert J. Guckenberger M. Polat B. Sauer O. Voegelé M. Flentje M. Sweeney RA. Semi-robotic 6 degree of freedom positioning for intracranial high precision radiotherapy; first phantom and clinical results. <i>Radiation Oncology</i> . 5:42, 2010.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
138	Wiseman CL. Kharazi A. Objective clinical regression of metastatic breast cancer in disparate sites after use of whole-cell vaccine genetically modified to release sargramostim. <i>Breast Journal</i> . 12(5):475-80, 2006 Sep-Oct.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
139	Yasojima H. Shimomura A. Naoi Y. Kishi K. Baba Y. Shimazu K. Nakayama T. Kim SJ. Tamaki Y. Noguchi S. Association between c-myc amplification and pathological complete response to neoadjuvant chemotherapy in breast cancer. <i>European Journal of Cancer</i> . 47(12):1779-88, 2011 Aug.	Article did not include metastatic breast cancer patients.
140	Yavetz D. Corn BW. Matcyevesky D. Ben-Josef R. Soyfer V. Bershtein I. Inbar M. Ron I. Jiveliouk I. Schiffer D. Improved treatment of the breast and supraclavicular fossa based on a simple geometrical principle. <i>Medical Dosimetry</i> . 36(4):434-9, 2011.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
141	Yen CP. Sheehan J. Patterson G. Steiner L. Gamma knife surgery for metastatic brainstem tumors. <i>Journal of Neurosurgery</i> . 105(2):213-9, 2006 Aug.	Article did not address use of imaging for treatment evaluation for metastatic breast cancer.
142	Yu JC. Hsu GC. Hsieh CB. Yu CP. Chao TY. Role of sentinel lymphadenectomy combined with intraoperative ultrasound in the assessment of locally advanced breast cancer after neoadjuvant chemotherapy. <i>Annals of Surgical Oncology</i> . 14(1):174-80, 2007 Jan.	Article did not include metastatic breast cancer patients.

Appendix E. Calculation of Estimate of Number of Women Receiving Imaging for Treatment Evaluation of Metastatic Breast Cancer

We estimated that the U.S. prevalence of women with metastatic breast cancer is about 160,000, with a median survival time of about two years.¹ Our Key Informants estimated that about 90% of women with metastatic breast cancer receive some type of chemotherapy and that treatment for metastatic breast cancer typically lasts about one year. We estimated that about half of the 160,000 women, or about 80,000 women, would be in the first year of their metastatic breast cancer diagnosis and would be candidates for receiving treatment, and 90% of these, or 72,000, would be receiving chemotherapy and thus imaging for treatment evaluations per year. Our literature search covered 11 years, so $72,000 \times 11 = 792,000$ women received scans for treatment evaluation of metastatic breast cancer.

¹ Metastatic Breast Cancer Network. Education: Prevalence of Metastatic Breast Cancer. 2013. <http://mbcn.org/education/category/prevalence/>. Accessed on December 16, 2013.