

CADTH Health Technology Review

# Implementation of Stereotactic Ablative Radiotherapy for the Treatment of Oligometastatic Cancer in Canada

**Authors:** Diksha Kumar, Danielle MacDougall

**Acknowledgements:** The authors would like to thank Michelle Clark (Program Development Officer) for her contributions to developing and administering the survey, Rupinder Bagha (Policy & Program Analyst) for her review of survey questions and the draft report, and Jill Sutherland (Liaison Officer) for her review of technical content in the draft report.

**ISSN:** 2563-6596

**Disclaimer:** The information in this document is intended to help Canadian health care decision-makers, health care professionals, health systems leaders, and policy-makers make well-informed decisions and thereby improve the quality of health care services. While patients and others may access this document, the document is made available for informational purposes only and no representations or warranties are made with respect to its fitness for any particular purpose. The information in this document should not be used as a substitute for professional medical advice or as a substitute for the application of clinical judgment in respect of the care of a particular patient or other professional judgment in any decision-making process. The Canadian Agency for Drugs and Technologies in Health (CADTH) does not endorse any information, drugs, therapies, treatments, products, processes, or services.

While care has been taken to ensure that the information prepared by CADTH in this document is accurate, complete, and up to date as at the applicable date the material was first published by CADTH, CADTH does not make any guarantees to that effect. CADTH does not guarantee and is not responsible for the quality, currency, propriety, accuracy, or reasonableness of any statements, information, or conclusions contained in any third-party materials used in preparing this document. The views and opinions of third parties published in this document do not necessarily state or reflect those of CADTH.

CADTH is not responsible for any errors, omissions, injury, loss, or damage arising from or relating to the use (or misuse) of any information, statements, or conclusions contained in or implied by the contents of this document or any of the source materials.

This document may contain links to third-party websites. CADTH does not have control over the content of such sites. Use of third-party sites is governed by the third-party website owners' own terms and conditions set out for such sites. CADTH does not make any guarantee with respect to any information contained on such third-party sites and CADTH is not responsible for any injury, loss, or damage suffered as a result of using such third-party sites. CADTH has no responsibility for the collection, use, and disclosure of personal information by third-party sites.

Subject to the aforementioned limitations, the views expressed herein are those of CADTH and do not necessarily represent the views of Canada's federal, provincial, or territorial governments or any third-party supplier of information.

This document is prepared and intended for use in the context of the Canadian health care system. The use of this document outside of Canada is done so at the user's own risk.

This disclaimer and any questions or matters of any nature arising from or relating to the content or use (or misuse) of this document will be governed by and interpreted in accordance with the laws of the Province of Ontario and the laws of Canada applicable therein, and all proceedings shall be subject to the exclusive jurisdiction of the courts of the Province of Ontario, Canada.

The copyright and other intellectual property rights in this document are owned by CADTH and its licensors. These rights are protected by the Canadian *Copyright Act* and other national and international laws and agreements. Users are permitted to make copies of this document for non-commercial purposes only, provided it is not modified when reproduced and appropriate credit is given to CADTH and its licensors.

**About CADTH:** CADTH is an independent, not-for-profit organization responsible for providing Canada's health care decision-makers with objective evidence to help make informed decisions about the optimal use of drugs, medical devices, diagnostics, and procedures in our health care system.

**Funding:** CADTH receives funding from Canada's federal, provincial, and territorial governments, with the exception of Quebec.

Questions or requests for information about this report can be directed to [Requests@CADTH.ca](mailto:Requests@CADTH.ca)

## Table of Contents

---

<b>List of Tables</b> .....	<b>5</b>
<b>Abbreviations</b> .....	<b>6</b>
<b>Key Messages</b> .....	<b>7</b>
<b>Abstract</b> .....	<b>7</b>
<b>Context</b> .....	<b>8</b>
Oligometastatic Cancer .....	8
Stereotactic Ablative Radiotherapy .....	8
Canadian Context .....	9
<b>Objectives</b> .....	<b>9</b>
<b>Research Questions</b> .....	<b>10</b>
<b>Methods</b> .....	<b>10</b>
Literature Search .....	10
Survey .....	11
Synthesis Approach.....	12
<b>Findings</b> .....	<b>12</b>
Summary of Information Sources .....	12
Use of SABR Technology in Canadian Jurisdictions .....	13
Patient Selection and Prioritization.....	14
Treatment Guidelines .....	16
Resources for Implementation .....	18
Improving the Availability of SABR in Canada .....	22
<b>Limitations</b> .....	<b>24</b>
<b>Conclusions and Implications for Decision- or Policy-Making</b> .....	<b>26</b>
Use of SABR for the Treatment of Oligometastatic Cancer in Canadian Jurisdictions .....	26
Management of SABR Treatment of Oligometastatic Cancer.....	26
Use of SABR to Treat Localized Disease.....	26
Barriers and Facilitators to Implementation .....	27
<b>Final Remarks</b> .....	<b>28</b>
<b>References</b> .....	<b>29</b>

Appendix 1: Survey Questionnaire.....	31
Appendix 2: Information on Survey Respondents .....	40

## List of Tables

---

Table 1: Components for Literature Screening and Information Gathering .....	11
Table 2: Oligometastatic Sites Treated With SABR in Surveyed Canadian Cancer Centres by Jurisdiction .....	14
Table 3: Devices Used for the SABR Treatment of Oligometastatic Cancer in Surveyed Canadian Cancer Centres	19
Table 4: Information on Survey Respondents .....	40

## Abbreviations

<b>ECOG</b>	Eastern Cooperative Oncology Group
<b>HTA</b>	health technology assessment
<b>OAR</b>	organs at risk
<b>QA</b>	quality assurance
<b>SABR</b>	stereotactic ablative radiotherapy
<b>VMAT</b>	volumetric modulated arc therapy

## Key Messages

- The aim of this Environmental Scan is to identify and describe the use of stereotactic ablative radiotherapy in Canada, the systems in place to manage the treatment of patients with oligometastatic cancer, and the barriers and facilitators to the implementation of this treatment. The findings are based on a literature review, 22 survey responses from stakeholders, and email- and video call-based follow-up consultations with select stakeholders. Ten Canadian jurisdictions were represented by the survey respondents, who were primarily radiation oncologists.
- Stereotactic ablative radiotherapy for the treatment of oligometastatic cancer is currently being accessed in all Canadian provinces as a standard treatment option. Centres are primarily treating oligometastases in the lungs, bones (non-spine), lymph nodes, spine, and liver. Some cancer care centres have the capacity for stereotactic ablative radiotherapy to treat localized primary tumours but do not treat oligometastatic sites.
- There is a variation in patient selection criteria and treatment guidelines across Canadian jurisdictions, with most facilities following institutional guidance for the processes required for patient prioritization and treatment. There is a lack of standardized consensus guidelines with common criteria.
- Reported facilitators for the implementation of stereotactic ablative radiotherapy for the treatment of oligometastatic cancer include access to dedicated equipment and teams. Reported barriers to its implementation include the lack of standardized patient selection and treatment guidelines, and constraints in equipment and staff resources (including time).

## Abstract

Stereotactic ablative radiotherapy (SABR) is a treatment for cancer tumour lesions that delivers precise and high doses of radiation to tumours located in specific body sites over the course of a few treatment sessions. Its use in the treatment of oligometastatic cancer, which is often defined as 1 to 5 discrete metastatic tumour deposits, is expanding throughout Canada. CADTH received input from Canadian jurisdictions that identified a number of common considerations regarding the use and implementation of SABR for oligometastatic cancer, such as patient selection criteria, treatment guidelines, and resource allocation. The aims of this Environmental Scan are to identify and describe the use of SABR in Canada, the systems in place to manage treatment of patients with oligometastatic cancer, and the barriers and facilitators to the implementation of this treatment.

The findings of this Environmental Scan on the implementation of SABR in Canada are based on a literature review, 22 survey responses from stakeholders, and email- and video call-based follow-up consultations with select informants. Ten Canadian jurisdictions were represented by the survey respondents, who were primarily radiation oncologists. SABR for the treatment of oligometastatic cancer is currently being offered in all Canadian provinces as a standard treatment option. Centres are primarily treating oligometastatic sites in the lungs, bones (non-spine), lymph nodes, spine, and liver. Some cancer care centres have the capacity for SABR but do not treat oligometastatic sites. There is variation in patient selection criteria and treatment guidelines across Canadian jurisdictions, with most facilities following internal, locally developed guidance for the processes required for patient prioritization and treatment.

Some jurisdictions reported the implementation of a multidisciplinary tumour review process to determine which patients should receive SABR for oligometastatic disease. Current implementation issues include the lack of standardized patient selection and treatment guidelines, gaps in evidence from randomized clinical trials, and treatment planning and delivery time. Facilitators for the implementation and expansion of SABR programs reported by key informants are access to dedicated equipment, such as linear accelerators capable of delivering SABR, and staff resources, such as radiation oncologists, medical physicists, and radiation therapists with training to deliver SABR to different sites within the body. Access to additional and dedicated resources may depend on funding. Adoption of SABR technology for the treatment of oligometastatic cancer at more Canadian cancer centres, as well as expansion of its use to treat other disease sites in the body, are likely to follow if more robust clinical data emerges.

## Context

### Oligometastatic Cancer

Cancer is the leading cause of death in Canada,<sup>1</sup> with the main cause of cancer-related death attributed to tumour metastasis.<sup>2</sup> Metastasis occurs when cancer cells from 1 part of the body, known collectively as the primary tumour, migrate from their place of origin to other locations to form 1 or more tumours.<sup>2</sup> Along the continuum of localized cancer to widely metastatic disease, oligometastasis is defined as the presence of limited tumour lesions – typically 1 to 3 or 1 to 5 metastases – with a level of systemic control so that the cancer is not rapidly spreading to more sites.<sup>3</sup> Metastatic cancer is usually harder to treat than primary cancers, with the goals of treatment being to prolong the patient's survival and quality of life.<sup>2</sup> Treatment options for patients with oligometastatic cancer include surgery, conventional radiotherapy, systemic therapies such as chemotherapy or hormone therapy, and ablative therapies such as cryoablation, microwave ablation, radiofrequency ablation, and SABR.<sup>3</sup>

### Stereotactic Ablative Radiotherapy

SABR – also known as stereotactic body radiation therapy – is a novel form of radiation treatment that delivers high doses of radiation, very precisely, to specific body sites over a course of longer but fewer sessions than conventional radiotherapy.<sup>4</sup> As an alternative to surgical treatment, SABR does not require recovery before resuming systemic therapy and can be used to treat sites that are not surgically accessible.<sup>5</sup> Through its precise delivery, SABR is able to spare healthy, non-cancerous tissue.<sup>6</sup>

Treatments are outpatient procedures lasting 30 to 60 minutes and are completed over the course of 1 to 5 days.<sup>6</sup> Radiation doses are dependent on the proximity of normal critical structures to the tumour.<sup>7</sup> The prescribed dose is typically fractionated, meaning that the treatment is delivered over multiple sessions.<sup>7</sup> A variety of tumour motion management strategies may be used to minimize or account for tumour motion during treatment. For example, tumour motion with respiration may be measured using a 4-dimensional CT scan, which can be used to calculate the treatment volume of the tumour lesion or lesions of interest.<sup>7</sup> SABR is delivered by a machine called a linear accelerator that focuses high-energy X-rays in an intersecting manner to ablate the tumour target.<sup>8</sup> During the pre-procedure planning and treatment processes, the patient is held still by an immobilization device.<sup>8</sup> During



the provision of the SABR treatment, variations in patient positioning are further minimized by on-board imaging, such as cone beam CT imaging.

## Canadian Context

The availability of SABR has increased across Canada<sup>9</sup> and there is interest in expanding its use to new indications such as oligometastatic disease. A survey of 41 Canadian radiotherapy centres conducted in 2011 identified that 5 provinces had facilities with SABR capacity: Alberta, British Columbia, Manitoba, Ontario, and Quebec.<sup>9</sup> Canadian centres were using SABR to treat primary tumours and oligometastases in various parts of the body, such as the lungs, liver, bone, and lymph nodes.<sup>9</sup> The survey also highlighted that the radiotherapy centres had varying patient selection criteria for SABR treatment and that not all centres used SABR to treat oligometastases.<sup>9</sup>

CADTH received input from Canadian jurisdictions, which identified a number of common considerations regarding the use and implementation of SABR for the treatment of oligometastatic cancer.<sup>10</sup> There was an interest in determining which patients should be treated with SABR to achieve the greatest benefit (e.g., location and number of metastases) and how those patients should be managed (e.g., radiation dose, treatment sites, immobilization methods, tracking, and imaging guidance).<sup>10</sup> In addition to patient treatment and management, the jurisdictions expressed interest in information regarding the implementation of SABR technology to treat oligometastases including how other Canadian jurisdictions have successfully accessed and operationalized the use of this technology. Implications for resource use and allocation of equipment, additional staffing requirements and training, and time for planning and delivering treatment sessions were identified as important considerations for the broader adoption of this technology.<sup>10</sup> As some centres may already have SABR capacity, an understanding of how the technology is used differently for the treatment of oligometastatic disease versus localized disease may inform operational changes.<sup>11</sup>

As part of a health technology assessment (HTA) of SABR for the treatment of oligometastatic cancer,<sup>12</sup> CADTH has conducted this Environmental Scan to identify current public policies on the access and management of SABR. The other component of the HTA is a living systematic review on the clinical effectiveness and safety of SABR, alone or in combination with other therapies, in the treatment of patients with oligometastatic cancer.<sup>12</sup> The living systematic review also aimed to identify criteria for patient selection by documenting study and patient characteristics (e.g., location of primary tumour and oligometastases, number of oligometastatic sites and lesions) and planned subgroup analyses to explore any impact of these characteristics on treatment outcomes, where possible.<sup>12,13</sup> The Environmental Scan further reviews implementation issues associated with SABR for the treatment of oligometastatic cancer to inform decision-making on this topic.

## Objectives

The key objectives of this Environmental Scan are, as follows:

- Identify and describe how SABR technology is being accessed and used by Canadian jurisdictions.

- Identify and describe the systems that are in place to manage SABR treatment for patients with oligometastatic cancer, including training and resource allocation.
- Compare the application of SABR technology in treating localized disease versus oligometastatic disease in terms of infrastructure required for delivery.
- Identify and describe the barriers and facilitators to the implementation of SABR treatment for patients with oligometastatic cancer.

This Environmental Scan does not include an assessment of the clinical or cost-effectiveness of SABR. Thus, conclusions or recommendations about the value of SABR or its place in therapy are outside the scope of this report. Of note, CADTH has completed a systematic review on the clinical effectiveness of SABR for the treatment of patients with oligometastatic cancer.<sup>12</sup>

## Research Questions

This Environmental Scan aimed to address the following questions:

1. How is SABR technology accessed and used by Canadian jurisdictions?
2. What existing methods are used to prioritize which patients, or which oligometastatic sites, would benefit most from SABR?
3. What are the frameworks, policies, or guidelines to guide SABR treatment for patients with oligometastatic cancer?
4. What are the strategies being implemented to improve the availability of SABR for the treatment of oligometastatic cancer?
5. What are the resources required (e.g., staffing, equipment, space, funding, etc.) to support the successful implementation of SABR for the treatment of oligometastatic cancer?

## Methods

A limited grey literature search, responses to the CADTH survey titled *Implementation of Stereotactic Ablative Radiotherapy in Canada* (Appendix 1), and focused follow-up consultations with select stakeholders by email and video call were used to inform the report.

### Literature Search

Because of the lack of published literature on implementation considerations identified during the detailed scoping for the HTA, and given the novelty of the technology and its consideration for this indication, a database literature search was not performed.<sup>10</sup>

A literature search was conducted by an information specialist on key grey literature resources including the international HTA database, the websites of Canadian and major international health technology agencies, as well as a focused internet search.<sup>14</sup> The main search concepts were SABR and oligometastatic cancer. Where possible, retrieval was limited to the human population. The search was also limited to documents published

between January 01, 1990 and December 11, 2020. There were no language limits applied to the search.

### Screening and Study Selection

One author assessed titles and abstracts of the grey literature search for eligibility. Articles were selected for full-text review and inclusion using the components outlined in Table 1. No restrictions were made regarding study design or type of publication.

### Survey

A 42-item questionnaire was developed, reviewed for content validation by 4 CADTH staff, and tested for usability by 1 other staff. The questionnaire was also reviewed by an external clinical expert. The questionnaire included a combination of demographic, dichotomous (yes or no), multiple choice, and open-ended questions covering the topics addressed by the project objectives. Following the demographic questions, respondents were directed to answer a series of questions in 1 of 3 sections according to the level of SABR implementation at their facility (SABR being used for treatment of oligometastatic cancer, SABR being used for other indications, no SABR capacity). Survey respondents were also prompted to attach guidelines and process documents, where possible. The questionnaire can be found in Appendix 1. It was designed using Survey Monkey and launched electronically on January 27, 2021. An email invitation containing the link to the online questionnaire was sent to a list of contacts identified by the CADTH Implementation Support and Knowledge Mobilization team and through the HTA clinical review experts. The list of contacts consisted of government employees in policy-based roles, medical physicists, oncologists, radiation therapists, including individuals representing administrative leadership positions at Canadian cancer centres with radiotherapy services. Survey contacts were encouraged to share the survey link with other interested colleagues who had a perspective on SABR implementation. Participants were given 10 business days to complete the questionnaire. Two reminders were sent to non-responders with a single 10-business day extension. Before starting the survey, participants provided written consent for their information to be used in this Environmental Scan report. The survey was closed on February 24, 2021. After a follow-up consultation with a survey respondent in April 2021, key informants from jurisdictions that did not previously respond to the survey were identified and re-engaged. The survey was then closed again on May 3, 2021. Consultations

**Table 1: Components for Literature Screening and Information Gathering**

Components	Inclusion	Exclusion
<b>Population</b>	Patients with oligometastatic cancer (i.e., limited metastatic lesions)	Patients with metastases only in the brain
<b>Intervention</b>	SABR or SBRT; alone or in combination with 1 or more concurrent or neoadjuvant therapies (e.g., surgery, conventional radiotherapy, chemotherapy)	Stereotactic radiosurgery
<b>Settings</b>	<ul style="list-style-type: none"> <li>• Tertiary care</li> <li>• Canadian jurisdictions</li> </ul>	N/A
<b>Types of Information</b>	<ul style="list-style-type: none"> <li>• Implementation status</li> <li>• Implementation barriers and facilitators</li> </ul>	N/A

N/A = not applicable; SABR = stereotactic ablative radiotherapy; SBRT = stereotactic body radiation therapy.

Brief email-based consultations with several of the survey respondents occurred post-survey to fill knowledge gaps identified during a synthesis of survey findings. Respondents were sent specific questions by email in March 2021 and responses were used to inform the report. Two of the follow-up consultations occurred via video call in April 2021.

## Synthesis Approach

Feedback from respondents who gave consent to use their survey and consultation information was included in the report. Final survey results were downloaded from Survey Monkey to Microsoft Excel for data cleaning and organization. Survey questionnaire responses were excluded when the respondent's demographic and contact information were unavailable, and when respondents exited the survey after filling out the introductory demographic information. Survey responses were abstracted by question and were summarized by jurisdiction, when possible, or were pooled to represent multiple jurisdictions.

## Findings

The findings presented are based on the results of a survey of Canadian stakeholders and targeted email-based and video call consultations with select stakeholders received and collected by April 30, 2021.

## Summary of Information Sources

### Summary of Survey Responses

Surveys were distributed to 76 contacts in all provinces. The survey was not distributed to contacts in the territories; the authors of the 2014 survey of Canadian radiotherapy centres identified that there are no radiation centres in the territories<sup>9</sup> and no contacts were noted by the CADTH Implementation Support and Knowledge Mobilization team during the planning process. A total of 28 survey responses were received; 22 responses were complete and included, representing all provinces. Responses were received from Alberta (7), British Columbia (1), Manitoba (1), New Brunswick (3), Newfoundland and Labrador (1), Nova Scotia (1), Ontario (2), Prince Edward Island (1), Quebec (4), and Saskatchewan (1). Respondents held professional roles in hospital and cancer care facilities, as well as Canadian jurisdictions (e.g., regional or provincial). The organizations represented by respondents are reported in Appendix 2.

Respondents identified primarily as radiation oncologists (20) but also included government employees (2) and a medical physicist (1). One of the respondents identified as both a radiation oncologist and a government employee.

Respondents represented facilities and jurisdictions with varying SABR capacity. Of the 22 respondents, 19 representing all provinces work in facilities or jurisdictions where SABR capacity currently exists and is used for the treatment of oligometastatic cancer. Three respondents from Alberta and New Brunswick work in facilities where SABR capacity currently exists but is not being used for the treatment of oligometastatic cancer.

## Summary of Consultations

Following the organization and initial analysis of survey responses, 7 survey respondents were followed up to engage in brief email consultations aimed at addressing knowledge gaps. The stakeholders engaged for further email or video call consultation consisted of 6 radiation oncologists and 1 medical physicist. The questions were written to address knowledge gaps in quality assurance protocols, patient prioritization, and specific barriers of SABR implementation. Four survey respondents from Alberta, Ontario, and Saskatchewan replied to follow-up questions via email. One survey respondent from Alberta was engaged in a consultation via a video call. A consultation via video call with 2 stakeholders from Manitoba was facilitated by a CADTH Liaison Officer to address knowledge gaps in the implementation of SABR in this jurisdiction. One of the consulted experts from Manitoba also responded to the survey.

## Summary of Included Literature

No relevant references were identified for inclusion from the grey literature search. One survey<sup>15</sup> and 2 provincial guidelines<sup>16,17</sup> identified through survey respondents from Alberta were summarized in the Findings section of this report to describe the use of SABR technology in Canada and the existing recommendations on how it should be delivered.

## Use of SABR Technology in Canadian Jurisdictions

### Use of SABR for the Treatment of Oligometastatic Cancer

Nineteen survey respondents representing each of the 10 provinces (Alberta, British Columbia, Manitoba, New Brunswick, Newfoundland and Labrador, Nova Scotia, Ontario, Prince Edward Island, Quebec, Saskatchewan) reported that their facilities or jurisdictions currently have SABR capacity for the treatment of oligometastatic cancer. Respondents reported that several oligometastatic sites can be treated with SABR at their centres (Table 2). All hospitals or cancer centres from the 10 provinces represented in this portion of the survey are treating lung oligometastases. Some respondents from Alberta, British Columbia, Manitoba, New Brunswick, Nova Scotia, Ontario, Prince Edward Island, and Quebec reported that their centres have capacity to treat oligometastatic tumour sites in the bones (non-spine, 16), lymph nodes (14), spine (13), and liver (12). Respondents from some centres in Alberta, Quebec, and Ontario reported SABR treatment of sites in the adrenal glands. One respondent from Ontario also mentioned that their centre is treating pancreatic oligometastases. SABR equipment in the centres surveyed was also being used to treat primary cancers, with the 3 most commonly reported primary cancers being lung, prostate, and liver. A 2019 survey of all Canadian cancer centres providing radiotherapy services reported similar patterns in the types of tumour lesions treated with SABR. Lung SABR was reported to be the most available treatment in centres with SABR capacity and SABR treatment of lesions in other organs or tissue types tended to be less prevalent in less populated regions.<sup>15</sup>

SABR treatment is offered as part of standard care for oligometastatic cancer in many Canadian jurisdictions, as noted by 18 out of 19 survey respondents. One respondent from Alberta stated that their centre takes on selected cases depending on the decision of a tumour board review and if the patient is not eligible for an ongoing clinical trial. Another respondent from Quebec described that, while SABR is considered standard of care at their centre, there is limited access. Several respondents from Alberta, British Columbia, Nova Scotia, Ontario, and Quebec reported that their centres offer SABR treatment on a research or

clinical trial capacity in addition to standard of care. None of the surveyed facilities use SABR solely for research purposes.

## Use of SABR for the Treatment of Localized Disease

While all provinces have SABR capacity for the treatment of oligometastatic lesions, not all facilities within each province offer SABR treatment for this indication. Three respondents from 2 provinces (Alberta and New Brunswick) reported that their facilities have SABR capacity but are only using it for the treatment of primary tumours. All respondents work in a facility with SABR capacity to treat primary lung tumours; 1 respondent from Alberta works in a facility that also treats primary liver tumours.

## Patient Selection and Prioritization

### Selection Criteria

Respondents from several facilities reported that there are internal guidelines on patient selection and prioritization for SABR treatment. Survey respondents indicated that their facilities use criteria within the following categories to select patients with oligometastatic cancer for SABR treatment: number and size of lesions, control of primary tumour, functional status, life expectancy, number of organs involved, and tumour histology.

### Number and Size of Lesions

The characteristics of the oligometastatic lesions, especially number and size, are important criteria for patient selection across jurisdictions. Respondents from Alberta stated that patients must have 5 or fewer extracranial oligometastatic lesions that are well defined and discrete from critical structures, with no more than 3 in a given organ and no more than 3 organs involved. One respondent from Alberta also stated that the lesions must be located within the target areas of 1 to 3 radiation isocentres. Located within a tumour

**Table 2: Oligometastatic Sites Treated With SABR in Surveyed Canadian Cancer Centres by Jurisdiction**

Jurisdiction	Lung	Bones (non-spine)	Lymph nodes	Spine	Liver	Adrenal glands	Pancreas
Alberta <sup>a</sup>	Yes	Yes	Yes	Yes	Yes	Yes	No
British Columbia	Yes	Yes	Yes	Yes	Yes	No	No
Manitoba	Yes	Yes	Yes	Yes	Yes	No	No
New Brunswick <sup>a</sup>	Yes	No	No	No	No	No	No
Newfoundland and Labrador	Yes	No	No	No	No	No	No
Nova Scotia	Yes	Yes	Yes	Yes	Yes	No	No
Ontario	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Prince Edward Island	Yes	Yes	No	No	No	No	No
Quebec	Yes	Yes	Yes	Yes	Yes	Yes	No
Saskatchewan	Yes	No	No	No	No	No	No

<sup>a</sup>The findings in this table apply to cancer centres in the province that reported using SABR to treat oligometastatic cancer. Note that other surveyed cancer centres in these jurisdictions reported only using SABR to treat primary tumours.

lesion, isocentres are where the centre axes of all beams used during the treatment intersect; patients undergoing SABR have to be repositioned for each isocentre.<sup>13</sup> In general, more isocentres correspond to greater complexity for treatment planning and treatment. Similarly, a respondent described that patients are eligible for SABR treatment at a centre in Saskatchewan if they have a limited number of oligometastatic lesions, without mentioning a discrete number. Respondents from Manitoba, Nova Scotia, and Newfoundland and Labrador reported that patients are required to have no more than 3 lesions. Respondents from Ontario also noted that the number of lesions is important, with 1 respondent describing the criterion at their centre as 1 to 3 lesions. The survey respondent from British Columbia also mentioned that centres in their jurisdiction treat solitary lesions less than 3 cm in size with SABR.

### ***Functional Status***

Functional status of the patient is a selection criterion described by respondents from Alberta, British Columbia, Manitoba, Nova Scotia, and Saskatchewan. A respondent from Alberta stated that the patient's symptoms have to be well-managed before the initiation of SABR treatment and that the patient has to be able to tolerate the immobilization systems and specific positioning necessary for radiation therapy. In Alberta, British Columbia, and Nova Scotia, a patient's eligibility for SABR treatment is partly determined by assessment with the Eastern Cooperative Oncology Group (ECOG) scale. A measure of a patient's performance status that is often used in cancer treatment and trials, the ECOG scale describes level of functioning in terms of physical ability, daily activity, and the patients' abilities to care for themselves.<sup>18</sup> The scale ranges from 0, where the patient is fully active, to 5, which indicates fatality.<sup>18</sup> Patients must fall under grades 0 or 1 on the ECOG scale to qualify for SABR treatment in British Columbia and some facilities in Alberta, meaning that they are mobile and can at least partake in light activity (e.g., light house work, office work). In Nova Scotia, patients who fall under grades 0 to 2 on the ECOG scale are eligible for SABR treatment as standard of care, with grade 2 patients being capable of all self-care but unable to carry out any work activities. Likewise, a respondent from a centre in Saskatchewan described that patients with lung oligometastases must have good lung function at the time of treatment initiation.

### ***Control of Primary Tumour***

The patients' primary tumours must also be controlled for them to be eligible for SABR treatment, as described by respondents from Alberta, British Columbia, Manitoba, Newfoundland and Labrador, and Saskatchewan. The respondent from British Columbia described that the patient must also have a disease-free interval of greater than 12 months, which is the time from when first-line treatment was completed to when the cancer recurred. A shorter disease-free interval may indicate a more aggressive disease that may be unlikely to benefit or be well-controlled by SABR.

### ***Other Considerations***

Respondents from Manitoba, Nova Scotia, and some facilities in Alberta reported that patients must have life expectancy of greater than 6 months to be eligible for SABR treatment. According to a respondent from Alberta, other selection criteria include no need for urgent radiation therapy and limited overlap between radiation fields if the patient had undergone prior radiotherapy. Patients must be ineligible for other standard of care options such as chemotherapy or surgery. Other considerations described by a respondent from a centre in Ontario are tumour histology and whether there is documented clinical effectiveness of SABR treatment in conjunction with systemic therapy for the specific tumour site. A respondent

from Quebec stated that their centre refers to patient criteria from specific clinical trials<sup>19,20</sup> in the case of oligometastases in patients with non-small-cell lung carcinoma.

### Selection Process

Respondents from Alberta, Newfoundland and Labrador, Manitoba, Nova Scotia, and Saskatchewan mentioned that discussions among members of a larger team of cancer care providers are an important aspect of SABR treatment planning and delivery. Respondents from Alberta elaborated on their patient selection process. One cancer centre in Alberta has a central referral process and a dedicated multidisciplinary SABR tumour board for selecting patients with metastatic disease eligible for SABR treatment. The tumour board, consisting of SABR radiation oncologist providers and medical physicists, discusses the cancer care history, including age, important comorbidities, clinical or pathological diagnosis, and treatments of each patient referred for SABR. It is noted whether the patient had previously undergone radiation therapy near the target region of their current oligometastatic lesions and the dose and location of the previous treatment, if applicable. Proximity of the target tumour lesions to adjacent organs at risk (OAR) is also discussed. SABR may not be offered in cases where the dose required to effectively target tumour lesions could be toxic to normal tissue or if the ablative dose, when reduced to conform to OAR dose tolerances, is unlikely to lead to lesional control. According to the tumour board guidelines, the patient must meet these clinical criteria and be classified under either “oligoprogression” or “oligometastatic” depending on their history, concurrent treatments, and progression of lesions as seen with current imaging. Patients with oligoprogression have numerous metastatic lesions but only 1 or 2 are progressing. In these cases, the goal is to treat the progressing lesions with SABR and remain on the current course of systemic therapy. The other category of patients eligible for SABR is that of patients who are oligometastatic, where the patient has a limited number of lesions and the goal of SABR treatment is to control all of them and avoid further systemic therapy. During a follow-up consultation, 1 respondent from Alberta elaborated that, as chemotherapy is the gold standard treatment for oligometastatic cancer, eligible patients must have first exhausted this treatment option. The tumour board’s decision is then sent back to the referring physician, who may need to conduct additional investigations to help assess the patient’s eligibility. If approved, patients are referred to site-based SABR providers who treat lesions within a specific organ.

### Treatment Guidelines

#### Guidelines and Protocols

There is a lack of publicly available guidelines and recommendations regarding the SABR treatment of oligometastatic cancer across Canadian jurisdictions. In 2016, Alberta Health Services developed clinical practice guidelines with the input of provincial radiation oncologists to inform the treatment of patients with bone metastases; however, it was not specific to oligometastases.<sup>16</sup> The guideline reported that SABR is increasingly being used for the re-treatment of bone metastases near the spinal cord but did not specify recommended doses or fraction schedules.<sup>16</sup> A more recent guideline on metastatic colorectal cancer from Alberta Health Services did not present recommendations specific to the treatment with oligometastases but stated that SABR could be considered for liver tumour sites in the case of unresectable disease when there are no other therapy options.<sup>17</sup> It was recommended that these patients be discussed at multidisciplinary rounds.<sup>17</sup> Respondents from Alberta noted that they refer to these provincial guidelines.



The majority of survey respondents reported that their centres have guidelines and processes for SABR treatment of patients with oligometastatic cancer, encompassing dose fractionation schedules, normal tissue constraints, and quality assurance. There was variation across centres on how SABR treatment was standardized among patients with oligometastatic cancer.

Most centres surveyed – including those in Alberta, British Columbia, Manitoba, Newfoundland and Labrador, Nova Scotia, Ontario, Prince Edward Island, and Quebec – reported that they have internal documents to guide the SABR treatment process. A respondent from Quebec elaborated that their centre has dosimetry documentation to strike a balance between achieving the objective of target coverage with SABR and following dose constraints to prevent damage of nearby OAR. Dosimetry broadly refers to the measurement of radiation exposure and, in the context of radiotherapy treatment planning, involves converting administered radiation to absorbed radiation dose at the target site.<sup>21,22</sup> SABR at this centre in Quebec is delivered via the technique of volumetric modulated arc therapy (VMAT). VMAT is a radiation technique whereby several beams are delivered to the target area in an arc trajectory as the machine rotates.<sup>23</sup> It is intended to achieve a more conformal dose distribution compared to conventional radiation techniques.<sup>23</sup> The centre also has guidelines for standardized image-guided radiotherapy, a SABR imaging technique, for the tumour sites that it treats (lungs, spine, bones, lymph nodes, adrenal glands).

Similarly, a respondent from British Columbia noted that there are common treatment indications and dose constraints across all 6 centres in the province that have SABR capacity for oligometastatic cancer. Respondents from Alberta and Nova Scotia stated that they take guidance from internal department standards and guidelines on procedures and dose constraints, as well as provincial clinical practice guidelines when providing SABR treatment to patients with oligometastatic cancer. Respondents from Alberta referenced the clinical guidelines by Alberta Health Services previously discussed. Centres in Manitoba and Ontario have standard protocols for patient selection, treatment planning, and quality assurance, as well as guidelines for each tumour site on how SABR treatment should be delivered, with reference to target and organ-at-risk dose metrics. Similar to Quebec, their guidelines are based on anatomic locations of the different tumours to balance dose fractionations for target coverage and dose constraints. The respondent from Prince Edward Island stated that their centre, which offers SABR for the treatment of lung oligometastatic lesions, has a local draft guideline for lung SABR. Similarly, the respondent from a centre in Newfoundland and Labrador, which also only treats lung lesions, reported that there is a centre-specific protocol in place.

Published clinical trial literature was also an aspect guiding SABR treatment, according to a few survey respondents. The respondent from New Brunswick explained that their internal guidelines follow the dose fractionation and normal tissue constraints outlined in SABR clinical trials – the LUSTRE trial<sup>24</sup> for lung lesions in patients with primary non-small-cell lung cancer and the COMET trial<sup>19</sup> for bone (non-spine) lesions. A respondent from Alberta noted that they refer to the SABR-COMET-3 trial<sup>25</sup> and studies conducted by the Radiation Therapy Oncology Group.

### Quality Assurance

Quality assurance (QA) was reported by survey respondents as 1 of the ways to standardize SABR treatment among patients. In a follow-up consultation, a respondent from Ontario elaborated that their centre has QA protocols on multiple levels, from individual to

institutional. Physicians involved in delivering SABR treatment first undergo training and mentorship from a senior site-based oncologist and progress to unsupervised treatment after observing 10 SABR treatment plans in action. During training, there is emphasis on treatment decision-making and the technical aspects of delivering SABR. On an institutional level, proposed SABR plans are reviewed and verified by several members of the patient's cancer care team, including the radiation therapist (twice), medical physicist, and physician. Peer review before treatment delivery is also an important aspect of QA at this centre.

From a radiation oncology perspective, the QA process consists of a peer review of treatment plans, with input from radiation oncologists, medical physicists, and radiation therapists. Multidisciplinary tumour boards at some cancer centres in Alberta, which examine every proposed SABR treatment plan through a central referral process, comprise SABR providers with medical physics support. Dedicated QA rounds are held to discuss SABR treatment plans. QA is also built into their centre's SABR program through departmental standards for target doses, dose constraints, immobilization, and daily imaging. In Saskatchewan, 2 radiation oncologists outline the tumour and 2 others review the treatment plans. Treatment plans are then presented at QA rounds. Consulted stakeholders from a centre in Manitoba reported that they also have dedicated QA rounds. Their SABR QA procedure is largely based on previously established processes for generalized radiation therapy. There is, however, a greater amount of discussion around cases of oligometastases because of their complex nature. A respondent from Newfoundland and Labrador noted that cases of oligometastases at their centre are reviewed by the lung disease site team before treatment initiation. The respondent from New Brunswick stated that their QA protocols for the treatment of oligometastatic lesions are the same as those used for non-SABR VMAT radiation treatment plans.

## Resources for Implementation

### Equipment and Infrastructure

#### *Treatment Devices*

A variety of linear accelerators and immobilization systems are used for SABR by Canadian facilities that offer it for the treatment of oligometastatic cancer. There are some specific considerations when selecting radiotherapy equipment for the provision of SABR, such as treatment site-specific needs (e.g., a 6-degrees-of-freedom treatment couch for treating spine lesions), dedicated software packages for SABR planning, and adequate space in the treatment room for additional ancillary equipment or the additional shielding if retrofitting an existing treatment room. Optional features of linear accelerators related to radiation and imaging techniques that are required for the provision of SABR may be associated with additional costs. Regarding safety, the provision of SABR does not require any additional considerations to protect staff during treatment in comparison to other radiation therapies. Linear accelerators and immobilization systems reported by survey respondents used to treat oligometastatic lesions are presented in Table 3.

Almost all survey respondents reported that their centres use volumetric on-board imaging when treating patients with oligometastases. Respondents from a few of the surveyed cancer care centres also reported the use of integrated orthogonal kV or planar X-ray imaging systems (e.g., ExacTrac).

Respondents from 3 surveyed facilities that do not use SABR for the treatment of oligometastatic cancer reported using similar equipment and patient immobilization systems

**Table 3: Devices Used for the SABR Treatment of Oligometastatic Cancer in Surveyed Canadian Cancer Centres**

Device	Alberta	British Columbia	Manitoba	New Brunswick	Newfoundland and Labrador	Nova Scotia	Ontario	Prince Edward Island	Quebec	Saskatchewan
<b>Linear accelerators</b>										
Clinac	No	No	No	No	No	No	No	No	Yes	No
CyberKnife	No	No	No	No	No	No	No	No	Yes	No
Infinity	No	No	No	No	No	No	Yes	No	No	No
Novalis	No	No	No	No	No	No	No	No	Yes	No
Synergy	No	No	No	No	No	No	Yes	No	No	No
TomoTherapy	Yes	No	No	No	No	No	No	No	Yes	No
TrueBeam	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Versa	No	No	No	No	No	No	Yes	No	Yes	No
<b>Immobilization systems</b>										
Commercial immobilization devices <sup>a</sup>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A <sup>b</sup>
In-house fabricated immobilization devices	Yes	Yes	No	No	No	No	No	Yes	Yes	N/A <sup>b</sup>
Thermoplastic mask systems	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	N/A <sup>b</sup>

N/A = not applicable; SABR = stereotactic ablative radiotherapy.

<sup>a</sup>Specific examples reported by survey respondents included BodyFIX (Elekta), Body Pro-Lok (Civco Medical Solutions), and Vac-Lok (Civco Medical Solutions).

<sup>b</sup>Survey respondent did not provide an answer.

in comparison to centres with SABR capacity for oligometastatic cancer. Specific linear accelerators being used for SABR treatment across these facilities included Clinac, Synergy, and Versa. They use various commercially available immobilization devices. All 3 facilities use volumetric on-board imaging and 1 respondent reported the use of 4-dimensional cone beam CT imaging, as well.

### *Procurement of SABR Infrastructure*

Respondents from some facilities in Alberta, British Columbia, Manitoba, Ontario, Prince Edward Island, Quebec, and Saskatchewan reported that their centres purchased new generalized radiotherapy equipment, or software capable of SABR for imaging or treatment planning, to implement their SABR program for oligometastatic cancer. Almost all of those facilities also invested in new equipment and software dedicated to SABR. The survey respondent from New Brunswick reported that their facility purchased new equipment dedicated to SABR. A respondent from Ontario elaborated that their initial investment in terms of SABR technology included advancing the imaging for treatment units, relocatable immobilizers that can be reused on multiple patients, and motion management devices to limit movement caused by breathing during treatment.

On the other hand, the survey respondent from Newfoundland and Labrador, as well as respondents from some facilities in Alberta and Quebec, reported that their centres reallocated existing radiotherapy equipment for the provision of SABR. The respondent from Nova Scotia reported that their facility reallocated existing equipment, as well as purchased new generalized equipment. A few facilities in Alberta, British Columbia, and Ontario were able to build or acquire additional spaces to use for SABR treatment.

To implement SABR treatment, a centre in Newfoundland and Labrador formed a standing committee to initiate the program. The centre started with treating lung oligometastatic lesions, as it was able to reallocate and repurpose existing equipment; it is currently moving toward expanding to spine and prostate lesions. Survey respondents from Ontario reported that their facilities expanded SABR capacity over time as the number of cases, as well as clinical expertise, in the area grew. There was a discussion among radiation oncologists and medical physicists that new equipment was necessary. The facilities reviewed their existing infrastructures to determine whether they were adequate to meet their goals of patient care. In a centre in Nova Scotia, the acquisition of their linear accelerator and SABR software was guided by medical physicists. Facilities in Alberta slowly expanded their capacity for SABR treatment and are continuing to do so as the volume of patients eligible for SABR treatment is anticipated to rise in coming years. According to 1 survey respondent, the development of technologies such as cone beam CT and CT simulation, as well as clinical trials conducted within their centre, has facilitated the growth of their SABR program. Having an established SABR program for primary tumours, a centre in Manitoba was able to expand its SABR capacity to treat oligometastatic cancer through existing SABR experts who were treating primary tumours. They have a dedicated linear accelerator for patients receiving SABR treatment and have expanded to offer SABR using additional linear accelerators. The respondent from New Brunswick elaborated that their facility decided to invest in new equipment and software for SABR based on the projected future demand for the treatment option, as predicted by radiation oncologists in the department. Their centre currently offers SABR for the treatment of lung and bone (non-spine) oligometastatic lesions, with their rationale for prioritization being that the demand was highest for lung oligometastatic cancer, and the technical resources necessary for expanding their program to include bone (non-spine) lesions were minimal.

## Staff Resources and Training

SABR is a time- and labour-intensive procedure requiring staff resources for detailed treatment planning and delivery that include radiation oncologists, medical physicists, radiation therapists, operations managers, and administrators. Most survey respondents, representing facilities in Alberta, British Columbia, Newfoundland and Labrador, New Brunswick, Nova Scotia, Ontario, Prince Edward Island, Quebec, and Saskatchewan reported that their centres provided specialized training to existing staff to implement SABR treatment for patients with oligometastatic cancer. A survey respondent from Alberta elaborated that staff training and education was an important element of the implementation of SABR for the treatment of oligometastatic cancer in their facility. Radiation oncologists received specialized training through fellowships and radiation therapists received training, as well.

Hiring additional staff and creating a dedicated team of health professionals were also common tasks reported by several respondents. Most respondents from Alberta, British Columbia, New Brunswick, Newfoundland and Labrador, Ontario, Quebec, and Saskatchewan represented centres that hired or trained medical physicists to support the provision of SABR for the treatment of oligometastatic cancer. Respondents from Alberta, British Columbia, New Brunswick, Ontario, Quebec, and Saskatchewan represented facilities that hired or trained radiation technologists. Respondents from Alberta, British Columbia, Ontario, and Quebec reported that their facility hired or trained radiation oncologists that specialized in metastatic disease. One survey respondent from Newfoundland and Labrador reported that their facility hired or trained radiation therapists (dosimetrists) to support SABR implementation for the treatment of oligometastatic cancer. One respondent from Alberta noted that their facility did not undergo any staffing changes to support the provision of SABR for oligometastases. The respondent from Manitoba also reported that their centre did not hire or train staff when expanding the use of SABR for the treatment of oligometastatic cancer, as there was already an established SABR program with dedicated staff. For example, the centre has a dedicated medical physicist for the provision of SABR treatment.

Some respondents from Alberta, Ontario, and Quebec reported that their facility has dedicated SABR staff for patients with oligometastatic cancer who are separate from staff who treat patients with primary tumours. One respondent from Alberta specified that dedicated radiation oncologist, medical physicist, and radiation therapist leads were sought to oversee the SABR program for oligometastatic cancer. The medical physics lead was able to educate colleagues on topics such as QA. Another respondent clarified that, at their centre in Alberta, SABR providers are site-based and only treat lesions within a specific organ to manage clinical workload. Therefore, patients with oligometastatic cancer with multi-site involvement visit different providers for SABR treatment.

## Funding

The most common source of funding for access to SABR technology was hospital operating and capital budgets, reported by survey respondents from Alberta, British Columbia, Manitoba, New Brunswick, Nova Scotia, Ontario, and Quebec. Respondents from Alberta expressed that SABR had now become routine practice based on the clinician's decision and therefore funded through routine capital funding initiatives. Whether or not a centre has SABR capacity is largely incidental to machine replacement. Older linear accelerators require more maintenance and may not be able to be retrofitted with newer technologies such as SABR. Centres in Alberta sought internal hospital funding also for the purpose of educating radiation therapists and nursing staff. In Manitoba, radiotherapy equipment was procured through capital funding, with some equipment having SABR capacity. The respondent from New

Brunswick reported that staff training and the purchase of their linear accelerator were funded through their capital budget.

Some respondents also reported that their facility sought additional funding from the provincial government and private or charitable partners. One respondent from Alberta mentioned that the provincial cancer agency had provided a small, 1-time grant to support the development of their SABR program. Using the grant, their centre was able to hold meetings with radiation oncologists who could be potential SABR providers to develop training programs and consensus treatment guidelines to ensure that the program was standardized throughout the province. A facility in New Brunswick was able to fund the additional training of dedicated SABR staff partly through private donations from charitable foundations. The respondent from Prince Edward Island reported that their radiation oncology department was able to obtain funding for new equipment capable of SABR treatment through the provincial treasury board, in addition to the hospital foundation. Respondents from Manitoba stated that, in addition to other linear accelerators with SABR capacity, they have access to 1 linear accelerator dedicated to SABR treatment in a provincial tertiary centre. This equipment was initially purchased using funds from donors and now receives partial operational funding from the provincial government and is scheduled as half-day operations every day of the week.

Program evaluation was identified as a part of the funding process by respondents representing facilities in Nova Scotia, Ontario, and Saskatchewan. Program evaluation is a systematic methodology used in health care to determine the impact and health-related outcomes of an intervention to assist in decision-making.<sup>26</sup> The respondent from Nova Scotia elaborated that internal program evaluation was conducted for potential patients who could be treated with SABR at 2 cancer care centres in their jurisdiction. Additionally, their jurisdiction sought external program evaluation from an independent organization involved in reviewing radiation oncology treatments and workflows.

## Improving the Availability of SABR in Canada

### Current Implementation Issues

No literature was identified regarding issues related to the implementation of SABR for the treatment of oligometastatic cancer. The most commonly reported unmet needs or areas of improvement by survey respondents from facilities with SABR capacity for the treatment of oligometastatic cancer were patient selection criteria, guidelines to standardize SABR treatment, and availability of resources (e.g., staff, equipment). The respondent from Prince Edward Island highlighted the need for national-level consensus guidelines for the delivery of SABR in patients with oligometastatic cancer. This was echoed by the respondent from New Brunswick, who emphasized the need for guidelines specifically on patient selection and treatment. The respondent from New Brunswick also mentioned that it is critical for a cancer care centre to have a dedicated SABR-capable linear accelerator, as well as a specialized group of staff – including radiation therapists, medical physicists, and radiational oncologists – for the delivery of SABR treatment.

Gaps in evidence from randomized controlled trials regarding the optimal use of SABR for the indication of oligometastatic cancer were mentioned by some survey respondents from Alberta and Ontario. There is a lack of global consensus in target dose fractions and OAR constraints (i.e., recommended maximum radiation doses for organs that are more at risk for radiation damage, which may limit treatment plans for target tumour lesions). While this reflects the current state of the clinical trial evidence, 1 respondent described that this

makes it difficult to compare results from Canadian clinical trials to those from around the world, thus limiting the development of optimal SABR practices. Currently available results from SABR trials on patients with oligometastases are not necessarily specific to a disease site and the selected participants are a mixture of patients with disease states that can be more or less responsive to radiation therapy. One informant suggested that future studies that incorporate tumour histology and markers into the selection criteria and reported patient characteristics could better inform clinical practice. Respondents from Alberta explained that patient selection criteria and standardized SABR guidelines are still under development as more clinical trial data surface. Further randomized clinical trials were described as having the means to elucidate the magnitude of the clinical benefit patients with oligometastatic cancer may achieve through SABR treatment, as well as reveal which subset(s) patients would benefit most. Respondents reported that, in practice, patients can present oligometastatic lesions in various organs and tissues, but it is unclear from current data whether these patients all experience the same clinical benefits and survival advantage from SABR treatment. Respondents also suggested that future clinical trials could also focus on improving our understanding of the role of SABR in treating oligoprogressive disease.

Some survey respondents elaborated that time for treatment planning is a significant area for improvement. Respondents from Alberta noted that because of the complexity of SABR, the number of cases have to be limited so that staff in charge of dosimetry can manage the workload of treatment planning. At the moment, clinicians are able to prioritize and make decisions around which patients with oligometastatic cancer are eligible and most likely to benefit from SABR treatment through a central referral process, rounds, and tumour board discussions, which helps mitigate the barrier of human resources in dosimetry. In a follow-up consultation, the respondent from Saskatchewan concurred that the resourcing of dosimetrists and physicists, as well as machine time for treatment planning, are the most prevalent barriers that their centre faces in expanding SABR capacity. A respondent from Quebec suggested that an increased availability of trained medical physicists could resolve the issue.

Respondents from Alberta and Manitoba noted that there were areas of improvement in existing technology for imaging and treatment planning. Software tools for planning and contouring were perceived to be able to improve the efficiency of SABR treatment. Hardware improvements, such as those that allow for tighter mechanical and dosimetric tolerances on the linear accelerator, as well as improved treatment imaging methods, are also imperative for increased accuracy. Upcoming technologies such as auto-contouring by artificial intelligence were also thought to improve the efficiency of all radiotherapy in general and solve issues surrounding adaptive radiotherapy workflow. More advanced planning and on-treatment imaging technology were described as of benefit when conducting SABR on soft tissue oligometastatic lesions, which are more mobile, such as surface monitoring systems and internal tracking systems.

### **Resources for Future Expansion or Implementation**

SABR program organization with dedicated equipment and teams was reported to facilitate the expansion of programs to include the treatment of oligometastases. In a follow-up consultation, a survey respondent from Ontario noted that their hospital's cancer care centre has a program that specifically pertains to ablative technologies, which led them to be early adopters of SABR technology, particularly multi-site SABR. While the initial financial investment in SABR technology and staff training was significant, the respondent anticipated that the opportunity cost of delivering fewer treatments per patient will deem SABR cost-

neutral or even cost-efficient in the future. The benefits of having a dedicated SABR program in enabling expansion were also emphasized by respondents from Manitoba during a follow-up consultation. At the beginning of the SABR program at their centre, they had access to a linear accelerator and a team of medical physicists and radiation therapists specifically dedicated to SABR treatment for spine lesions; from there, they were able to expand to treating other sites and eventually oligometastases.

Funding was also mentioned as an area of improvement, with 1 respondent from an Ontario cancer centre with SABR capacity for oligometastatic cancer elaborating that the complexity of SABR treatment requires proper funding to be widely implemented. The respondent from Newfoundland and Labrador stated that their centre is limited in their SABR capacity, currently offering treatment for lung oligometastatic lesions, and cannot expand to treat other sites until new equipment and additional staff resources can be procured. The respondent from Nova Scotia reported that their jurisdiction is looking to obtain more linear accelerators or upgrade current linear accelerators so that their program can be expanded to treat more oligometastatic sites such as the prostate, head and neck, kidney, and pancreas. They currently have 2 linear accelerators with SABR capacity in the province. Nationally, 25% of the linear accelerators available in Canadian cancer care centres are more than 10 years old, which may be limiting SABR capacity in several jurisdictions.<sup>15</sup> The respondent from New Brunswick also reported that their centre, which currently has capacity for treating lung and bone (non-spine) oligometastatic lesions, has plans for expanding their SABR treatment program to other sites. They are planning for a projected implementation of spine SABR in the next 2 to 3 years, as well as eventually liver SABR.

Respondents from facilities that offered SABR treatment, only, for localized disease (i.e., primary lung and liver tumours) reported that patients with oligometastatic cancer are either being treated with standard of care alternatives (e.g., conventional radiotherapy, surgery, systemic therapy) or referred to another facility to receive SABR. All 3 facilities are considering the future implementation of SABR for the treatment of oligometastatic cancer, with lungs and bones being the most commonly reported oligometastatic sites that they are intending to treat. The most prevalent barrier preventing SABR treatment for patients with oligometastatic cancer is staff resource constraints, such as staffing requirements and training, and time for planning and delivering treatment sessions. Other reported barriers included funding constraints, infrastructure constraints, and uncertainty around patient selection criteria or prioritization. Respondents from these facilities reported that several operational changes would be necessary to facilitate its implementation. These changes, from most to least commonly cited, are recruitment of additional staff, reorganization of existing staff resources, staff training, new software, and additional funding. One respondent from New Brunswick mentioned that an increase in facility space would also be necessary.

## Limitations

Using a survey approach for this Environmental Scan allowed for responses from several stakeholders across Canada in a timely manner. Although the questions were reviewed by clinical experts, they were still subject to the limitations of survey research methodology. For example, multiple-choice questions that are suitable in a questionnaire format tend to be more directive than open-ended questions and detailed responses can be challenging



to gather. The technical details of SABR and its treatment guidelines were more difficult to interpret through the succinct answers from survey respondents.

Due to the sampling method, this Environmental Scan is not a comprehensive assessment of SABR capacity at all Canadian cancer centres with radiotherapy services. Some survey respondents, such as select individuals from British Columbia, Manitoba, Newfoundland and Labrador, Nova Scotia, and Prince Edward Island, answered on behalf of their provincial jurisdiction, whereas others gave insight into processes specific to their own facility. Therefore, some of the data collected through the surveys, such as which oligometastatic body sites are being treated in each jurisdiction (Table 2), may not be complete as they do not represent information from all Canadian cancer centres. Furthermore, some jurisdictions, such as Alberta and New Brunswick, consist of facilities with varying SABR capacity, with some cancer centres using SABR only to treat primary tumours; it is unknown whether this situation applies to other provinces, as well. Therefore, the results of the Environmental Scan may not represent an overall provincial approach.

Through the grey literature search, CADTH determined that there is a lack of published, publicly available information on the implementation of SABR technology in Canada, particularly for the treatment of oligometastatic cancer. This finding was consistent with the results of detailed scoping for the SABR HTA project, which included a database search.<sup>10</sup> Survey respondents reported that their SABR protocols were mainly based on internal guidelines used by their department or jurisdiction. Therefore, it is difficult to determine the level of consensus among jurisdictions in how they deliver SABR treatment.

Additionally, there was a gap in representation of the various professions involved in the implementation of SABR technology. Survey and consultation respondents mainly consisted of radiation oncologists, which helped provide clinical context to the implementation of SABR in Canada. However, there was a lack of representation of non-physician staff who are involved in SABR treatment, such as radiation therapists and radiation oncology nurses, as well as those in policy-based roles. In addition, input from medical physicists was limited to 1 respondent. Certain details of SABR treatment – such as different aspects of SABR QA (including equipment and treatment plan QA programs), patient safety during the procedure, and follow-up care – were lacking from the collected responses.

Furthermore, only 3 survey respondents were eligible for Section C of the survey, which addressed facilities with SABR capacity for indications other than oligometastatic cancer. This limited the conclusions that could be made regarding the differences between SABR treatment of oligometastatic cancer versus localized disease. None of the survey respondents were eligible for Section D of the survey, which included questions for centres without SABR capacity; this may reflect participation bias. Through the follow-up consultations, respondents were able to give a retrospective overview of the history and expansion of the SABR program at their centre. However, potential respondents from facilities without SABR capacity could have contributed an additional perspective as a centre that is currently considering the initiation a new SABR program.

## Conclusions and Implications for Decision- or Policy-Making

The findings of this Environmental Scan on the implementation of SABR in Canada are based on a literature review, 22 stakeholder survey responses, and 4 email- and 2 video call-based follow-up consultations with select stakeholders.

### Use of SABR for the Treatment of Oligometastatic Cancer in Canadian Jurisdictions

Compared to the 2011 survey of Canadian radiotherapy centres,<sup>9</sup> where SABR capacity was identified in only 5 provinces, all 10 provinces now have access to SABR for the treatment of oligometastatic cancer. SABR technology is being used in a similar manner across Canadian jurisdictions; all respondents reported that their hospitals or cancer care centres offer SABR as a standard treatment option and none use SABR solely for research purposes. While SABR is used to treat oligometastatic lesions in the lungs in all 10 provinces in Canada, the capacity for SABR treatment of non-lung oligometastatic sites varies. Currently, all surveyed centres that offer SABR for the treatment of oligometastases treat lung lesions, with some centres additionally reporting capacity to treat oligometastases in the bones (non-spine), lymph nodes, spine, and liver. SABR capacity largely appears to be tumour site-based; if a centre has resources to treat primary tumours in a particular tissue or organ (e.g., lung), they are more easily able to expand their program to treat oligometastatic lesions in the same area of the body. This was confirmed by respondents from Manitoba on a follow-up consultation call, who explained that expanding their established SABR program to include the treatment of oligometastatic lesions did not require any major operational changes such as hiring new staff or purchasing new equipment.

### Management of SABR Treatment of Oligometastatic Cancer

Sufficient and appropriate equipment and staff resources are essential components for the delivery of SABR treatment for oligometastatic cancer. Centres must have access to at least a linear accelerator machine capable of SABR. The need to hire new staff or provide additional training to existing staff largely depends on the centre's previous experience with SABR technology, although the ability to acquire additional resources to expand the program may depend on the availability of funding. Medical physics and dosimetry support are essential for the large-scale implementation of SABR and constraints in resourcing present 1 of the main reasons why patients have to be carefully prioritized and selected for SABR treatment. The development of standardized patient selection guidelines and continued use of tumour board review processes could further support the prioritization of patients likely to experience the most clinical benefits from SABR. Contouring and treatment planning for SABR are inherently time- and resource-intensive processes, and proper allocation of staff and equipment can help optimize workflow. Respondents who participated in the follow-up consultations also emphasized that treatment planning and the resourcing of dosimetrists were the main challenges they faced.

### Use of SABR to Treat Localized Disease

As communicated by 3 survey respondents from Alberta and New Brunswick, not all cancer centres with SABR capacity in Canada treat patients with oligometastatic lesions. On the other hand, other respondents from the same jurisdictions work in facilities that treat

patients with oligometastatic cancer, which suggests that SABR capacity is determined by the needs and resources of an individual facility rather than on a jurisdictional or provincial basis. According to the survey, facilities that only use SABR for the treatment of primary tumours typically treat a limited number of organs or tissue types (i.e., lesions in the lungs or liver). Reasons for not treating oligometastatic lesions mentioned by these respondents were mainly staff resource constraints in terms of not having the capacity to train or recruit additional staff.

There was also a difference in equipment regarding manufacturer and model reported to be used by facilities that provided SABR for the treatment of oligometastatic cancer versus facilities that only treated primary tumours. However, this Environmental Scan did not identify important differences in infrastructure required for the delivery of SABR treatment for localized disease versus oligometastatic disease. All surveyed centres are using linear accelerators capable of SABR and therefore can treat oligometastatic lesions based on the functionality of their equipment.

## Barriers and Facilitators to Implementation

There were various barriers and facilitators to the implementation of SABR treatment of oligometastatic cancer that were identified through the survey responses and consultations. Some centres have procured dedicated staff resources and infrastructure for the successful implementation of SABR for this indication. By dedicating staff specific to SABR provision, centres in Alberta, Manitoba, and Ontario were able to expand their program to treat multiple oligometastatic sites. While a SABR-specific linear accelerator may be helpful, it is not necessary for the provision of SABR for oligometastatic disease. In general, having equipment and an overall radiotherapy program with sufficient SABR capacity allows for centres to dedicate machine time for the SABR treatment of oligometastases without detrimentally impacting patients receiving other radiation therapy treatments. Funding for the implementation of SABR was largely supported by hospital operating and capital budgets, and therefore facilities with larger budgets were able to expand their SABR program more quickly.

As highlighted by CADTH's living systematic review on the clinical effectiveness and safety of SABR for the treatment of oligometastatic cancer published in March 2021,<sup>12</sup> there was variation in patient characteristics (type and location of primary and oligometastatic lesions) in identified clinical trials that evaluated SABR versus standard of care, which survey respondents have reiterated is a barrier to the widespread implementation of SABR. Because of heterogenous patient populations and mixed tumour histology in clinical trials, radiation oncologists are uncertain whether expanding their SABR program beyond the sites they already treat would lead to better clinical outcomes in prospective patients. With SABR for the treatment of oligometastases being an active area of research and with several ongoing clinical trials anticipated to be completed through 2029,<sup>12</sup> future updates to CADTH's living systematic review could inform whether certain characteristics in patients with oligometastatic cancer are associated with better clinical outcomes from SABR treatment.

Respondents from centres with SABR capacity that do not use it for the treatment of oligometastatic cancer cited barriers to implementation that were similar to those reported by respondents from centres that do use SABR for this indication. The most commonly described barrier preventing SABR treatment for patients with oligometastatic cancer is staff resource constraints, such as staffing requirements and training, and time for planning and delivering treatment sessions. While input from centres that only use SABR for the treatment of localized disease was limited, coming from 3 survey respondents, there was

some suggestion that the expansion of the SABR program at these facilities may be of clinical benefit to patients with oligometastatic cancer; 1 respondent remarked that patients being treated at their centre could potentially have increased progression-free survival if they were offered an alternative to systemic treatments, which were described as inducing toxicity.

## Final Remarks

Canadian cancer care centres are currently on a continuum in their use of SABR technology for the treatment of oligometastatic cancer: some smaller centres have applied their existing SABR resources to offer this treatment to patients with oligometastatic lesions in a few different body sites, while others have had the ability to acquire more equipment and staff to not only treat more patients, but also facilitate research in expanding the use of SABR. Adoption of SABR technology for this indication in other facilities, as well as expansion of current SABR programs to other oligometastatic sites, are likely to follow if more robust clinical data emerges. As it becomes clear which patients with oligometastatic lesions are likely to most benefit from SABR compared to standard of care treatment, more Canadian cancer care centres may allocate funding toward SABR to invest in the equipment and staff resources required for implementation.

## References

1. Canadian Cancer Society. Cancer statistics at a glance. 2021; <https://action.cancer.ca/en/research/cancer-statistics/cancer-statistics-at-a-glance>. Accessed 2021 May 18.
2. Canadian Cancer Society. Metastatic cancer. 2021; <https://www.cancer.ca/en/cancer-information/cancer-type/metastatic-cancer/metastatic-cancer/?region=on>. Accessed 2021 May 18.
3. Reyes DK, Pienta KJ. The biology and treatment of oligometastatic cancer. *Oncotarget*. 2015;6(11):8491-8524. [PubMed](#)
4. Buyyounouski MK, Price RA, Jr., Harris EE, et al. Stereotactic body radiotherapy for primary management of early-stage, low- to intermediate-risk prostate cancer: report of the American Society for Therapeutic Radiology and Oncology Emerging Technology Committee. *Int J Radiat Oncol Biol Phys*. 2010;76(5):1297-1304. [PubMed](#)
5. Hong JC, Salama JK. The expanding role of stereotactic body radiation therapy in oligometastatic solid tumors: What do we know and where are we going? *Cancer Treat Rev*. 2017;52:22-32. [PubMed](#)
6. Stanford Health Care. Stereotactic Ablative Radiotherapy (SABR/SBRT). 2020; <https://stanfordhealthcare.org/medical-treatments/s/stereotactic-body-radiation-therapy.html>. Accessed 2021 May 18.
7. Chang JY, Liu H, Balter P, et al. Clinical outcome and predictors of survival and pneumonitis after stereotactic ablative radiotherapy for stage I non-small cell lung cancer. *Radiat Oncol*. 2012;7:152. [PubMed](#)
8. Mayo Clinic. Stereotactic radiosurgery. 2019; <https://www.mayoclinic.org/tests-procedures/sbrt/pyc-20446794>. Accessed 2021 May 18.
9. Lund CR, Cao JQ, Liu M, Olson R, Halperin R, Schellenberg D. The Distribution and Patterns of Practice of Stereotactic Ablative Body Radiotherapy in Canada. *J Med Imaging Radiat Sci*. 2014;45(1):8-15. [PubMed](#)
10. Stereotactic ablative radiotherapy for the treatment of oligometastatic cancer. (*CADTH scoping brief*). Ottawa (ON): CADTH; 2020: <https://cadth.ca/sites/default/files/pdf/ht0029-sabr-for-oligometastatic-cancer-scoping-brief.pdf>. Accessed 2021 Mar 25.
11. Stereotactic ablative radiotherapy for the treatment of oligometastatic cancer: summary of jurisdictional input [internal document]. Ottawa (ON): CADTH; 2019. Accessed 2021 May 19.
12. Stereotactic ablative radiotherapy for the treatment of oligometastatic cancer: a clinical review as part of a health technology assessment. (*CADTH health technology assessment*). Ottawa (ON): CADTH; 2021: [https://www.cadth.ca/sites/default/files/pdf/stereotactic\\_ablative\\_radiotherapy\\_for\\_the\\_treatment\\_of\\_oligometastatic\\_cancer.pdf](https://www.cadth.ca/sites/default/files/pdf/stereotactic_ablative_radiotherapy_for_the_treatment_of_oligometastatic_cancer.pdf). Accessed 2021 May 18.
13. Zhang M, Zhou S-M, Qu T. What Do We Mean When We Talk about the Linac Isocenter? *Int J Med Phys Clin Eng Radiat Oncol*. 2015;04(03):233-242.
14. Grey matters: a practical tool for searching health-related grey literature. Ottawa (ON): CADTH; 2019: <https://www.cadth.ca/grey-matters>. Accessed 2020 Apr 27.
15. Loewen SK. The Canadian Association of Radiation Oncology (CARO) 2019 Workforce and Technology Utilization Study. *ESTRO 2020, Online, November 28 - December 01*. Brussels (BE): European Society for Radiotherapy and Oncology (ESTRO); 2020. Accessed 2021 Apr 12.
16. Palliative radiotherapy: bone metastases and spinal cord compression. (*Clinical practice guideline RT-003 v.1*). Edmonton (AB): Alberta Health Services; 2016: <https://www.albertahealthservices.ca/assets/info/hp/cancer/if-hp-cancer-guide-rt003-palliative-rt-bone.pdf>. Accessed 2021 May 18.
17. Guideline Resource Unit. Metastatic colorectal cancer. (*Clinical practice guideline GI-003 v.12*). Edmonton (AB): Cancer Care Alberta; 2021: <https://www.albertahealthservices.ca/assets/info/hp/cancer/if-hp-cancer-guide-gi003-colorectal-metastatic.pdf>. Accessed 2021 May 18.
18. ECOG-ACRIN. ECOG performance status. 2020; <https://ecog-acrin.org/resources/ecog-performance-status>. Accessed 2021 May 18.
19. Palma DA, Olson R, Harrow S, et al. Stereotactic ablative radiotherapy versus standard of care palliative treatment in patients with oligometastatic cancers (SABR-COMET): a randomised, phase 2, open-label trial. *Lancet*. 2019;393(10185):2051-2058. [PubMed](#)
20. Gomez DR, Blumenschein GR, Jr., Lee JJ, et al. Local consolidative therapy versus maintenance therapy or observation for patients with oligometastatic non-small-cell lung cancer without progression after first-line systemic therapy: a multicentre, randomised, controlled, phase 2 study. *Lancet Oncol*. 2016;17(12):1672-1682. [PubMed](#)
21. National Cancer Institute. Dictionary of Cancer Terms: dosimetry. *NCI Dictionaries* <https://www.cancer.gov/publications/dictionaries/cancer-terms/def/dosimetry>, 2021 Jun 22.
22. Jurcic JG, Wong JYC, Knox SJ, Wahl DR, Rosenblat TL, Meredith RF. Chapter 22 - Targeted Radionuclide Therapy. In: Gunderson LL, Tepper JE, eds. *Clinical Radiation Oncology* (Fourth Edition). Philadelphia (PA): Elsevier; 2016:399-418.e314.
23. Tas B. Advanced radiation treatment planning of prostate cancer. In: Onal C, ed. *Prostate Cancer*. London (UK): IntechOpen Limited; 2018: <https://www.intechopen.com/books/prostate-cancer/advanced-radiation-treatment-planning-of-prostate-cancer>. Accessed 2021 Jun 22.
24. Swaminath A, Wierzbicki M, Parpia S, et al. Canadian Phase III Randomized Trial of Stereotactic Body Radiotherapy Versus Conventionally Hypofractionated Radiotherapy for Stage I, Medically Inoperable Non-Small-Cell Lung Cancer - Rationale and Protocol Design for the Ontario Clinical Oncology Group (OCOG)-LUSTRE Trial. *Clin Lung Cancer*. 2017;18(2):250-254. [PubMed](#)

25. British Columbia Cancer Agency. NCT03862911: Stereotactic Ablative Radiotherapy for Comprehensive Treatment of Oligometastatic (1-3 Metastases) Cancer (SABR-COMET-3). *ClinicalTrials.gov*. Bethesda (MD): U.S. National Library of Medicine; 2021: <https://clinicaltrials.gov/ct2/show/NCT03862911>. Accessed 2021 May 18.
26. A guide to planning and conducting program evaluation. Surrey (BC): Fraser Health Authority: [https://www.fraserhealth.ca/-/media/Project/FraserHealth/FraserHealth/Health-Professionals/Research-and-Evaluation-Services/20170601\\_guide\\_to\\_planning\\_conducting\\_program\\_evaluation.pdf?la=en&hash=2B887211BE43B9DE9E413B8E6E46094544E9987](https://www.fraserhealth.ca/-/media/Project/FraserHealth/FraserHealth/Health-Professionals/Research-and-Evaluation-Services/20170601_guide_to_planning_conducting_program_evaluation.pdf?la=en&hash=2B887211BE43B9DE9E413B8E6E46094544E9987). Accessed 2021 May 18.

## Appendix 1: Survey Questionnaire

### CONSENT FORM

Thank you for your interest in contributing to a CADTH report. Your input is highly valued, as it helps inform decision-making on the management of health technologies in Canada. The purpose of this survey is to gather information that will be used to prepare a CADTH Environmental Scan entitled *Implementation of Stereotactic Ablative Radiotherapy in Canada*, which will be published on the CADTH website.

Your participation in this survey is voluntary. You may choose not to participate, or you may exit the survey at any time. It should take approximately 20 minutes to complete.

Your identifiable private information will be kept confidential. This consent form *does not* give CADTH permission to disclose your name. If any direct quotes from the survey results are used, you will be contacted directly for your permission before publication.

CADTH will summarize your responses in the published report and your organization may be identified as a source. However, you and the organization you represent (if applicable) are not responsible for the analyses, conclusions, opinions, and statements expressed by CADTH.

For detailed information on the purpose of this [Environmental Scan](#), please refer to the invitation email or contact Diksha Kumar (diksha.kumar@cadth.ca).

### ELECTRONIC CONSENT

Please select 1 of the following choices:

Clicking on the *Agree* button indicates that:

- you have read the aforementioned information
- you voluntarily agree to participate
- you authorize CADTH to use the information provided by you for the purpose stated in this form.

If you do not wish to participate in the survey, please decline participation by clicking on the *Disagree* button.

- Agree
- Disagree

Please complete:

- Name: xxxxx
- Title: xxxxx
- Organization: xxxxx
- Province: xxxxx
- Email: xxxxx
- Phone (optional): xxxxx
- Date (DD/MM/YYYY): xxxxx

For the purpose of this Environmental Scan, oligometastatic cancer is defined as having limited or few metastatic lesions (typically up to 5) and stereotactic ablative radiotherapy (SABR) (synonym: stereotactic body radiation therapy [SBRT]) is a method of precisely delivering high dose per fraction radiation to a site outside the brain.

There is no standard definition of SABR in terms of specific dose and fractionation. However, SABR is usually considered to be at least 5 Gy per fraction, sometimes with biologic effective doses (BED) of greater than 100 Gy or using an alpha/beta ratio of 10. Often a much lower BED is used, particularly when the dose has to be compromised due to proximity to normal structures. For example, a dose of 30 Gy in 5 fractions (6 Gy per fraction) with a BED10 of 48 would be considered SABR.

## Section A: Demographics

- Which province or territory do you work in? [multiple choice]
  - Alberta
  - British Columbia
  - Manitoba
  - New Brunswick
  - Newfoundland and Labrador
  - Northwest Territories
  - Nova Scotia
  - Nunavut
  - Ontario
  - Prince Edward Island
  - Quebec
  - Saskatchewan
  - Yukon
  - Other (e.g., pan-Canadian organization) (please specify)
- What is your profession or role? (Choose all that apply.) [checkbox]
  - Radiation oncologist
  - Medical oncologist
  - Medical physicist
  - Hospital administrator
  - Government employee
  - Academic researcher
  - Other (please specify)
- Which of the following organization types are you answering on behalf of? [checkbox]
  - A facility (e.g., hospital or cancer centre)
  - A jurisdiction (e.g., regional, provincial, or territorial)
  - Other (please specify)
- Which of the following best described SABR at your centre(s)?
  - SABR capacity currently exists and **is used** for the treatment of oligometastatic cancer (continue to Section B)



- SABR capacity currently exists and **is not used** for the treatment of oligometastatic cancer (continue to Section C)
- SABR capacity **does not currently exist** (continue to Section D)

Survey respondents will answer only 1 of the following sections (B, C, or D)

## Section B: Centres that use SABR for the treatment of oligometastatic cancer

### Treatment Guidelines

- Which of the following oligometastatic sites are being treated with SABR in your centre(s)? (Choose all that apply.) [checkbox]
  - Lungs
  - Liver
  - Spine
  - Bones (non-spine)
  - Lymph nodes
  - Other (please specify)
- In what capacity is SABR for the treatment of oligometastatic cancer being used in your centre(s)? (Choose all that apply.) [checkbox]
  - Research
  - Standard of care
  - Other (please specify)
- In your centre(s), are there any specific criteria that a patient with oligometastatic cancer must meet to receive SABR treatment as a standard of care option outside of a clinical trial (e.g., location and/or number of metastases)? [multiple choice]
  - Yes
  - No
  - Not applicable (i.e., SABR is used in clinical trials, only)
- If yes, please describe the specific criteria that a patient with oligometastatic cancer must meet to receive SABR treatment as a standard of care option outside of a clinical trial (e.g., location and/or number of metastases). [textbox]
- Does your centre(s) have guidelines or processes on any of the following topics to standardize SABR treatment among patients? (Choose all that apply.) [checkbox]
  - Dose fractionation schedules
  - Normal tissue constraints
  - Patient prioritization
  - Quality assurance
  - None
  - Other (please specify)
- Please describe the guidelines and processes used by your centre(s) to standardize SABR treatment among patients with oligometastatic cancer. Please include links or attachments of any guidelines that can be shared. [textbox/attachment]

## Equipment and Infrastructure

- Which of the following devices are used for SABR treatment in your centre(s)? (Choose all that apply.) [checkbox]
  - XKnife
  - Versa
  - Infinity
  - Precise
  - TrueBeam
  - Novalis Tx
  - Trilogy
  - Clinac
  - Accuray TomoTherapy
  - Radixact
  - CyberKnife
  - Synergy
  - Gamma Knife Icon
  - ExacTrac
  - Other (please specify)
- Which of the following immobilization devices are used for SABR treatment in your centre(s)? (Choose all that apply.) [checkbox]
  - Civco Body Pro-Lok
  - Elekta BodyFIX
  - Thermoplastic mask system
  - In-house/customized immobilization device
  - Other (please specify)
- Which of the following imaging systems are used for SABR treatment in your centre(s)? (Choose all that apply.) [checkbox]
  - Volumetric on-board imaging
  - Integrated orthogonal kV imaging (e.g., ExacTrac)
  - Planar imaging
  - Other (please specify)
- Which of the following tasks did your centre(s) undertake to implement SABR treatment for oligometastatic cancer? (Choose all that apply.) [checkbox]
  - Reallocated existing radiotherapy equipment for the provision of SABR
  - Purchased new generalized equipment or software capable of SABR
  - Purchased new equipment and software dedicated to SABR
  - Built or acquired additional space in the facility to use for SABR treatment
  - Other (please specify)
- Considering your answer to the previous question, please describe the decision-making frameworks used to determine which tasks would be undertaken to implement SABR treatment. Please included links or attachments of relevant documentation that can be shared. [textbox/attachment]

- In addition to oligometastatic sites, what types or locations of primary cancers are treated using SABR equipment and infrastructure at your centre(s)? (Choose all that apply.) [multiple choice]
  - Breast
  - Colorectal
  - Lung
  - Prostate
  - Kidney
  - Head and neck
  - Liver (e.g., hepatocellular)
  - Pancreas
  - Other (please specify)
  - None of the above (i.e., SABR equipment and infrastructure are only used for the treatment of oligometastases)

### Staff Resources and Training

- Which of the following tasks did your centre(s) undertake to implement SABR treatment for oligometastatic cancer? (Choose all that apply.) [checkbox]
  - Hired additional staff
  - Provided specialized training to existing staff
  - Created a dedicated team of health professionals
  - Other (please specify)
- Have any of the following staff been hired or trained to support the provision of SABR for patients with oligometastatic cancer in your centre(s)? (Choose all that apply.) [checkbox]
  - Administrative support staff
  - Metastatic disease radiation oncologists
  - Radiation oncology nurses
  - Radiation technologists
  - Medical physicists
  - Other (please specify)
- Do the SABR staff that treat patients' primary tumours also treat the oligometastatic cancer in your centre(s) (i.e., the team that treats primary lung cancer with SABR also treats lung cancer metastases with SABR)? [multiple choice]
  - Yes
  - No

### Funding

- Did your centre(s) pursue or participate in any of the following activities to gain access to SABR technology? (Choose all that apply.) [checkbox]
  - Seeking additional funding from hospital operating and/or capital budgets
  - Seeking additional funding from provincial government
  - Seeking additional funding from private or charitable partners
  - Risk-sharing schemes (e.g., managed-access schemes or programs, outcomes-based or performance-based schemes)

- Program evaluation
- Central registry or reporting agreements
- Other (please specify)
- Considering your answer to the previous question, please provide more details relating to the activities pursued to gain access to SABR technology. [textbox]

## Barriers

- What are the unmet needs or areas for improvement with respect to the use of SABR for the treatment of oligometastatic cancer in your centre(s)? (Choose all that apply.) [checkbox]
  - Patient selection criteria
  - Guidelines to standardize SABR treatment
  - Funding
  - Wait times
  - Staff resources
  - Staff training
  - Equipment
  - Facility space or infrastructure
  - Other (please specify)
- Considering your answer to the previous question, please describe the unmet needs or areas for improvement with respect to the use of SABR for the treatment of oligometastatic cancer. [textbox]
- Following this survey, CADTH may be conducting short consultations to further understand the implementation of SABR for the treatment of oligometastatic cancer in Canada. Would you be willing to participate in these consultations? [multiple choice]
  - Yes
  - No

## Section C: Centres that use SABR for indications other than oligometastatic cancer

- Which of the following primary cancers are being treated with SABR in your centre(s)? (Choose all that apply.) [checkbox]
  - Breast
  - Colorectal
  - Lung
  - Prostate
  - Kidney
  - Head and neck
  - Liver (e.g., hepatocellular)
  - Pancreas
  - Other (please specify)

## Equipment

- Which of the following devices are used for SABR treatment in your centre(s)? (Choose all that apply.) [checkbox]

- XKnife
- Versa
- Infinity
- Precise
- TrueBeam
- Novalis Tx
- Trilogy
- Clinac
- Accuray TomoTherapy
- Radixact
- CyberKnife
- Synergy
- Gamma Knife Icon
- ExacTrac
- Other (please specify)
- Which of the following immobilization devices are used for SABR treatment in your centre(s)? (Choose all that apply.) [checkbox]
  - Civco Body Pro-Lok
  - Elekta BodyFIX
  - Thermoplastic mask system
  - Other (please specify)
- Which of the following imaging systems are used for SABR treatment in your centre(s)? (Choose all that apply.) [checkbox]
  - Volumetric on-board imaging
  - Integrated orthogonal kV imaging (e.g., ExacTrac)
  - Planar imaging
  - Other (please specify)

## Implementation and Barriers

- How are patients with oligometastatic cancer currently being managed in your centre(s)? (Choose all that apply.) [checkbox]
  - Standard of care in centre(s) (e.g., conventional radiotherapy, surgery, systemic therapy)
  - Referred to another facility for SABR treatment
  - Referred to another facility for other care (e.g., standard of care, palliative care)
  - Other (please specify)
- Is your centre(s) considering the implementation of SABR for the treatment of oligometastatic cancer in the future? [multiple choice]
  - Yes
  - No
- If the answer to the previous question was yes, which of the following oligometastatic sites are you intending to treat? (Choose all that apply.) [checkbox]
  - Lungs

- Liver
- Spine
- Bones (non-spine)
- Lymph nodes
- Other (please specify)
- Which of the following barriers are preventing your centre(s) from offering or considering SABR treatment for patients with oligometastatic cancer? (Choose all that apply.) [checkbox]
  - Funding constraints
  - Staff resource constraints (e.g., staffing requirements and training, time for planning and delivering treatment sessions)
  - Infrastructure constraints (e.g., limited equipment or facility space)
  - Uncertainty of clinical benefit
  - Uncertainty of safety
  - Uncertainty around criteria for patient selection or prioritization
  - Other (please specify)
- What kinds of operational changes would be necessary in your centre(s) to facilitate the use of existing equipment or other infrastructure to provide SABR for the treatment of oligometastatic cancer? (Choose all that apply.) [checkbox]
  - Additional funding
  - Recruitment of additional staff
  - Reorganization of existing staff resources
  - Staff training
  - New software
  - Other (please specify)

## Gaps in Cancer Care

- Could SABR for the treatment of oligometastatic cancer address existing gaps in the delivery of cancer treatment in your centre(s)? [multiple choice]
  - Yes
  - No
- Considering your answer to the previous question, please describe how SABR for the treatment of oligometastatic cancer could, or could not, address existing gaps in the delivery of cancer treatment in your centre(s). [textbox]
- Following this survey, CADTH may be conducting short consultations to further understand the implementation of SABR for the treatment of oligometastatic cancer in Canada. Would you be willing to participate in these consultations? [multiple choice]
  - Yes
  - No

## Section D: Centres with no SABR capacity

- Is your facility or jurisdiction considering the implementation of SABR for the treatment of oligometastatic cancer in the future? [multiple choice]
  - Yes

- No
- Which of the following barriers are preventing your centre(s) from currently offering or considering SABR treatment? (Choose all that apply.) [checkbox]
  - Funding constraints
  - Staff resource constraints (e.g., staffing requirements and training, time for planning and delivering treatment sessions)
  - Infrastructure constraints (e.g., limited equipment or facility space)
  - Uncertainty of clinical benefit
  - Uncertainty of safety
  - Uncertainty around criteria for patient selection or prioritization
  - Other (please specify)
- Could SABR for the treatment of oligometastatic cancer address existing gaps in the delivery of cancer treatment in your centre(s)? [multiple choice]
  - Yes
  - No
- Considering your answer to the previous question, please describe how SABR for the treatment of oligometastatic cancer could, or could not, address existing gaps in the delivery of cancer treatment in your centre(s). [textbox]
- Which of the following oligometastatic sites do you feel should be treated by SABR in your centre(s) if there was capacity? (Choose all that apply.) [checkbox]
  - Lungs
  - Liver
  - Spine
  - Bones (non-spine)
  - Lymph nodes
  - Other (please specify)
  - None
- Following this survey, CADTH may be conducting short consultations to further understand the implementation of SABR for the treatment of oligometastatic cancer in Canada. Would you be willing to participate in these consultations? [multiple choice]
  - Yes
  - No

## Appendix 2: Information on Survey Respondents

**Table 4: Information on Survey Respondents**

Jurisdiction	Number of respondents (% total of respondents)	Organization(s) represented by survey respondents
Alberta	7 (31.8%)	Alberta Health Services; Cancer Care Alberta; Tom Baker Cancer Centre; Central Alberta Cancer Centre
British Columbia	1 (4.5%)	BC Cancer
Manitoba	1 (4.5%)	CancerCare Manitoba
New Brunswick	3 (13.6%)	Dr. Georges-L.-Dumont University Hospital Centre; Horizon Health Network
Newfoundland and Labrador	1 (4.5%)	Eastern Health
Nova Scotia	1 (4.5%)	Nova Scotia Health Authority
Ontario	2 (9.1%)	Sunnybrook Hospital; London Health Sciences Centre
Prince Edward Island	1 (4.5%)	PEI Cancer Treatment Centre
Quebec	4 (18.2%)	Centre hospitalier de l'Université de Montréal; CISSS de Chaudière-Appalaches; CISSS du Bas-Saint-Laurent; McGill University Health Centre
Saskatchewan	1 (4.5%)	Saskatchewan Cancer Agency

BC = British Columbia; CISSS = Centre intégré de santé et de services sociaux (integrated health and social services centres); PEI = Prince Edward Island.