# Final Key Questions and Background
# Stereotactic Radiation Surgery and Stereotactic Body Radiation Therapy

## Introduction

Approximately half of all cancer patients receive some form of radiation therapy. Radiation utilizes high energy particles or waves to destroy or damage cancer cells. Patients may receive radiation therapy alone or in combination with other treatments. Radiation can cause acute and chronic side effects that depend on the area of the body radiated and dose of radiation given. There are three main modalities for delivering radiation: 1) externally by a machine (external beam radiation therapy, EBRT), 2) internally via radioactive material placed in the body (brachytherapy), or 3) systemically through the use of radiopharmaceuticals that are swallowed or injected into the blood stream.

Current conventional or standard EBRT uses three-dimensional (3D) imaging technology from computed tomography (CT), positron-emission tomography (PET), and/or magnetic resonance imaging (MRI) for planning purposes and delivers photon beams of uniform intensity to the target tumor using a medical linear accelerator (linac). Conformal refers to the ability to precisely conform the delivery of the EBRT to the shape and size of the tumor, so current conventional EBRT is often referred to as 3D conformal radiation therapy (3DCRT). Over the past ten years, significant advances have been made in the techniques available to deliver EBRT including stereotactic radiation surgery (SRS) limited to the central nervous system and a single dose, stereotactic body radiation therapy (SBRT), intensity modulated radiation therapy (IMRT), and proton or particle beam radiation therapy.

For SRS and SBRT, the *technical goals* are to 1) improve the targeting of the radiation to the tumor to minimize damage of normal tissue and 2) increase the dose of radiation (fraction) delivered to improve outcomes and decrease the number of fractions (doses) and length of treatment. The patient-important outcomes of SRS and SBRT include: 1) improved survival in patients with inoperable cancer due to the location of the tumor or patient condition, 2) reduced acute and chronic radiation side-effects, and 3) improved convenience for patients since the course of treatment may be substantially shorter. The focus of this report will be on SRS and SBRT. However, it should be noted that SBRT and IMRT are not mutually exclusive.

## Policy Context

There is increasing use of SRS SBRT for a variety of cancers. The impact of this technology on patient-important outcomes compared to current conventional (coronal or standard) EBRT is unclear. State agencies' concerns about SRS and SBRT include:

Safety – Medium

Efficacy - High

Cost – High

**Population:** Adults and children with central nervous system (CNS) and non-CNS tumors where treatment by radiation therapy is appropriate

**Intervention**: Stereotactic Radiation Surgery (SRS) or Stereotactic Body Radiation Therapy (SBRT) with devices such as Gamma Knife®, CyberKnife®, TomoTherapy®.

**Comparator:** Conventional (conformal) external beam therapy (EBRT)

**Outcomes:** Survival rate, duration of symptom-free remission, quality of life, harms including radiation exposure and complications, cost, cost-effectiveness

## Key Questions

KQ1: What is the evidence of effectiveness for stereotactic radiation surgery (SRS) and stereotactic body radiation therapy compared to conventional external beam radiation therapy (EBRT) for the following patients:

a. Patients with central nervous system (CNS) tumors
b. Patients with non-central nervous system cancers?

KQ2: What are the potential harms of SRS and SBRT compared to conventional external beam radiation therapy (EBRT)? What is the incidence of these harms? Include consideration of progression of treatment in unnecessary or inappropriate ways.

KQ3: What is the evidence that SRS and SBRT have differential efficacy or safety issues in sub populations? Including consideration of:

a. Gender
b. Age
c. Site and type of cancer
d. Stage and grade of cancer
e. Setting, provider characteristics, equipment, quality assurance standards and procedures

KQ4: What is the evidence of cost and cost-effectiveness of SRS and SBRT compared to EBRT?

## Public Comment and Response

See ***Key Question Public Comment and Response*** document published separately.

For additional information on key questions and public comments