

Microwave ablation and thermotherapy for tumors

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Policy contains: breast cancer, colorectal liver metastases, hepatocellular carcinoma, intrahepatic cholangiocarcinoma, kidney tumors, lung tumors, microwave ablation, microwave thermotherapy, papillary thyroid carcinoma, cervical nodal recurrence, and vertebral metastatic disease

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Coverage policy

Lung tumors

Microwave ablation of a primary or metastatic lung tumor is clinically proven and, therefore, may be medically necessary when all of the following criteria are met (National Comprehensive Cancer Network, 2026f):

- The member is medically inoperable because of the location or extent of the lesion or because of comorbid conditions.
- The member will not receive stereotactic ablative radiation therapy or definitive radiation therapy.
- A single tumor is 3 cm or smaller.

Kidney tumors

Microwave ablation of a malignant kidney tumor is clinically proven and, therefore, may be medically necessary when all of the following criteria are met (National Comprehensive Cancer Network, 2026e):

- The member is not a candidate for surgery because of other medical conditions or faces a significant risk of illness or death from surgery.
- The tumor is a localized malignant renal lesion that is 3 cm or smaller.

Hepatocellular carcinoma

Microwave ablation of hepatocellular carcinoma is clinically proven and, therefore, may be medically necessary when all of the following criteria are met (National Comprehensive Cancer Network, 2026d):

- The disease is confined to the liver.
- The member has been evaluated by a multidisciplinary team and has adequate hepatic reserve for locoregional therapy.
- All tumors are 3 cm or smaller.
- Each tumor is accessible for ablation.
- All tumor tissue and an adequate margin of normal tissue can be treated.
- The procedure will be performed at an experienced center.

For hepatocellular carcinoma greater than 3 cm and no greater than 5 cm, microwave ablation may be medically necessary on a case-by-case basis when multidisciplinary review determines that ablation, alone or as part of combination treatment, is appropriate (National Comprehensive Cancer Network, 2026d).

Liver metastases from a colon or rectal primary

Microwave ablation of limited liver metastases from a colon or rectal primary may be medically necessary when all of the following criteria are met (Knavel Koepsel, 2022; National Comprehensive Cancer Network, 2026c, 2026g):

- A multidisciplinary team has determined that surgical resection is not appropriate or that ablation is part of a plan to treat all known disease.
- There is no uncontrolled extrahepatic disease.
- Each liver metastasis selected for ablation is 3 cm or smaller and is accessible for treatment.
- All selected tumor tissue and an adequate margin of normal liver tissue can be treated.

Intrahepatic cholangiocarcinoma

Microwave ablation of a primary or recurrent intrahepatic cholangiocarcinoma may be medically necessary when all of the following criteria are met (Knavel Koepsel, 2022; National Comprehensive Cancer Network, 2026a):

- There is one tumor smaller than 3 cm.
- Surgical resection is not appropriate because of tumor location, recurrence, comorbid conditions, or operative risk.
- There is no biliary ductal dilation, macroscopic vascular invasion, regional lymph node involvement, or distant metastatic disease.
- All tumor tissue and an adequate margin of normal tissue can be treated.
- The procedure will be performed at an experienced center after multidisciplinary review.

Painful vertebral metastatic disease

Microwave ablation as part of palliative treatment for painful vertebral metastatic disease may be medically necessary when all of the following criteria are met (Khan, 2022):

- A focal metastatic vertebral lesion or pathological vertebral compression fracture is causing ongoing or increasing mechanical pain.
- A multidisciplinary assessment, including radiation oncology and spine consultation when appropriate, supports percutaneous ablation.
- There is no spinal cord compression, neurologic compromise, or mechanical instability requiring decompression or surgical stabilization.
- The treatment plan addresses mechanical stabilization, including vertebral augmentation when clinically indicated.

Breast cancer

Focused microwave thermotherapy and percutaneous microwave ablation of breast tumors are investigational and not medically necessary (American Society of Breast Surgeons, 2018; National Comprehensive Cancer Network, 2026b).

Thyroid tumors

Microwave ablation of a primary papillary thyroid carcinoma, cervical nodal recurrence, or a benign thyroid nodule is investigational and not medically necessary. American professional guidance is conditional, the evidence is predominantly observational, and radiofrequency ablation has the more established evidence base (Baldwin, 2026; Dueñas, 2026).

Limitations

Coverage is limited to the indication-specific criteria above.

- Microwave ablation is not covered for hepatocellular carcinoma larger than 5 cm.
- Microwave ablation is not covered for colorectal liver metastases larger than 3 cm, uncontrolled extrahepatic disease, or disease that cannot be completely treated with an adequate margin.
- Microwave ablation is not covered for multifocal, vascular-invasive, node-positive, metastatic, or extrahepatic cholangiocarcinoma.
- The vertebral indication is palliative and does not apply when spinal cord compression, neurologic compromise, or instability requires decompression or surgical stabilization.
- Focused microwave breast thermotherapy, breast tumor microwave ablation, and thyroid microwave ablation remain investigational.

Additional uses of microwave ablation or thermotherapy outside the criteria above are not clinically proven and may not be medically necessary (Baldwin, 2026; Dueñas, 2026; National Comprehensive Cancer Network, 2026a, 2026b, 2026c, 2026d, 2026e, 2026f, 2026g).

Alternative covered services

- Radiofrequency ablation.
- Cryoablation.
- Surgical resection or surgical stabilization.
- Stereotactic ablative radiation therapy or other definitive radiation therapy.
- Systemic anticancer therapy.
- Vertebral augmentation.
- Active surveillance or radioactive iodine when appropriate for a thyroid indication.

Background

Tumor ablation is a minimally invasive technique that applies chemical or thermal methods under image guidance to induce cellular necrosis and destroy solid tumors while sparing adjacent tissue. Thermal ablation is accomplished by cooling or heating targeted tissue to less than minus 40 degrees Celsius or more than 60 degrees Celsius. Depending on the technique, tissue may be accessed through the skin, by laparoscopy, during open surgery, by endoscopy, or from outside the body to achieve local tumor control (Gala, 2020).

Available thermal ablative methods include radiofrequency ablation, laser ablation, cryoablation, high-intensity focused ultrasound, and microwave ablation. Irreversible electroporation is a nonthermal method that applies short electrical pulses to create permanent pores in cell membranes and induce cell death. Microwave ablation has emerged as an alternative to the more established radiofrequency technique (Gala, 2020).

A microwave system includes a generator, a coaxial cable, and a 14- to 17-gauge antenna that transmits energy into tissue. The antenna is positioned with ultrasound, computed tomography, or fluoroscopic guidance, depending on lesion location. Sustained heating produces coagulative necrosis within the planned treatment zone (Gala, 2020).

Radiofrequency ablation passes alternating electrical current through tissue, whereas microwave ablation uses electromagnetic energy, commonly at 915 or 2,450 megahertz. Rapid heating and a larger electromagnetic field can create a larger and more predictable ablation zone and can reduce sensitivity to heat loss near blood vessels. The clinical importance of these technical differences varies by organ, tumor size, location, device, and operator experience (Gala, 2020).

Computed tomography and magnetic resonance imaging are used at regular intervals to assess response after local treatment. The most appropriate follow-up method and interpretation depend on the therapy used and the treatments being considered (American College of Radiology, 2018).

The United States Food and Drug Administration has cleared several microwave ablation devices through the 510(k) pathway as electrosurgical cutting and coagulation devices and accessories for soft-tissue ablation. Clearance does not establish effectiveness for every tumor or anatomic site addressed in this policy (United States Food and Drug Administration, 2026).

Within the liver, the relevant diseases are biologically distinct. Hepatocellular carcinoma arises from liver cells, colorectal liver metastases represent spread from a colon or rectal primary tumor, and intrahepatic cholangiocarcinoma arises from bile ducts within the liver. The role and boundaries of ablation therefore depend on disease-specific guidance, tumor burden, resectability, hepatic reserve, and the ability to obtain an adequate treatment margin (Knavel Koepsel, 2022; National Comprehensive Cancer Network, 2026a, 2026c, 2026d, 2026g).

For vertebral metastatic disease, ablation is a palliative local treatment for tumor-related pain and is often combined with vertebral augmentation when mechanical support is needed. Tumor destruction alone does not restore spinal stability and is not a substitute for decompression when the spinal cord or nerves are threatened (Khan, 2022; Purnomo, 2026). Directed thermal ablation of thyroid tumors uses an image-guided probe, but the supporting American statements are conditional and identify radiofrequency ablation as the most established technology (Baldwin, 2026; Dueñas, 2026).

Focused microwave thermotherapy for breast cancer is a regional hyperthermia technique that heats a larger tissue volume, sometimes with radiation therapy. It is distinct from percutaneous microwave ablation, which places an antenna directly within a tumor. Evidence for one procedure should not be assumed to establish the other (Bakker, 2019; Carriero, 2023).

Findings

Microwave ablation has been evaluated across several tumor types, but the evidentiary role differs by indication. The Findings are organized by disease so each coverage position is paired with its American professional guidance, evidence synthesis, and principal limitations. Across indications, tumor size, location, surgical candidacy, organ function, treatment margin, adjunctive procedures, and operator experience influence outcomes.

Lung tumors

The National Comprehensive Cancer Network recommends image-guided thermal ablation for selected primary or secondary lung tumors 3 cm or smaller in nonsurgical candidates. The American Association for Thoracic Surgery states that surgery remains preferred for medically operable early non-small cell lung cancer and stereotactic ablative radiation therapy is the preferred nonsurgical treatment; image-guided thermal ablation is an additional option when surgery and radiation therapy are declined or unsuitable. The American College of Radiology also considers image-guided thermal ablation potentially appropriate for a peripheral enlarging nodule in an individual at high surgical risk after tissue diagnosis (Gilyard, 2026; National Comprehensive Cancer Network, 2026f; Pennathur, 2025).

Systematic reviews emphasize careful selection and report less reliable control for tumors larger than 3 cm. Pooled comparisons of surgery, radiation therapy, and thermal ablation are predominantly nonrandomized and do not establish equivalence. Meta-analyses comparing microwave with radiofrequency ablation generally report similar technical success and recurrence, with shorter procedure times for microwave ablation. A recent analysis of 10 studies involving 959 individuals rated most outcomes as low or very low certainty; pneumothorax was the most frequent complication, and no consistent survival or overall safety advantage was demonstrated (Adar, 2026; Chan, 2021; Laeseke, 2023; Lanuti, 2025; Liu, 2025; Nelson, 2019; Sun, 2019; Yuan, 2019).

A review of microwave ablation for colorectal pulmonary metastases reported favorable local control in selected individuals, but variation in tumor burden, technique, and follow-up prevents a comparative conclusion against metastasectomy or stereotactic radiation therapy. The evidence supports the narrow small-tumor, nonsurgical role in the coverage criteria and does not support substitution for surgery or preferred radiation treatment in otherwise appropriate candidates (Tan, 2023).

Malignant kidney tumors

The National Comprehensive Cancer Network explicitly lists microwave ablation, cryoablation, and radiofrequency ablation as percutaneous options for localized renal lesions and notes that ablation is most applicable to masses 3 cm or smaller. The Society of Interventional Radiology supports percutaneous renal tumor ablation. The American Urological Association recommends thermal ablation for solid renal masses smaller than 3 cm but specifically names radiofrequency ablation and cryoablation, so the degree of technology-specific support differs among guidelines (Campbell, 2021; Gunn, 2020; Morris, 2020; National Comprehensive Cancer Network, 2026e).

Meta-analyses comparing microwave ablation with radiofrequency ablation and cryoablation report broadly similar technical success, survival, and safety. A large review included 32 microwave studies involving 2,069 individuals and found high local control with a low rate of serious complications, but follow-up was shorter and heterogeneity was substantial. Comparisons with partial nephrectomy suggest lower procedural morbidity and better renal function preservation but cannot establish equivalent long-term cancer control because treatment selection differs and randomized trials are absent (Castellana, 2023; Huang, 2025; McClure, 2023; Shaaban Abdelgalil, 2025; Uhlig, 2019).

The evidence supports microwave ablation as a nephron-sparing option for a localized malignant renal lesion 3 cm or smaller when surgery poses substantial risk. It does not establish superiority over other ablation methods or partial nephrectomy, and evidence for larger localized renal tumors remains insufficient (Campbell, 2021; Huang, 2025; National Comprehensive Cancer Network, 2026e).

Hepatocellular carcinoma

The National Comprehensive Cancer Network identifies thermal ablation, including microwave ablation, as potentially curative for selected hepatocellular carcinoma 3 cm or smaller when all tumors are accessible, an adequate margin can be treated, hepatic reserve is sufficient, and care follows multidisciplinary evaluation at an experienced center. For tumors greater than 3 cm and no greater than 5 cm, ablation is less reliably curative and may be considered alone or with another local treatment. Ablation is not recommended for tumors larger than 5 cm (National Comprehensive Cancer Network, 2026d).

A component network meta-analysis of 41 randomized trials found longer recurrence-free survival with microwave than radiofrequency ablation, while other local outcomes were broadly comparable. A direct meta-analysis of 19 studies found no clear differences in complete ablation, overall survival, disease-free survival, or major adverse events, and most included studies were observational. Comparisons with resection did not establish noninferiority for survival and found more intrahepatic recurrence after ablation, although morbidity and major complications were lower (Charbonneau, 2024; Fu, 2026; Sun, 2026).

Observational evidence suggests that combination treatment with transarterial chemoembolization can improve outcomes for selected intermediate disease, and selected tumors at technically challenging sites may be treated successfully in experienced centers. These analyses do not establish microwave superiority or expand microwave monotherapy beyond the disease, size, margin, and center requirements in the coverage criteria (Fu, 2025; Yang, 2022).

Colorectal liver metastases

The National Comprehensive Cancer Network Colon Cancer and Rectal Cancer guidelines include thermal ablation, including microwave ablation, as a local treatment option for carefully selected colorectal liver metastases when all known disease can be addressed. For selected lesions 3 cm or smaller, NCCN states that thermal ablation is equivalent to resection and should be prioritized when feasible because of equivalent outcomes and reduced toxicity. This does not establish equivalence for larger, incompletely treatable, or otherwise unsuitable disease. The American College of Radiology rates percutaneous ablation as usually appropriate for a solitary colorectal liver metastasis in a nonsurgical setting. Multidisciplinary, anatomy-specific selection remains necessary (Knavel Koepsel, 2022; National Comprehensive Cancer Network, 2026c, 2026g).

A microwave-specific review included 12 studies involving 395 individuals; most studies were observational and most treated tumors were smaller than 3 cm. Pooled overall survival was 86.7 percent at one year, 59.6 percent at three years, and 44.8 percent at five years, while serious complications occurred in 8.4 percent. These uncontrolled estimates demonstrate feasibility but not comparative benefit. A meta-analysis of five retrospective comparative studies found less local tumor progression after microwave than radiofrequency ablation but no difference in total complications; residual confounding prevents a superiority conclusion (Mimmo, 2022; Tang, 2023).

A 2026 meta-analysis of one randomized trial and six matched or target-trial studies involving metastases 3 cm or smaller found no significant difference in overall survival, disease-free survival, or progression-free survival between thermal ablation and resection, with fewer complications after ablation; certainty for survival was low and the analysis combined technologies. A separate analysis found markedly more local progression when the treatment margin was smaller than 5 mm and suggested that a margin of at least 10 mm may improve control,

but it was not specific to microwave ablation. The evidence supports a narrow role for small, completely treatable metastases and does not establish unrestricted substitution for resection (Chlorogiannis, 2023; Su, 2026).

Intrahepatic cholangiocarcinoma

The National Comprehensive Cancer Network includes microwave within thermal ablation options for selected unresectable or recurrent intrahepatic cholangiocarcinoma. The American College of Radiology rates percutaneous ablation as usually appropriate for a single peripheral tumor smaller than 3 cm without biliary ductal dilation, macroscopic vascular invasion, regional lymph node involvement, or distant metastases. This is class-level support for ablation and does not establish microwave as the preferred method (Knavel Koepsel, 2022; National Comprehensive Cancer Network, 2026a).

A microwave-specific meta-analysis included eight retrospective single-arm studies involving 423 individuals, seven from China and one from Italy. Pooled technical success and technical efficacy were 100 percent and 99 percent, median overall survival was 22 months, and major complications occurred in 2.8 percent. A broader meta-analysis of 20 retrospective thermal-ablation studies involving 917 individuals found technical efficacy of 91.9 percent and major complications in 5.7 percent; tumors larger than 3 cm and multiple tumors were associated with shorter survival (Kim, 2022; Song, 2025).

An updated review identified 31 percutaneous-ablation studies involving 1,526 individuals, including 13 microwave studies involving 891 individuals. Median overall survival in microwave series was approximately 30 months, but local recurrence ranged from 8.6 percent to 77.8 percent. The literature is predominantly retrospective and heterogeneous, with no randomized direct comparison of microwave and radiofrequency ablation. The evidence supports feasibility for a solitary small primary or recurrent tumor when resection is not appropriate and does not support multifocal, vascular-invasive, node-positive, metastatic, or extrahepatic disease (Pallas, 2026).

Painful vertebral metastatic disease

The American College of Radiology rates percutaneous spine ablation as usually appropriate for a pathological vertebral compression fracture with ongoing or increasing mechanical pain, alongside vertebral augmentation, radiation oncology consultation, and surgical consultation. The recommendation addresses percutaneous ablation as a class and does not prefer microwave ablation over another technology (Khan, 2022).

A microwave-specific meta-analysis included 13 studies and 670 individuals treated with microwave ablation plus percutaneous vertebral augmentation. Pain, disability, and opioid use improved through follow-up of up to six months. The evidence included one randomized trial, one prospective cohort, and 11 retrospective cohorts; most estimates were uncontrolled before-and-after comparisons, statistical heterogeneity was substantial, and publication bias and inconsistent adverse-event reporting limited certainty. Cement leakage was the most frequent complication and was often asymptomatic; less frequent serious events included neural injury, skin burns, pathological fracture, and neurologic deficit (Purnomo, 2026).

Two additional reviews found pain improvement and reported local control above 80 percent in studies that assessed it, but nearly all evidence was nonrandomized and at serious risk of bias. Microwave ablation was used alone or with vertebral augmentation or surgery, which prevents valid technology comparisons and prevents attributing the combined procedure's results to microwave ablation alone. The evidence supports a palliative role in selected painful vertebral disease and does not establish superiority over radiation therapy, surgery, radiofrequency ablation, or vertebral augmentation alone (Faiella, 2024; Yao, 2023).

Thyroid tumors

The North American Society for Interventional Thyroidology states that thermal ablation may be offered to carefully selected individuals with a small, solitary, low-risk papillary thyroid carcinoma surrounded by healthy

thyroid tissue and without cervical nodal disease, extension beyond the thyroid, an unfavorable location, or known high-risk molecular features. Microwave ablation is included among the technologies discussed, but the statement identifies radiofrequency ablation as the current gold standard because it has the most robust evidence, the highest sonographic disappearance rate, and the lowest complication rate (Baldwin, 2026).

A separate statement directly includes microwave ablation among directed therapies for cervical nodal recurrence of papillary thyroid carcinoma. For curative intent, it conditionally supports treatment of no more than three nodes, each no larger than 2 cm, without high-risk telomerase reverse transcriptase promoter or tumor protein 53 molecular alterations, when surgery is refused or high risk, disease does not respond to radioactive iodine, or the risk-benefit balance of radioactive iodine is unfavorable. The recommendation is conditional and based on low-certainty observational evidence, predominantly from Asia and Europe, with limited long-term cancer outcomes and limited North American representation (Dueñas, 2026).

These statements show a developing role for directed thermal ablation but do not provide equally strong technology-specific support for microwave ablation. Because radiofrequency ablation is preferred for primary low-risk disease and the recurrence recommendation is conditional and low certainty, thyroid microwave ablation remains investigational in this policy (Baldwin, 2026; Dueñas, 2026).

Breast cancer

The National Comprehensive Cancer Network breast cancer guideline does not address focused microwave thermotherapy. In its 2018 consensus statement, the American Society of Breast Surgeons classified thermotherapies as investigational and recommended their use only in clinical trials. Focused microwave thermotherapy is a regional hyperthermia method and is distinct from the percutaneous needle-based microwave ablation evaluated for other tumor sites (American Society of Breast Surgeons, 2018; National Comprehensive Cancer Network, 2026b).

Systematic reviews of hyperthermia with radiation therapy report higher complete-response rates in recurrent breast cancer, but they combine microwave and other heat-delivery methods, largely evaluate multimodal treatment, and are predominantly nonrandomized or single-arm. A review of minimally invasive breast ablation included only 78 microwave-treated individuals, and later small microwave series do not establish durable equivalence to standard surgery and radiation treatment. The evidence does not establish the effectiveness, durability, or comparative safety of focused microwave thermotherapy or percutaneous microwave ablation for breast cancer; the noncoverage conclusion from the separate breast cancer policy is therefore retained here so that policy can be retired without a coverage gap (Bakker, 2019; Carriero, 2023; Datta, 2016; Mauri, 2017).

Cross-indication evidence limitations

Across covered tumor indications, outcomes are most consistent for small tumors that can be completely treated with an adequate margin. Much of the lung, kidney, colorectal liver metastasis, intrahepatic cholangiocarcinoma, vertebral, and thyroid evidence is observational and susceptible to selection bias. Several reviews evaluate thermal ablation as a class, multiple reviews reuse the same primary cohorts, and vertebral studies commonly combine ablation with augmentation. Device generation, technique, image guidance, operator experience, outcome definitions, and follow-up vary substantially. The evidence supports indication-specific use in carefully selected individuals but does not establish broad substitution for surgery, radiation therapy, systemic therapy, or another ablation technology (Adar, 2026; Huang, 2025; Mimmo, 2022; Pallas, 2026; Purnomo, 2026).

In 2026, we changed the coverage criteria for this document to include selected liver metastases from a colon or rectal primary (Knave Koepsel, 2022; National Comprehensive Cancer Network, 2026c, 2026g), selected primary or recurrent intrahepatic cholangiocarcinoma (Knave Koepsel, 2022; National Comprehensive Cancer Network, 2026a), and selected painful vertebral metastatic disease (Khan, 2022).

References

On August 24, 2026, we searched PubMed; the Cochrane Library; the United Kingdom National Health Services Centre for Reviews and Dissemination; the Agency for Healthcare Research and Quality; the Centers for Medicare & Medicaid Services; and professional society and guideline databases. Search terms included “microwave ablation,” “microwave thermotherapy,” “lung neoplasm,” “renal cell carcinoma,” “hepatocellular carcinoma,” “colorectal liver metastases,” “intrahepatic cholangiocarcinoma,” “vertebral metastases,” “papillary thyroid carcinoma,” “cervical nodal recurrence,” “breast neoplasm,” and “hyperthermia.” We included the best available evidence according to established evidence hierarchies, typically systematic reviews, meta-analyses, full economic analyses when available, and professional guidelines based on evidence and clinical expertise. Coding sources were reviewed for codes in effect on August 24, 2026.

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Policy updates

7/2023: initial review date and clinical policy effective date: 8/2023

7/2024: Policy references updated.

7/2025: Policy references updated. Coverage updated.

Related codes

Below are the most commonly submitted codes for the service(s)/item(s) subject to this policy CCP.1528 .This is not an exhaustive list of codes. Providers are expected to consult the appropriate coding manuals and bill accordingly.

Code	Code description
19499	Unlisted procedure, breast
20982	Ablation therapy for reduction or eradication of 1 or more bone tumors (eg, metastasis) including adjacent soft tissue when involved by tumor extension, percutaneous, including imaging guidance when performed; radiofrequency
20999	Unlisted procedure, musculoskeletal system, general
32998	Ablation therapy for reduction or eradication of 1 or more pulmonary tumor(s) including pleura or chest wall when involved by tumor extension, percutaneous, including imaging guidance when performed, unilateral; radiofrequency
32999	Unlisted procedure, lungs and pleura
47379	Unlisted laparoscopic procedure, liver
47382	Ablation, 1 or more liver tumor(s), percutaneous, radiofrequency
47399	Unlisted procedure, liver
50542	Laparoscopy, surgical; ablation of renal mass lesion(s), including intraoperative ultrasound guidance and monitoring, when performed
50592	Ablation, 1 or more renal tumor(s), percutaneous, unilateral, radiofrequency
53899	Unlisted procedure, urinary system
60699	Unlisted procedure, endocrine system
0673T	Ablation, benign thyroid nodule(s), percutaneous, laser or radiofrequency, including imaging guidance
0944T	3D contour simulation of target liver lesion(s) and margin(s) for image-guided percutaneous microwave ablation