

Head and Neck Cancer Surgery in Ontario, 2003–2010

An ICES Atlas

November 2015



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About the Organizations Involved in This Atlas

Cancer Care Ontario

Cancer Care Ontario (CCO) is the provincial agency responsible for continually improving cancer services.

As the government's cancer advisor, CCO:

- Implements provincial cancer prevention and screening programs.
- Works with cancer care professionals and organizations to develop and implement quality improvements and standards.
- Uses electronic information and technology to support health professionals and patient self-care, and to continually improve the safety, quality, efficiency, accessibility and accountability of Ontario's cancer services.
- Plans cancer services to meet current and future patient needs, and works with health care providers in every Local Health Integration Network (LHIN) to continually improve cancer care for the people they serve.
- Conducts research and rapidly transfers knowledge of new research into improvements and innovations in clinical practice and cancer service delivery.

Institute for Clinical Evaluative Sciences

The Institute for Clinical Evaluative Sciences (ICES) is an independent, nonprofit organization that uses population-based health information to produce knowledge on a broad range of health care issues. ICES' unbiased evidence provides measures of health system performance, a clearer understanding of the shifting health care needs of Ontarians, and a stimulus for discussion of practical solutions to optimize scarce resources.

Key to ICES' work is its ability to link population-based health information, at the patient level, in a way that ensures the privacy and confidentiality of personal health information. Linked databases reflecting 13 million of 34 million Canadians allow researchers to follow patient populations through diagnosis and treatment, and to evaluate outcomes.

ICES receives core funding from the Ontario Ministry of Health and Long-Term Care. In addition, ICES scientists and staff compete for peer-reviewed grants from federal funding agencies, such as the Canadian Institutes of Health Research, and project-specific funds from provincial and national organizations. ICES knowledge is highly regarded in Canada and abroad, and is widely used by government, hospitals, planners, and practitioners to make decisions about health care delivery and to develop policy.

Foreword

Leveraging health data to drive quality improvements in cancer surgery

One of Cancer Care Ontario's goals is to continuously enhance the quality and accessibility of cancer surgery. Together with our partners, we use data and research analysis to support population-based planning for cancer services across the province.

Previous cancer research atlases published by the Institute for Clinical Evaluative Sciences (ICES) have laid a strong foundation for advancements in cancer surgery. The 2008 atlas *Cancer Surgery in Ontario* showcased variations in the range and use of health services by cancer surgery patients within Ontario's 14 Regional Cancer Programs and provided data that has helped us further our efforts in improving performance and quality.

The 2015 ICES atlas presents vital information about cancer surgery and related health services provided to Ontarians who were newly diagnosed with cancer of the oral cavity, larynx/hypopharynx or salivary gland between 2003 and 2010. It examines the types of procedures patients received, where they received their procedure, and any other health services they utilized. Data is presented by age group, sex, neighbourhood income level, community size and region. By assessing variations that exist in access, treatment and outcomes, the findings will allow Cancer Care Ontario's Surgical Oncology

Program and our valued partners to identify opportunities for quality improvement across the province.

The data in this new atlas are particularly relevant as Cancer Care Ontario recently established Head and Neck Centres in eight Regional Cancer Programs across the province. This regionalization has balanced access to care with the benefits of high-quality specialized cancer treatment. The decision to have head and neck surgeries provided at large-volume centres was based on strong evidence and was also supported by regional data presented in the 2008 atlas. The updated data in the current atlas will help us as we work toward our goal of having all head and neck cancer surgeries performed in designated centres.

I want to thank all of the authors for their contributions to this terrific piece of work. In conjunction with key evidence, the data it contains can be used by healthcare providers, planners and policymakers to inform planning and decision-making. It is an effective resource that helps ensure a consistent, high-quality approach to head and neck cancer surgery across all care settings in Ontario. I am looking forward to leveraging this data in the years ahead.

Michael Sherar, PhD

President and Chief Executive Officer
Cancer Care Ontario

Executive Summary

Issue

Head and neck cancers include oral cavity, larynx/hypopharynx and salivary gland cancers. The treatment of these cancers is complex and requires multidisciplinary health care teams. Patients treated for head and neck cancers are often left with significant impairments, such as difficulties with swallowing, taste, speech, breathing and body image.

Study

This atlas presents information on surgery and related health services provided to persons in

Ontario who were newly diagnosed with cancer of the oral cavity, larynx/hypopharynx or salivary gland between 2003 and 2010. The atlas also describes the impact of patient factors (i.e., age, sex, socioeconomic status, place of residence) and provider factors (i.e., surgical specialty and the type and location of hospitals delivering services) on the health care services provided to these patients. Patients were identified using data from the Ontario Cancer Registry, and information on patient and provider characteristics and health care service utilization was obtained by linking several Ontario health administrative databases.

Key findings

- The vast majority of Ontarians with newly diagnosed head and neck cancers underwent a surgical procedure in the 12 months before and after their diagnosis, including 85% of patients with oral cavity cancer, 69% of patients with larynx/hypopharynx cancer and 93% of patients with salivary gland cancer. Patients aged 75 years or older were less likely to have a cancer-related surgery.

- Among the nine major head and neck cancer treatment centres in Ontario, there were large variations in the proportion of patients who had a consultation with a radiation or medical oncologist and in the approach to treatment.
- The majority of resection procedures were performed at head and neck cancer treatment centres and involved 90% of patients with oral cavity cancer, 98% of those with larynx/hypopharynx cancer and 57% of those with salivary gland cancer.
- There were significant variations across Ontario's 14 Local Health Integration Networks (LHINs) in the use of surgery and radiation therapy for patients newly diagnosed with head and neck cancers.
- There was significant variation across the LHINs in the use of palliative care services by patients with head and neck cancers, which may reflect differences in the availability of these services.

Implications

- Variations in the diagnostic workup, treatment approach, use of adjunctive procedures and number of consultations for patients exist even among high-volume regional head and neck cancer treatment centres.
- Although treatment for head and neck cancers is highly regionalized, some cases are still being treated in low-volume centres.
- Further research is necessary to understand differences in access to specialist care and head and neck cancer treatment patterns across the LHINs.
- As the Ontario population ages, there may be an increasing demand for health care services to treat head and neck cancers.

Glossary of Terms

Benign Not life-threatening or severe and likely to respond to treatment. A tumour that is not malignant.

Definitive surgical procedure The most extensive surgical procedure performed for a patient who has had more than one procedure.

Fine-needle aspiration A type of biopsy procedure in which a thin needle is inserted into an area of abnormal-appearing tissue or body fluid.

Free flap Tissue taken from one part of the body and transplanted to another to close a surgical site after removal of a cancer.

Histology The scientific study of the microscopic structure of tissues.

Hypopharynx Part of the throat that lies beside and behind the larynx.

Incidence The extent or rate of occurrence, specifically in the number of new cases of a disease in a population over a period of time.

Laryngectomy The surgical removal of the larynx.

Larynx An organ located in the neck above the opening of the trachea (windpipe). Often called the voice box.

Local Health Integration Network One of 14 health regions in Ontario with a mandate for planning, integrating and funding health care services at a local level.

Malignant Relating to cancer cells that are invasive and tend to metastasize.

Mandible The bone that forms the lower jaw and holds the lower teeth in place.

Maxilla The upper jaw.

Neck dissection Removal of the regional lymph nodes in the neck.

Oncology The branch of medicine that deals with tumours, including the study of their development, diagnosis, treatment and prevention.

Oral cavity/Oropharynx Includes the lips, cheeks, palate (roof of the mouth), floor of the mouth, and part of the tongue in the mouth.

Palliative Relieving or soothing the symptoms of a disease such as cancer without effecting a cure.

Pharyngolaryngectomy The surgical removal of the larynx (voice box) and pharynx (area at the back of the throat).

Radiation therapy Treatment of cancer by controlled exposure to a radioactive substance.

Resection Surgical removal of all or part of an organ, tissue or other body structure.

Salivary glands Glands found in and around the mouth and throat that secrete saliva into the mouth. The major salivary glands are the parotid, submandibular and sublingual glands.

1 Introduction

Inside

- Why Do We Need an Atlas for Head and Neck Cancer Surgery in Ontario?
- The Role of Surgery and Surgeons in Head and Neck Cancer Diagnosis and Treatment
- Head and Neck Cancer in Ontario
- How We Did the Research
- Content and Format of the Chapter Exhibits
- References

Why Do We Need an Atlas for Head and Neck Cancer Surgery in Ontario?

In 2008, the Institute for Clinical Evaluative Sciences (ICES) summarized epidemiologic data from April 1, 2003, to March 31, 2004, for five of the most common oncologic diagnoses affecting Ontarians: breast, prostate, colorectal, lung and female genitourinary cancers.¹ In 1997, similar data were used to summarize the epidemiology of a number of malignancies, including cancers of the head and neck, from 1992 to 1997.² These data are now out of date, and there have been significant changes in the incidence and management of these cancers. For example:

- Ontario's 14 Local Health Integration Networks (LHINs) were created in 2007, and there is limited information on how head and neck cancer surgery services are distributed among these geographical and health resource units.
- There has been a major shift in the regionalization of head and neck cancer surgery to large-volume centres. Fewer hospitals and surgeons are performing head and neck cancer surgery as compared to 1992–1995, but the extent of these trends was largely unknown prior to the production of this atlas.

The information derived from such atlases can be used to support population-based regional planning of Ontario's cancer health services and provides the foundation for a research program in health services research in Ontario. Ultimately, this atlas will outline an agenda for cancer surgery-related health services research with the aims of improving the outcomes and quality of delivered care for patients with head and neck cancer.

The Role of Surgery and Surgeons in Head and Neck Cancer Diagnosis and Treatment

Radiation therapy and chemotherapy are important in the management of cancers, but most cancers are initially diagnosed by surgeons and are often initially treated with surgery.³ Head and neck cancers are not different. These cancers are almost always initially assessed by surgeons for acquisition of diagnostic tissue. Furthermore, surgery has an important role in the primary management of head and neck cancers.^{4–6} Even for those cancers treated primarily with radiotherapy and/or chemotherapy, salvage surgery is used if these tumours are incompletely treated or are recurrent.^{4–6}

The role of cancer surgeons

Surgeons are often the first specialists to see patients with cancers of the head and neck. As such, they are the gatekeepers to the cancer care system.³

Surgeons are usually responsible for establishing the diagnosis by performing a biopsy; determining the stage of the disease, usually through diagnostic imaging and other tests; and following patients regularly after treatment to detect any recurrences early. Surgeons are also responsible for performing the surgical removal of the tumour when that is warranted.

Surgeons are also involved in the coordination of patients' care, including referral to radiation and medical oncology when indicated. Complicated cases are presented at cancer tumour boards, and surgeons are often responsible for presenting such cases.

What we already know about patterns of care

Based on the current body of knowledge, cancer care is not delivered equally to all patients in the province of Ontario, and significant variations in exist in access, treatment and outcomes.¹ Depending on the region of residence at the time of diagnosis (LHIN), different types of surgical procedures may be offered to patients.¹ Possible reasons for this include surgeon training and preference, access to resources in the LHIN, patient preference and availability of alternate treatments.

Many studies show that cancer patients treated by higher-volume surgeons or at higher-volume hospitals have better outcomes (length of stay, readmission, survival).^{7–11} This is also true for head and neck cancer surgery.¹² An ICES study of head and neck cancer patients showed that hospital volume is a more important factor than surgeon volume, but both have a significant association with outcomes.¹³

Despite these important findings, there remain a number of unanswered questions. How many patients are developing these cancers in Ontario? Are there variations in surgical resection rates by social, demographic or regional factors? Who is performing these procedures? Where are they being performed? How far are patients travelling to receive care? How often are patients seeing radiation and medical oncologists? What other health services are they using? What resources will be needed to provide care to patients who develop these cancers in the future?

Health administrators and policy makers are constantly responding to concerns about equity, access, cost and quality of care in the delivery of cancer surgery in Ontario. One of our goals in producing this atlas, *Head and Neck Cancer Surgery in Ontario, 2003–2010*, is to assist policy makers with information that will aid them in their decision-making. This is particularly timely as quality-based procedures are being developed for cancer surgery in Ontario, where funding may potentially be linked to the quality of delivered care.¹⁴

Head and Neck Cancer in Ontario

Head and neck cancers are a heterogeneous group of cancers derived from the mucosa of the upper aerodigestive tract, which includes the oral cavity, nasopharynx, oropharynx, larynx, hypopharynx and paranasal sinuses (**Exhibit 1.1**). Tissues that produce saliva, including the submandibular and parotid glands, are also a major type of head and neck cancer: salivary gland cancer. Head and neck cancers together account for approximately 5% of cancers in the United States,¹⁵ but they represent a huge worldwide burden of disease and are some of the most common cancers in the developing world.

Changing incidence

As **Exhibit 1.2** demonstrates, the incidence of head and neck cancer in Ontario is changing.

The dramatic rise in oropharynx cancers in Ontario matches trends observed in the United States and Europe; this rise is linked to human papillomavirus (HPV), which is sexually transmitted.^{16,17} Tumours associated with HPV appear in a younger population than non-HPV-related tumours^{16,17} and are associated with significantly better survival outcomes compared to their non-HPV counterparts.

Salivary gland cancers appear to be on the rise, an unexpected finding. This is not explained by a rise in skin cancers in the head and neck region that may metastasize to the salivary glands, and it may be a result of mislabelling in the Ontario Cancer Registry. Skin cancer pathology and lymphoma were excluded in this assessment of incidence.

Incidence rates of larynx/hypopharynx, oral cavity and nasopharynx cancers have been stable over the last two decades in Ontario.

Atlas subsite focus

The larynx and hypopharynx subsites can be challenging to differentiate clinically and therefore have been studied in combination using ICES data. We chose to combine these two subsites in a single chapter for this reason. Oral cavity and salivary gland cancers are primarily surgically treated and are each assigned their own chapters.

Due to the low incidence of cancers of the nasopharynx and paranasal sinuses, neither of these subsites were amenable for summary in this atlas. Oropharynx cancer was not amenable for inclusion herein. There are several reasons for this. We found that many oropharynx cases were oral cavity cases that were inappropriately labelled in the Ontario Cancer Registry. This is in keeping with the subsite accuracy for the OCR which is 91%.¹⁸ Also, we found that we could not reliably code primary surgical treatment for (a) patients who were primarily treated with radiation or chemoradiation and then received surgery as a salvage procedure when they failed

EXHIBIT 1.1 Sagittal view of upper aerodigestive tract (left) and frontal view of oral cavity (right)

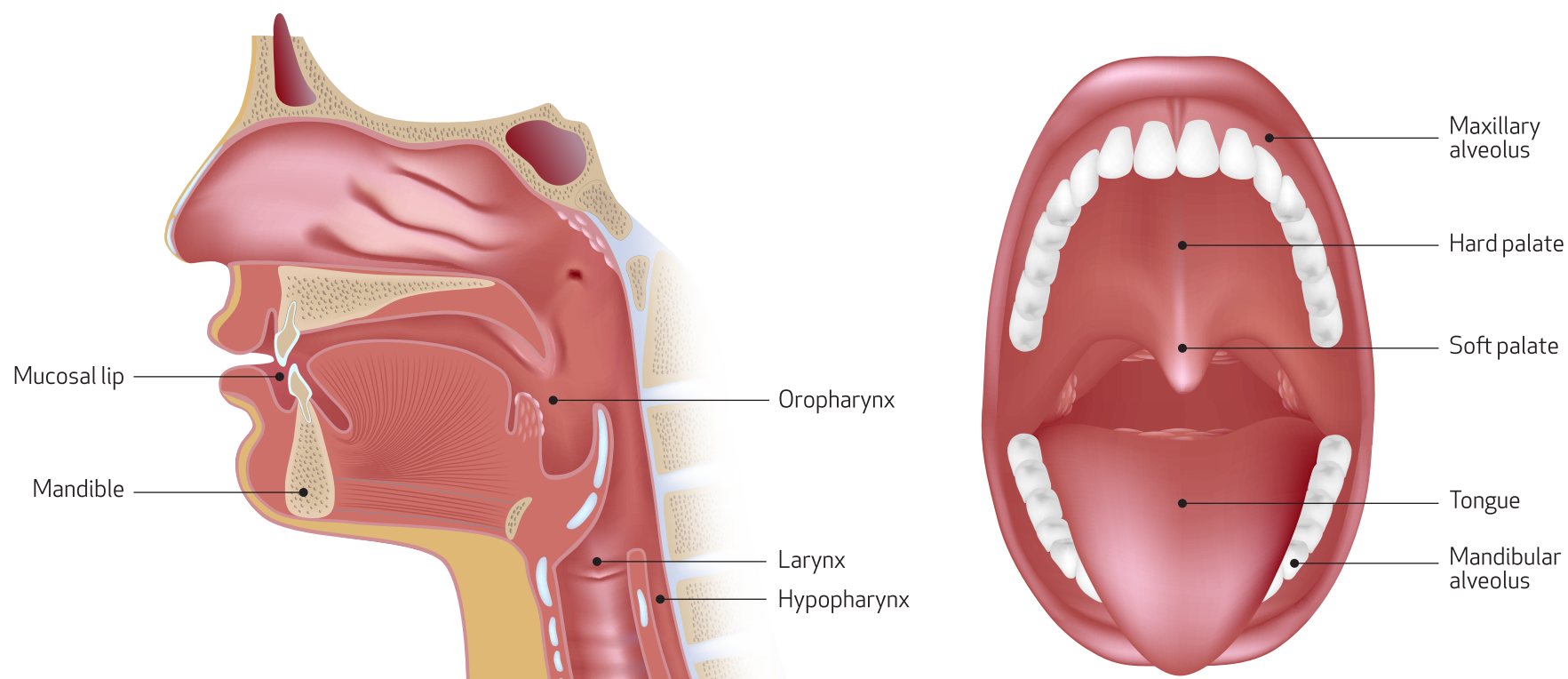
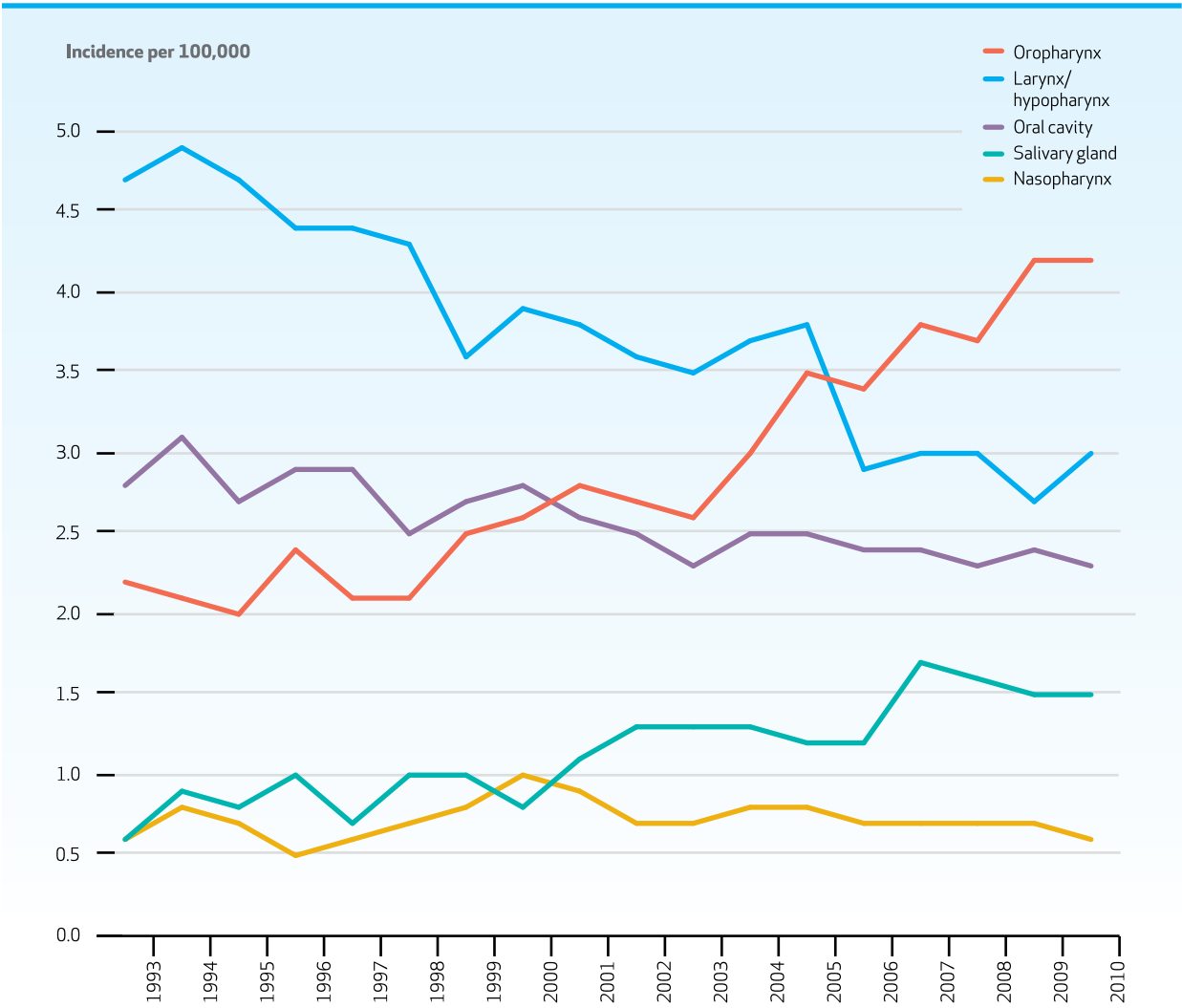


EXHIBIT 1.2 Age- and sex-standardized incidence of head and neck cancers per 100,000 population, in Ontario, 1993 to 2010



those other treatments, or (b) patients who received palliative treatments. This inability to define primary surgical resection patients from those receiving other treatments made it very difficult to define a surgical cohort and thus made the interpretation of surgical resources impossible. This subsite would benefit from a province-wide chart review to assess variations in practice.

How We Did the Research

Key questions about head and neck cancer surgery in Ontario

In developing this atlas, much like the previous cancer surgery atlases at ICES, we set out to address a variety of relevant and important questions about head and neck cancer surgery in Ontario:

- How many Ontarians are diagnosed with head and neck cancer and receive a surgical procedure as a result of their diagnosis?
- Among patients who undergo surgery for head and neck cancer, what procedures do they receive?
- Where do patients receive their surgery? How regionalized is the care delivered to these patients? How far do they have to travel to receive this care?

- What other health services are patients with head and neck cancer who receive surgery utilizing and does this differ from those that do not receive surgery?

Data is presented by age group, sex, neighbourhood income level, community size, and region (LHIN) of patient residence at the time of cancer diagnosis. Because we suspected that head and neck surgical oncologic care would largely be regionalized to a few centres, we also assessed differences by LHINs of treatment for key variations.

Data sources and methods

This atlas focuses on three subsites in the head and neck region: the larynx/hypopharynx, the oral cavity and the salivary gland. Reasons for exclusion of the nasopharynx, paranasal sinuses and oropharynx subsites have been previously described.

We present data on 6,470 patients in Ontario who were newly diagnosed with one of the three cancers between January 1, 2003, and December 31, 2010. This eight-year time frame was chosen to minimize the number of small cells that would have to be suppressed for privacy reasons, given the lower incidence of head and neck cancers compared to the cancers summarized in the 2008 ICES cancer surgery atlas.¹ We chose not to include data from prior to 2003, as information on radiation oncology was limited and this would have greatly affected the interpretability and relevance of our results.

We first identified incident cases of head and neck cancer in the Ontario Cancer Registry (OCR). The OCR has a 98% cancer capture rate in Ontario (except for nonmelanoma skin cancer) and goes back to 1964.¹⁹ The OCR identifies new cancer cases through hospital discharge and day-surgery summaries, pathology reports, patient records from regional cancer centres, and death certificates. Cancer stage is currently not captured.

Having identified our cohort of cancer patients, we then linked cases to records in the Ontario Health Insurance Plan, the Discharge Abstract Database, the National Ambulatory Care Reporting System, and the Registered Persons Database. This allowed us to determine which procedures, investigations and health resources used by patients identified in our cohort in a specific two-year time period – from 12 months before the date their cancers were diagnosed to 12 months after – similar to the previous cancer surgery atlas.¹ The Registered Persons Database allowed us to ascertain important demographic data, and this was linked to Statistics Canada postal code data to assess average family income as a surrogate for socioeconomic status.

Patients in the cancer system receive care for noncancer-related diseases and illnesses, and this was not captured in our atlas as our objective was to focus on health services related to the treatment of the cancer. Primary care services were not addressed.

Our approach to identifying cancer-related procedures and surgeries was similar to that used by the 2008 ICES cancer surgery atlas.¹ Rather than specifying a list of procedures at the outset of our analysis, we started by looking at all health services provided to patients with each specific type of cancer (i.e., each chapter). We then created a list of services that were used by more than 1% of all patients with that particular cancer. Using clinical experts on our research team, we were then able to go through this detailed list to determine which procedures were specifically related to cancer. This allowed us to capture diagnostic, curative and palliative procedures that might have otherwise been excluded. This methodology allowed us to include a variety of procedures that we would have otherwise potentially missed and was an excellent approach to assessing what health services these patients were utilizing.

Study populations

For each of the three head and neck cancer subsites chosen for our study, we identified study cohorts. These included all individuals 18 years of age or older who were identified as having that particular cancer in the Ontario Cancer Registry and whose diagnosis date fell between January 1, 2003, and December 31, 2010. These are referred to as the **Overall Cancer Cohorts**.

The Overall Cancer Cohorts were then divided into two pairs of smaller groups:

- The **Cancer Surgery Cohort** included anyone who had surgery related to their cancer during the period from 12 months before to 12 months after their diagnosis. The **Cancer/No Surgery Cohort** includes the remaining patients from the Overall Cohort which did not receive surgery related to their cancer.
- The **Cancer Resection Cohort** included anyone who had a resection of their cancer subsite during the period from 12 months before to 12 months after their diagnosis. The **Cancer/No Resection Cohort** included everyone in the **Overall Cohort** who did not have a surgical resection of their cancer subsite during the designated time period.

Content and Format of the Chapter Exhibits

Chapters 2, 3 and 4 of this atlas include exhibits that present our key findings in tabular form. These exhibits carry forward in the same format from chapter to chapter.

Some exhibits may have two or three parts with an alphanumeric designation. The first number identifies the chapter within the atlas that contains the exhibit; the second number identifies the number of the exhibit within the chapter. Thus, Exhibit 3.2 is the second exhibit in the third chapter.

In Chapters 2 through 4, exhibits with the same second number present similar information in a similar format; thus, Exhibits 2.1, 3.1 and 4.1 are similar in content and format.

The following overview outlines the content and format of each exhibit in Chapters 2 through 4, with the letter 'X' used as a stand-in for the chapter numbers.

Exhibit X.1 presents data on the incidence of each head and neck cancer in Ontario from 2003 to 2010. It also then divides this cohort into patients who received any form of surgical procedure related to their cancer diagnosis versus those who did not. A surgical procedure related to the cancer diagnosis is not limited to a resection procedure in which the cancer is removed by the surgeon but includes adjunctive procedures, such as tracheotomy tubes to assist patients with breathing and gastrostomy tubes to assist patients with feeding. The percentage of patients who received a surgical procedure are examined by age group, sex, neighbourhood income, community size and the Local Health Integration Network (LHIN) where patients were living at the time of their diagnosis (referred to as the LHIN of residence).

Socioeconomic status was measured using census data derived from patient postal code. Patients' neighbourhoods of residence were ranked according to how the average income in their neighbourhood compared to all other neighbourhoods in their city or metropolitan area. This was measured as an income quintile with a ranking of 1 indicating the least affluent neighbourhoods and a ranking of 5 indicating the wealthiest neighbourhoods.

Exhibit X.1A shows information for adults of both sexes, whereas Exhibits X.1B and X.1C present information for men and women, respectively.

Exhibits X.2 to X.8 focus on patients who received a definitive surgical resection (the Cancer Resection Cohorts) as opposed to patients who did not receive surgery or those who may have received a procedure related to their cancer but not a definitive surgical procedure to remove the cancer.

Exhibit X.2A presents the percentage of patients who underwent a surgical resection (as opposed to any cancer-related procedure). It focuses on certain aspects of health care use, including the average number of visits with a treating surgeon, the percentage of patients requiring more than one hospital admission, the frequency of admissions, and whether procedures were done on an inpatient basis (stayed at least one night in hospital) or outpatient basis (went home the same day as the procedure). Patients are classified by age group, sex, neighbourhood income level, community size and the Local Health Integration Network (LHIN) of residence and of treatment (where patients received surgical care).

Exhibit X.2B presents information on use of health care services but focuses on emergency department visits, Community Care Access Centre visits, length of stay in the intensive care unit, and hospital readmissions, all by LHIN of residence and of treatment.

Exhibit X.3 presents data on all the hospital admissions (both inpatient and outpatient) for resection surgery performed on those in the Cancer Resection Cohort. Here, the goal is to assess how many patients received cancer surgery in the LHIN where they were living when diagnosed. This exhibit also demonstrates the LHINs to which patients travelled to receive their resection. On the vertical axis is the LHIN of residence and on the horizontal axis is the LHIN of treatment. This exhibit depicts referral patterns and identifies high-volume LHINs of treatment.

Exhibit X.4 describes patterns of care as they relate to patients in the Cancer Resection Cohort where patients are grouped by definitive surgical procedure. Information is presented by sex, age group, neighbourhood income level, community size and LHIN of residence and of treatment.

Exhibit X.5 demonstrates geographic variations in the percentage of patients in the overall Cancer Resection Cohort who received a definitive surgical procedure by LHIN of residence. This could not be replicated for LHIN of treatment because we did not have an accurate way of determining where each of the patients in the overall Cancer Cohort were managed, as they were oftentimes managed at more than one centre despite not having received a surgical resection.

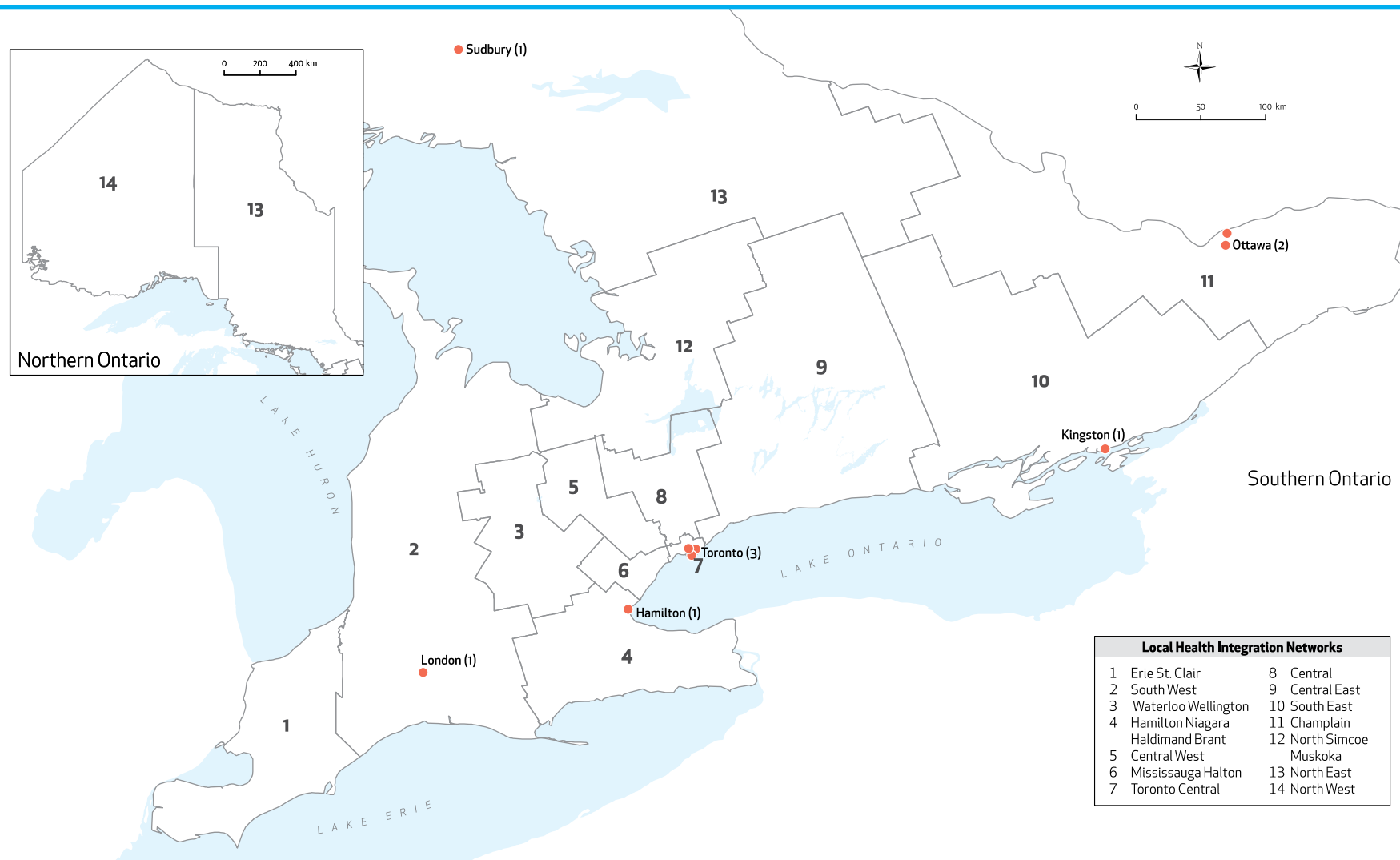
Exhibit X.6A presents information about the surgeons who operated on patients in the Cancer Resection Cohort. This is further categorized by the type of definitive procedure provided, according to surgical specialty. Data about surgical specialties were obtained from the Ontario Health Insurance Plan.

Exhibit X.6B presents information on the type of hospital where patients in each Cancer Resection Cohort underwent surgery for their cancers and the type of definitive procedure delivered by each hospital type. We considered classifying hospitals as academic (teaching) or community hospitals, but this would not have captured important information in Ontario. Head and neck cancer is rarer than the other cancers addressed in the 2008 ICES cancer surgery atlas.¹ In Ontario, there are nine hospitals at which fellowship-trained head and neck surgical oncologists and radiation oncologists manage these rare tumours; these hospitals are identified as head and neck cancer treatment centres in [Exhibit 1.3](#). We thus categorized our hospitals using this more important distinction as it demonstrates what percentage of procedures are being provided at nondesignated centres and is a measure of the degree of regionalization of head and neck cancer care in Ontario.

Exhibits X.7A, X.7B and X.7C present data on health services provided to patients in the Cancer Resection Cohort. These include cancer-related diagnostic and adjunctive procedures (panendoscopy, other endoscopy, biopsies, neck dissections, reconstructive procedures, tracheotomy and gastrostomy tubes), diagnostic imaging (head and neck, chest, and abdomen), and consultations and

services (radiation oncology, medical oncology and palliative care referrals). Each chapter differs slightly in the extent of the information included, as some anatomical cancer sites do not require many or any of these services. The exhibits only list health services that were provided to patients in the Cancer Resection Cohorts during a 24-month period (from 12 months before to 12 months after their definitive surgery). These exhibits are further organized by LHIN of residence and LHIN of treatment.

Exhibits X.8A, X.8B and X.8C present information on the health services described in X.7 but for the Cancer/No Resection Cohort during a 24-month period (from 12 months before to 12 months after their date of diagnosis). All information is presented by LHIN of patient residence only, as LHIN of treatment could not be accurately identified for the No Resection Cohort.

EXHIBIT 1.3 Map of head and neck cancer treatment centres, by Local Health Integration Network, in Ontario, 2010

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2 Surgery for Oral Cavity Cancer

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Summary

Issue

Oral cavity cancer is the 13th most common type of newly diagnosed cancer and the 15th most common cause of death due to cancer in Canada. Treatment of this cancer site can often affect a patient's swallowing, taste, speech, breathing and body image. A large multidisciplinary health team is often required for delivery of high-quality care to this patient group. For these reasons and due to the inherent complexity of treating this cancer, care should be confined to designated high-volume regional health care facilities.

Study

This chapter provides a snapshot of treatment patterns for adults newly diagnosed with oral cavity cancer in Ontario between January 1, 2003, and December 31, 2010. We focus on the delivery of surgical care and related health services and, where possible, include data regarding patient factors (sex, age, socioeconomic status and place of residence) and provider factors (surgical specialty and the location and type of hospital delivering services). We also assess the influence of patient and provider factors on the services provided.

Key findings

Nearly 85% of Ontario adults newly diagnosed with oral cavity cancer underwent a cancer-related surgical procedure for their disease within a year of diagnosis, and 75% had a definitive surgical procedure (an oral cavity resection).

Adults aged 75 or older who were newly diagnosed with oral cavity cancer were less likely to have a cancer-related surgery (or oral cavity resection) than younger people with this disease.

Significant variations existed among the nine head and neck cancer treatment centres in the province as to the rate of consultation with radiation oncologists and medical oncologists.

Of the 75% of patients in the study cohort who underwent an oral cavity resection procedure for oral cavity cancer, nearly half (49%) underwent a tongue resection. The more complex maxilla, mandible and mandibular alveolus resection procedures were more likely to be performed at one of the nine head and neck cancer treatment centres. These resections are a significant portion of the procedures required for this cohort (25%).

- A significant portion (90%) of the oral cavity cancer resection procedures done in Ontario between 2003 and 2010 were performed at head and neck cancer treatment centres.
- Among the province's 14 Local Health Integration Networks (LHINs), there were variations in the use of surgery and radiation therapy to treat newly diagnosed oral cavity cancer. There was

also variation in the use of palliative care consultation, which may reflect the availability of this service in the LHINs or differences in the stage (extent) of the disease at presentation.

Implications

- We noted variations in the use of surgical procedures and referral to specialists among oral cavity cancer patients residing in one LHIN and being treated in another. More research is necessary to understand this observation.
- The incidence of oral cavity cancer increases with age. As the Ontario population ages, there may be increasing demand for health services related to the diagnosis and treatment of this cancer.
- While care is largely confined to designated head and neck cancer treatment centres, 10% of cases are treated at centres with very low volumes (fewer than 10 cases per year).
- Variations in diagnostic workup, treatment approaches, adjunctive procedures and patient consultations exist even among regional head and neck cancer treatment centres with large caseloads.

Introduction

Tumours of the oral cavity constitute 2.8% of all new malignant cancers diagnosed annually in Canada; they account for approximately 2% of all deaths from cancer.¹ The oral cavity subsite, excluding the oropharynx, has historically been the second-most incident cancer of the upper aerodigestive tract, although the increasing incidence of oropharynx cancer has recently changed this order. There has been a moderate increase in incidence of oral cavity cancer in Canada, which mimics the trend in the United Kingdom.² In Canada, oral cavity cancer (including the oropharynx subsite) is the 13th most common newly diagnosed cancer and the 15th most common cause of death due to cancer for adults.¹ Recently published data estimate that 4,000 Canadians (2,700 men and 1,300 women) would be diagnosed with oral cavity cancer in 2012, and another 1,150 Canadians (800 men and 350 women) would die of the disease.¹

Oral cavity cancer is divided into two major groups according to the histology (tissue type) of the tumour. The majority of oral cavity cancers (90%) are of the squamous cell carcinoma type, which is this chapter's focus; the remainder involve a range of rare histologies.

Anatomically, the oral cavity starts at the lips and ends posteriorly at the circumvallate papillae (the border of the anterior two-thirds of the tongue and the posterior third) (see [Exhibit 1.1](#)). Superiorly, the oral cavity ends at the junction between the hard

palate and the soft palate. The area behind the oral cavity is referred to as the oropharynx and includes the remainder of the oropharyngeal tongue (the tongue base), the soft palate, the posterior pharyngeal wall and the tonsils. The oral cavity is very important for swallowing, taste and speech. Due to significant differences in the epidemiology and management of oral cavity and oropharynx cancer, these two subsites could not be included in the same chapter. We acknowledge the risk for their misclassification by physicians and in the Ontario Cancer Registry but believe that this chapter provides an adequate scoping review of the management of oral cavity cancer in Ontario.

While some cancers of the oral cavity (excluding the oropharynx) are diagnosed at an early stage, most patients with these cancers have advanced-stage disease at the time of diagnosis.³

Patients are sometimes treated with antibiotics or oral rinses for what is believed to be an oral ulcer or other more common noncancerous oral lesions before a referral to a specialist for biopsy and other diagnostic tests ultimately leads to a cancer diagnosis.

Role of surgery in diagnosis and staging

A definitive diagnosis of oral cavity cancer usually involves a biopsy of a suspicious-appearing lesion. Typically, this can be performed in an office setting. After a biopsy confirms cancer, a consultation with a surgeon with expertise in the evaluation and treatment of this cancer is arranged. A comprehensive head and neck examination is

performed that involves flexible fibre optic inspection of the upper aerodigestive tract, including the nasopharynx, oropharynx, larynx and hypopharynx. This allows for visualization to assess the extent of the primary lesion and, if necessary, for the biopsy (sampling or removal) of other suspicious lesions. Infrequently, an examination of the upper aerodigestive tract (referred to as a panendoscopy) is performed under general anesthetic when there is concern about a second malignancy and rarely to facilitate biopsy of a posterior oral cavity cancer.

Treatment of squamous cell carcinoma of the oral cavity

Following diagnosis, patients should undergo appropriate staging investigations to assess the extent—local, regional (neck) or distant—of their disease. The main curative treatment modality for oral cavity cancer is surgical resection of the primary tumour with a margin of surrounding normal tissue. In patients at risk of nodal metastases, surgical removal of the cervical lymph nodes, referred to as neck dissection is performed. Radiation with or without chemotherapy is less frequently used in the primary management of oral cavity cancer. Radiation or chemoradiation may be considered for very advanced tongue cancer in which surgery would result in total or near total glossectomy, tumours of the oral cavity with extensive oropharyngeal involvement, or patients who refuse or are not fit for surgery. Radiation or chemoradiation is often used postoperatively to treat the primary site or the neck

in patients with adverse pathologic features. Resection is largely dependent on the location and extent of disease, whether it is resectable and whether the patient will tolerate a major operation; there are also functional considerations such as the effect of resection on the patient's ability to speak, swallow, taste and breathe.⁴

Since the major risk factors for oral cavity cancer are tobacco and alcohol exposure, comorbid conditions such as smoking-related heart disease, chronic lung disease and alcohol-related liver disease are frequently present in this patient population. The presence of these health problems can sometimes limit the use of potentially curative surgical therapy for oral cavity cancer.

Type of surgical resection

Very small tumours are usually removed through the mouth, either in an operating room or at a procedure clinic. It is challenging in these circumstances to reliably distinguish a definitive resection from an excisional biopsy procedure using administrative data. For this reason, we defined definitive surgical procedures in this chapter based on resection codes for procedures performed in hospitals. These can be divided into resection by subsite (maxilla, mandible, mandibular alveolus, buccal, floor of mouth, tongue, and lip). The type of definitive procedure depends on tumour factors (location, extent), patient factors (comorbidities, preferences), and surgeon factors (ability to perform procedure).

How the study cohorts were defined

This chapter provides detailed information about surgical services and related health services delivered to adults newly diagnosed with oral cavity cancer (excluding oropharynx cancer) in Ontario from 2003 to 2010.

The study population for this chapter included all adults 18 years of age or older identified with oral cavity cancer in the Ontario Cancer Registry whose diagnosis date fell between January 1, 2003, and December 31, 2010. These are referred to as the **Overall Oral Cavity Cancer Cohort**.

The Overall Oral Cavity Cancer Cohort was then divided into two pairs of smaller groups.

For Exhibits 2.1A to 2.1C, the Overall Oral Cavity Cancer Cohort was divided as follows:

- The **Oral Cavity Surgery Cohort** included those who had surgery related to their oral cavity cancer within 12 months before or after their diagnosis date.
- The **Oral Cavity/No Surgery Cohort** included those who did not have surgery related to their oral cavity cancer within 12 months before or after their diagnosis date.

For Exhibits 2.2A to 2.8C, the Overall Oral Cavity Cancer Cohort was divided as follows:

- The **Oral Cavity Resection Cohort** included those who had resection of their primary tumour site within 12 months before or after their diagnosis date.
- The **Oral Cavity/No Resection Cohort** included those who did not have resection of their primary tumour site within 12 months before or after their diagnosis date. This group included all individuals who did not have surgery and those whose definitive surgery was limited to a surgical biopsy or adjunctive procedures (e.g., a tracheostomy or gastrostomy tube).

List of Exhibits

EXHIBIT 2.1A Incidence of oral cavity cancer and use of surgery among adults in the Overall Oral Cavity Cancer Cohort, by sex, age group, neighbourhood income quintile, community size and Local Health Integration Network of residence, in Ontario, 2003 to 2010

EXHIBIT 2.1B Incidence of oral cavity cancer and use of surgery among men in the Overall Oral Cavity Cancer Cohort, by age group, neighbourhood income quintile, community size and Local Health Integration Network of residence, in Ontario, 2003 to 2010

EXHIBIT 2.1C Incidence of oral cavity cancer and use of surgery among women in the Overall Oral Cavity Cancer Cohort, by age group, neighbourhood income quintile, community size and Local Health Integration Network of residence, in Ontario, 2003 to 2010

EXHIBIT 2.2A Health care use among adults in the Oral Cavity Cancer Resection Cohort, by sex, age group, neighbourhood income quintile, community size and Local Health Integration Network of residence and of treatment, in Ontario, 2003 to 2010

EXHIBIT 2.2B Health care use among adults in the Oral Cavity Cancer Resection Cohort, by Local Health Integration Network of residence and of treatment, in Ontario, 2003 to 2010

EXHIBIT 2.3 Hospital admissions for oral cavity surgery among men and women in the Oral Cavity Cancer Resection Cohort in the 12 months before and 12 months after their diagnosis, by Local Health Integration Network of residence and of treatment, in Ontario, 2003 to 2010

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EXHIBIT 2.5 Proportion of adults in the Overall Oral Cavity Cancer Cohort who received an oral cavity resection as a definitive procedure, by Local Health Integration Network of residence, in Ontario, 2003 to 2010

EXHIBIT 2.6A Overall pattern of surgical care provided to adults in the Oral Cavity Cancer Resection Cohort, by physician specialty, in Ontario, 2003 to 2010

EXHIBIT 2.6B Overall pattern of surgical care provided to adults in the Oral Cavity Cancer Resection Cohort, by hospital type, in Ontario, 2003 to 2010

EXHIBIT 2.7A Diagnostic and adjunctive procedures received by adults in the Oral Cavity Cancer Resection Cohort in the 12 months before and 12 months after their definitive surgery, by Local Health Integration Network of residence and of treatment in Ontario, 2003 to 2010

EXHIBIT 2.7B Radiologic services received by adults in the Oral Cavity Cancer Resection Cohort in the 12 months before and 12 months after their definitive surgery, by Local Health Integration Network of residence and of treatment, in Ontario, 2003 to 2010

EXHIBIT 2.7C Consultations and services received by adults in the Oral Cavity Cancer Resection Cohort in the 12 months before and 12 months after their definitive surgery, by Local Health Integration Network of residence and of treatment, in Ontario, 2003 to 2010

EXHIBIT 2.8A Diagnostic and adjunctive procedures received by adults in the Oral Cavity Cancer/No Resection Cohort in the 12 months before and 12 months after diagnosis, by Local Health Integration Network of residence, in Ontario, 2003 to 2010

EXHIBIT 2.8B Radiologic services received by adults in the Oral Cavity Cancer/No Resection Cohort in the 12 months before and 12 months after their definitive surgery, by Local Health Integration Network of residence, in Ontario, 2003 to 2010

EXHIBIT 2.8C Consultations and services received by adults in the Oral Cavity Cancer/No Resection Cohort in the 12 months before and 12 months after their definitive surgery, by Local Health Integration Network of residence, in Ontario, 2003 to 2010

EXHIBIT 2.1A Incidence of oral cavity cancer and use of surgery among adults in the Overall Oral Cavity Cancer Cohort, by sex, age group, neighbourhood income quintile, community size and Local Health Integration Network of residence, in Ontario, 2003 to 2010

Key Findings

- Men constituted 62% of all patients with oral cavity cancer in Ontario from 2003 to 2010. In the Overall Oral Cavity Cancer Cohort, the rate of oral cavity cancer cases per 100,000 population was higher among men (28.6) than women (14.6).
- The incidence of oral cavity cancer increased with age. Nearly half (47.3%) of newly diagnosed oral cavity cancers occurred in persons aged 65 or older, and a quarter (25.1%) occurred in those younger than age 55.
- The incidence of oral cavity cancer declined with increasing neighbourhood income.
- The incidence of oral cavity cancer increased with smaller community size. The proportion of Ontarians with oral cavity cancer who underwent cancer-related surgery decreased with smaller community size.
- There were variations in the incidence of oral cavity cancer across Local Health Integration Network (LHINs) of patient residence. The Central and Mississauga Halton LHINs had the lowest incidence rate (19 cases per 100,000) and the Erie St. Clair LHIN had the highest (23 cases per 100,000).
- The probability of undergoing surgery was lower for patients aged 75 or older (67%) compared to those in the younger age groups (all above 80%).
- Rates of surgery for oral cavity cancer varied across LHINs of patient residence. The proportion of patients in the cohort who had surgery for their disease ranged from a low of 77% among those living in the South East LHIN at the time of diagnosis to a high of 91% among those who resided in the South West LHIN.

EXHIBIT 2.1A *continued*

Characteristic	Age-standardized ¹ Incidence per 100,000	Overall Oral Cavity Cancer Cohort					
		Total		Had surgery		Did not have surgery	
		N	%	n	Age-standardized ² % of total	n	Age-standardized ² % of total
Ontario	21.3	2,196	100.0	1,786	85.3	410	14.7
Sex³							
Female	14.6	841	38.3	658	85.9	183	14.1
Male	28.6	1,355	61.7	1,128	85.2	227	14.8
Age group,³ years							
18–54	9.1	551	25.1	478	87.0	73	13.0
55–64	44.8	605	27.6	531	87.7	74	12.3
65–69	57.8	266	12.1	229	86.6	37	13.4
70–74	61.0	242	11.0	194	80.4	48	19.6
≥75	69.3	532	24.2	354	66.9	178	33.1
Neighbourhood income quintile							
Q1 (lowest)	24.0	466	21.2	379	86.6	87	13.4
Q2	23.7	495	22.5	398	82.9	97	17.1
Q3	19.8	403	18.4	337	87.7	66	12.3
Q4	20.1	413	18.8	328	84.8	85	15.2
Q5 (highest)	20.0	419	19.1	344	86.6	75	13.4
Community size (population)							
≥1,500,000	20.1	813	37.0	665	85.7	148	14.3
100,000–1,499,999	22.4	867	39.5	697	85.8	170	14.2
<100,000	22.4	516	23.5	424	83.7	92	16.3
LHIN of residence							
1. Erie St. Clair	23.0	130	5.9	101	85.1	29	14.9
2. South West	21.6	182	8.3	158	90.8	24	9.2
3. Waterloo Wellington	21.8	124	5.6	103	88.2	21	11.8
4. Hamilton Niagara Haldimand Brant	21.1	258	11.7	217	86.8	41	13.2
5. Central West	20.1	108	4.9	90	90.1	18	9.9
6. Mississauga Halton	19.1	149	6.8	118	81.3	31	18.7
7. Toronto Central	20.5	201	9.2	164	90.0	37	10.0
8. Central	19.1	246	11.2	202	84.6	44	15.4
9. Central East	20.2	256	11.7	212	82.3	44	17.7
10. South East	20.4	96	4.4	68	77.0	28	23.0
11. Champlain	20.3	207	9.4	154	83.7	53	16.3
12. North Simcoe Muskoka	19.7	79	3.6	66	81.1	13	18.9
13. North East	21.2	116	5.3	101	90.0	15	10.0
14. North West	20.6	44	2.0	32	84.5	12	15.5

¹ Standardized to the 1991 Canadian census.² Standardized to the Overall Oral Cavity Cancer Cohort.³ Sex-specific rates have been adjusted for age; age-specific rates have been adjusted for sex.

EXHIBIT 2.1B Incidence of oral cavity cancer and use of surgery among men in the Overall Oral Cavity Cancer Cohort, by age group, neighbourhood income quintile, community size and Local Health Integration Network of residence, in Ontario, 2003 to 2010

Key Findings

- The findings shown in this exhibit are similar to those in **Exhibit 2.1A**; that is, both the incidence of oral cavity cancer and the proportion of men who had surgery were related to age.
- Among men, the incidence of oral cavity cancer and the proportion of patients who had surgery were both related to income. For example, men in the lowest income group had the highest incidence of this cancer (34 cases per 100,000). Among men in the highest income group, 91% had received cancer-related surgery, the largest proportion overall.
- The incidence of oral cavity cancer was highest for men living in smaller communities at the time of their diagnosis (29 cases per 100,000).
- Men living in the North East Local Health Integration Network (LHIN) had the highest incidence of oral cavity cancer (31 cases per 100,000) and those living in the Central LHIN had the lowest (22 cases per 100,000).
- Men living in the North East LHIN were the most likely to have oral cavity cancer-related surgery (97%), while those living in the South East LHIN were the least likely (74%).

Characteristic	Age-standardized ¹ Incidence per 100,000	Overall Oral Cavity Cancer Cohort					
		Total		Had surgery		Did not have surgery	
		N	%	n	Age-standardized ² % of total	n	Age-standardized ² % of total
Ontario	28.6	1,355	100.0	1,128	85.5	227	14.5
Age group,³ years							
18-54	5.0	391	28.9	338	86.4	53	13.6
55-64	35.9	430	31.7	378	87.9	52	12.1
65-69	35.1	175	12.9	149	85.1	26	14.9
70-74	37.8	138	10.2	109	79.0	29	21.0
≥75	45.5	221	16.3	154	69.7	67	30.3
Neighbourhood income quintile							
Q1 (lowest)	33.5	305	22.5	258	85.5	47	14.5
Q2	31.1	308	22.7	257	83.3	51	16.7
Q3	25.1	247	18.2	208	88.7	39	11.3
Q4	24.1	245	18.1	196	79.4	49	20.6
Q5 (highest)	23.9	250	18.5	209	91.0	41	9.0
Community size (population)							
≥1,500,000	25.6	502	37.0	420	86.2	82	13.8
100,000-1,499,999	28.5	531	39.2	440	83.8	91	16.2
<100,000	28.7	322	23.8	268	87.1	54	12.9
LHIN of residence							
1. Erie St. Clair	29.0	80	5.9	61	76.5	19	23.5
2. South West	27.9	113	8.3	99	85.5	14	14.5
3. Waterloo Wellington	27.9	79	5.8	65	85.0	14	15.0
4. Hamilton Niagara Haldimand Brant	27.0	158	11.7	135	85.8	23	14.2
5. Central West	26.5	73	5.4	65	89.2	8	10.8
6. Mississauga Halton	23.3	92	6.8	74	78.5	18	21.5
7. Toronto Central	28.0	131	9.7	108	91.5	23	8.5
8. Central	21.6	138	10.2	117	86.3	21	13.7
9. Central East	24.1	149	11.0	127	85.7	22	14.3
10. South East	25.7	60	4.4	43	73.7	17	26.3
11. Champlain	23.9	119	8.8	95	85.2	24	14.8
12. North Simcoe Muskoka	26.9	53	3.9	45	81.3	8	18.7
13. North East	30.8	83	6.1	74	96.5	9	3.5
14. North West	24.7	27	2.0	20	92.3	7	7.7

¹ Standardized to the 1991 Canadian census.

² Standardized to the Overall Oral Cavity Cancer Cohort.

³ Age-specific rates have not been standardized.

EXHIBIT 2.1C Incidence of oral cavity cancer and use of surgery among women in the Overall Oral Cavity Cancer Cohort, by age group, neighbourhood income quintile, community size and Local Health Integration Network of residence, in Ontario, 2003 to 2010

Key Findings

- The incidence of oral cavity cancer among Ontario women increased markedly with age from 2003 to 2010. The rate was highest among women aged 75 or older (39 cases per 100,000).
- Across the Local Health Integration Networks (LHINs) of patient residence, the highest incidence of oral cavity cancer was among women living in the Erie St. Clair LHIN at the time of diagnosis (17 cases per 100,000). The lowest incidence was among those who resided in the North East LHIN (1.2 cases per 100,000).
- Women in the Overall Oral Cavity Cancer Cohort who were aged 75 or older at the time of diagnosis were less likely to undergo surgery related to their cancer than similarly aged men in the same cohort.
- The age-standardized proportion of women in the study cohort who underwent surgery related to their oral cavity cancer in the 12 months before or after diagnosis was highest among those living in the South West LHIN (96%).

Characteristic	Age-standardized ¹ Incidence per 100,000	Overall Oral Cavity Cancer Cohort					
		Total		Had surgery		Did not have surgery	
		N	%	n	Age-standardized ² % of total	n	Age-standardized ² % of total
Ontario	15.7	841	100.0	658	85.5	183	14.5
Age group,³ years							
18–54	2.1	160	19.0	140	87.5	20	12.5
55–64	14.2	175	20.8	153	87.4	22	12.6
65–69	15.5	91	10.8	80	87.9	11	12.1
70–74	22.1	104	12.4	85	81.7	19	18.3
≥75	38.5	311	37.0	200	64.3	111	35.7
Neighbourhood income quintile							
Q1 (lowest)	14.9	161	19.1	121	87.7	40	12.3
Q2	16.6	187	22.2	141	82.5	46	17.5
Q3	14.8	156	18.5	129	86.8	27	13.2
Q4	16.3	168	20.0	132	89.9	36	10.1
Q5 (highest)	16.2	169	20.1	135	82.4	34	17.6
Community size (population)							
≥1,500,000	14.8	311	37.0	245	85.3	66	14.7
100,000–1,499,999	16.5	336	40.0	257	87.7	79	12.3
<100,000	16.3	194	23.1	156	80.5	38	19.5
LHIN of residence							
1. Erie St. Clair	17.3	50	5.9	40	93.4	10	6.6
2. South West	15.6	69	8.2	59	95.9	10	4.1
3. Waterloo Wellington	16.0	45	5.4	38	91.2	7	8.8
4. Hamilton Niagara Haldimand Brant	15.4	100	11.9	82	87.8	18	12.2
5. Central West	14.1	35	4.2	25	91.1	10	8.9
6. Mississauga Halton	15.0	57	6.8	44	84.0	13	16.0
7. Toronto Central	13.4	70	8.3	56	88.6	14	11.4
8. Central	16.7	108	12.8	85	83.0	23	17.0
9. Central East	16.4	107	12.7	85	79.0	22	21.0
10. South East	15.3	36	4.3	25	80.2	11	19.8
11. Champlain	16.8	88	10.5	59	82.3	29	17.7
12. North Simcoe Muskoka	12.7	26	3.1	*	*	*	*
13. North East	11.9	33	3.9	27	83.7	6	16.3
14. North West	16.7	17	2.0	*	*	*	*

¹ Standardized to the 1991 Canadian census.

² Standardized to the Overall Oral Cavity Cancer Cohort.

³ Age-specific rates have not been standardized.

* In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

EXHIBIT 2.2A Type and number of health care services used by adults in the Oral Cavity Cancer Resection Cohort, by sex, age group, neighbourhood income quintile, community size and Local Health Integration Network of residence and treatment, in Ontario, 2003 to 2010

Key Findings

- Approximately 64% of hospital admissions for patients in the Oral Cavity Cancer Resection Cohort were for inpatient care; the remaining 36% were for ambulatory (same-day) care.
- Fifty-eight percent of patients in this cohort had more than one hospital admission in the 12 months before and after their cancer diagnosis.
- Patients residing in the South East Local Health Integration Network (LHIN) at the time of their diagnosis had the highest rate of same-day admissions (49%) in the 12 months before and after their oral cavity resection.
- Patients in this cohort averaged 4.1 visits with their treating surgeon in the 12 months before and after their oral cavity resection.
- Patients in this cohort had an average hospital length of stay of 9.4 days for their oral cavity resection procedure.
- Patients treated in seven of the LHINs (Erie St. Clair, Waterloo Wellington, Central West, Mississauga Halton, Central, Central East and North Simcoe Muskoka) had very short hospital stays (less than three days) for their oral cavity resection procedures. These patients may have had smaller resections that do not require a long hospital stay.

EXHIBIT 2.2A *continued*

Characteristic	Cohort, N	Patients who had surgical resection, %	Visits with treating surgeon, avg per patient ¹	Patients with more than one hospital admission, %	Total hospital admissions, ² n	Admissions, avg per patient ²	Same-day surgery as % of total admissions	Inpatient admissions as % of total admissions	Avg. length of stay, days	Median length of stay (IQR), days	Patients with preoperative XRT or chemotherapy, %
Ontario	1,640	74.7	4.1	58.2	3,566	2.2	36.4	63.6	9.4	8 (2–13)	3.2
Sex³											
Female	620	73.7	4.2	57.3	1,315	2.1	36.3	63.7	9.3	7 (1–13)	3.5
Male	1,020	75.3	4.0	58.7	2,251	2.2	36.5	63.5	9.4	8 (2–13)	3.0
Age group,³ years											
18–54	442	80.2	4.4	58.4	944	2.1	31.9	68.1	7.9	7 (2–12)	2.5
55–64	488	80.7	4.2	57.4	1,050	2.2	34.2	65.8	9.5	8 (2–13)	3.5
65–69	206	77.4	4.1	58.3	462	2.2	34.6	65.4	10.7	9 (2–15)	4.9
70–74	185	76.4	4.0	54.1	399	2.2	43.6	56.4	10.1	7 (1–13)	3.2
≥75	319	60.0	3.7	61.4	711	2.2	42.8	57.2	10.0	6 (1–14)	2.8
Neighbourhood income quintile											
Q1 (lowest)	331	71.0	3.9	58.6	716	2.2	34.6	65.4	9.7	8 (2–14)	2.4
Q2	370	74.7	4.1	58.6	803	2.2	34.0	66.0	10.5	9 (2–14)	3.5
Q3	311	77.2	4.1	55.3	692	2.2	40.6	59.4	9.0	7 (2–13)	2.3
Q4	305	73.8	4.3	58.7	649	2.1	36.1	63.9	8.9	7 (1–12)	3.6
Q5 (highest)	323	77.1	4.2	59.4	706	2.2	37.1	62.9	8.6	7 (1–13)	4.3
Community size (population)											
≥1,500,000	600	73.8	4.2	55.5	1,284	2.1	30.8	69.2	10.0	8 (2–14)	3.5
100,000–1,499,999	649	74.9	4.3	59.6	1,385	2.1	38.9	61.1	8.8	7 (1–13)	3.5
<100,000	391	75.8	3.6	59.8	897	2.3	40.5	59.5	9.4	8 (1–14)	2.3

¹ The time frame for surgeon visits was 6 months before to 6 months after the first surgery.² The time frame for hospital admissions was 12 months before to 12 months after the first surgery.³ Standardized to the Overall Oral Cavity Cancer Cohort; sex-specific rates have been adjusted for age; age-specific rates have been adjusted for sex.

IQR = interquartile range; XRT = cetuximab and radiation.

EXHIBIT 2.2A *continued*

Characteristic	Cohort, N	Patients who had surgical resection, %	Visits with treating surgeon, avg per patient ¹	Patients with more than one hospital admission, %	Total hospital admissions, ² n	Admissions, avg per patient ²	Same-day surgery as % of total admissions	Inpatient admissions as % of total admissions	Avg. length of stay, days	Median length of stay (IQR), days	Patients with preoperative XRT or chemotherapy, %
LHIN of residence											
1. Erie St. Clair	95	73.1	3.4	62.1	211	2.2	40.8	59.2	8.5	8 (1-13)	*
2. South West	155	85.2	3.7	51.6	304	2.0	28.0	72.0	10.6	9 (2-13)	*
3. Waterloo Wellington	97	78.2	3.8	56.7	204	2.1	39.7	60.3	8.5	6 (2-11)	*
4. Hamilton Niagara Haldimand Brant	203	78.7	4.3	62.6	442	2.2	44.8	55.2	6.9	6 (0-10)	*
5. Central West	80	74.1	4.1	60.0	188	2.4	33.5	66.5	10.2	9.5 (4-14)	*
6. Mississauga Halton	110	73.8	4.0	57.3	239	2.2	23.8	76.2	10.4	8 (2-15)	*
7. Toronto Central	144	71.6	4.2	50.7	288	2.0	26.0	74.0	10.7	7 (2-14)	*
8. Central	185	75.2	4.4	56.8	388	2.1	38.7	61.3	9.0	7 (2-12)	*
9. Central East	189	73.8	4.1	57.7	436	2.3	33.5	66.5	10.2	9 (3-14)	*
10. South East	65	67.7	4.3	58.5	165	2.5	49.1	50.9	7.3	5 (1-11)	*
11. Champlain	142	68.6	5.0	59.9	302	2.1	35.4	64.6	10.7	9 (1-15)	*
12. North Simcoe Muskoka	58	73.4	3.4	56.9	128	2.2	35.2	64.8	8.6	5 (2-14)	*
13. North East	89	76.7	3.8	64.0	199	2.2	46.7	53.3	9.1	10 (0-15)	*
14. North West	28	63.6	3.8	78.6	72	2.6	43.1	56.9	11.5	11 (3-16)	*
LHIN of treatment											
1. Erie St. Clair	16	**	4.2	68.8	41	2.6	68.3	31.7	0.8	0 (0-1)	*
2. South West	275	**	3.7	54.9	562	2.0	30.8	69.2	10.0	9 (3-13)	*
3. Waterloo Wellington	10	**	2.9	70.0	22	2.2	72.7	27.3	0.8	0 (0)	*
4. Hamilton Niagara Haldimand Brant	218	**	4.2	61.9	467	2.1	44.5	55.5	7.4	6 (0-10)	*
5. Central West	6	**	2.3	*	12	2.0	*	58.3	1.5	1.5 (1-2)	*
6. Mississauga Halton	7	**	6.3	*	15	2.1	46.7	53.3	1.9	2 (1-3)	*
7. Toronto Central	778	**	4.1	56.2	1,678	2.2	29.3	70.7	10.6	9 (3-14)	*
A. University Health Network	459	**	3.7	56.6	1,012	2.2	27.7	72.3	11.6	10 (3-16)	*
B. Sunnybrook Health Sciences Centre	151	**	4.7	59.6	315	2.1	37.8	62.2	10.1	9 (6-13)	*
C. Mount Sinai Hospital	142	**	4.5	50.0	288	2.0	26.0	74.0	8.3	4 (2-11)	*
D. Other	26	**	5.1	61.5	63	2.4	28.6	71.4	7.2	3.5 (0-11)	*
8. Central	11	**	2.0	81.8	30	2.7	80.0	20.0	0.3	0 (0)	*
9. Central East	21	**	3.8	61.9	55	2.6	69.1	30.9	2.9	0 (0-1)	*
10. South East	49	**	4.0	61.2	132	2.7	49.2	50.8	6.9	5 (1-11)	*
11. Champlain	155	**	5.0	60.0	338	2.2	37.6	62.4	10.3	9 (1-14)	*
12. North Simcoe Muskoka	8	**	2.6	*	16	2.0	62.5	37.5	0.8	0 (0-1.5)	*
13. North East	73	**	3.8	64.4	160	2.2	51.3	48.8	8.5	9 (0-14)	*
14. North West	13	**	6.7	76.9	38	2.9	60.5	39.5	8.2	5 (0-12)	*

¹ The time frame for surgeon visits was 6 months before to 6 months after the first surgery.² The time frame for hospital admissions was 12 months before to 12 months after the first surgery.³ Standardized to the Overall Oral Cavity Cancer Cohort; sex-specific rates have been adjusted for age; age-specific rates have been adjusted for sex.

* In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

** A percentage could not be derived as it is difficult to determine the denominator of patients that presented to each treatment LHIN using administrative data.

IQR = interquartile range; XRT = cetuximab and radiation.

EXHIBIT 2.2B Type and number of health care services used by adults in the Oral Cavity Cancer Resection Cohort, by Local Health Integration Network of treatment, in Ontario, 2003 to 2010

Key Findings

- Patients treated by oral cavity resection had, on average, less than 1 day (0.8 days) in the intensive care unit during their oral cavity resection admission. This varied by the LHIN of the treating institution, potentially reflecting differing tumour sizes and variation in the complexity of procedures performed by different institutions.
- Ten percent of patients undergoing an oral cavity resection procedure in Ontario between 2003 and 2010 were readmitted to hospital within 30 days of discharge. Even among LHINs with the highest treatment volumes, there was variation in the rate of readmission. The readmission rate was highest in the Hamilton Niagara Haldimand Brant LHIN (15%).

Characteristic	Cohort, N	ED Visits		CCAC Visits		ICU Days		Hospital Readmissions		
		n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Patients readmitted	
									n	%
Ontario	1,640	2,372	1.4	43,457	26.5	1,254	0.8	198	171	10.4
LHIN of residence										
1. Erie St. Clair	95	190	2.0	3,298	34.7	49	0.5	11	11	11.6
2. South West	155	360	2.3	4,251	27.4	149	1.0	13	11	7.1
3. Waterloo Wellington	97	102	1.1	2,953	30.4	29	0.3	13	12	12.4
4. Hamilton Niagara Haldimand Brant	203	312	1.5	6,437	31.7	67	0.3	30	26	12.8
5. Central West	80	87	1.1	1,995	24.9	72	0.9	*	*	*
6. Mississauga Halton	110	163	1.5	2,672	24.3	58	0.5	13	13	11.8
7. Toronto Central	144	175	1.2	3,700	25.7	147	1.0	22	20	13.9
8. Central	185	168	0.9	4,357	23.6	138	0.7	19	16	8.6
9. Central East	189	195	1.0	4,799	25.4	159	0.8	29	23	12.2
10. South East	65	105	1.6	1,195	18.4	31	0.5	*	*	*
11. Champlain	142	247	1.7	3,806	26.8	103	0.7	21	16	11.3
12. North Simcoe Muskoka	58	69	1.2	1,107	19.1	17	0.3	*	*	*
13. North East	89	152	1.7	1,939	21.8	213	2.4	13	11	12.4
14. North West	28	47	1.7	948	33.9	22	0.8	6	*	*
LHIN of treatment										
1. Erie St. Clair	16	18	1.1	*	*	*	*	*	*	*
2. South West	275	569	2.1	8,991	32.7	214	0.8	26	24	8.7
3. Waterloo Wellington	10	8	0.8	145	14.5	*	*	*	*	*
4. Hamilton Niagara Haldimand Brant	218	334	1.5	7,468	34.3	58	0.3	37	32	14.7
5. Central West	6	*	*	60	10.0	*	*	0	0	0.0
6. Mississauga Halton	7	*	*	*	*	0	0.0	0	0	0.0
7. Toronto Central	778	914	1.2	19,563	25.1	634	0.8	89	79	10.2
A. University Health Network	459	590	1.3	12,470	27.2	123	0.3	47	42	9.2
B. Sunnybrook Health Sciences Centre	151	145	1.0	4,503	29.8	350	2.3	23	20	13.2
C. Mount Sinai Hospital	142	152	1.1	2,071	14.6	104	0.7	14	13	9.2
D. Other	26	27	1.0	519	20.0	57	2.2	*	*	*
8. Central	11	18	1.6	196	17.8	*	*	*	*	*
9. Central East	21	27	1.3	254	12.1	*	*	*	*	*
10. South East	49	64	1.3	734	15.0	10	0.2	*	*	*
11. Champlain	155	278	1.8	4,060	26.2	110	0.7	22	17	11.0
12. North Simcoe Muskoka	8	14	1.8	45	5.6	0	0.0	*	*	*
13. North East	73	96	1.3	1,568	21.5	201	2.8	7	7	9.6
14. North West	13	22	1.7	325	25.0	9	0.7	*	*	*

¹ The denominator includes all patients in the Larynx/Hypopharynx Cancer Resection Cohort.

* In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

** The LHIN did not treat any patients from the Cancer Resection Cohort (i.e., no laryngectomies were performed in the LHIN).

ED = emergency department; CCAC = Community Care Access Centre; ICU = intensive care unit.

EXHIBIT 2.2C Type and number of health care services used by adults in the Oral Cavity Cancer Resection Cohort, by Local Health Integration Network of residence, in Ontario, 2003 to 2010

Key Findings

- Patients treated by oral cavity resection averaged 1.4 emergency department visits in the 12 months before and 12 months after their definitive resection procedure.
- Patients treated by oral cavity resection received 26.5 Community Care Access Centre (CCAC) visits, on average, in the 12 months before and after their definitive resection procedure. Patients residing in the Erie St. Clair LHIN at the time of diagnosis received the most CCAC visits (34.7); those living in the South East LHIN received the fewest (18.4).

Characteristic	Cohort, N	ED Visits		CCAC Visits		ICU Days		Hospital Readmissions		
		n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Patients readmitted	
									n	%
Ontario	1,640	2,372	1.4	43,457	26.5	1,254	0.8	198	171	10.4
LHIN of residence										
1. Erie St. Clair	95	190	2.0	3,298	34.7	49	0.5	11	11	11.6
2. South West	155	360	2.3	4,251	27.4	149	1.0	13	11	7.1
3. Waterloo Wellington	97	102	1.1	2,953	30.4	29	0.3	13	12	12.4
4. Hamilton Niagara Haldimand Brant	203	312	1.5	6,437	31.7	67	0.3	30	26	12.8
5. Central West	80	87	1.1	1,995	24.9	72	0.9	*	*	*
6. Mississauga Halton	110	163	1.5	2,672	24.3	58	0.5	13	13	11.8
7. Toronto Central	144	175	1.2	3,700	25.7	147	1.0	22	20	13.9
8. Central	185	168	0.9	4,357	23.6	138	0.7	19	16	8.6
9. Central East	189	195	1.0	4,799	25.4	159	0.8	29	23	12.2
10. South East	65	105	1.6	1,195	18.4	31	0.5	*	*	*
11. Champlain	142	247	1.7	3,806	26.8	103	0.7	21	16	11.3
12. North Simcoe Muskoka	58	69	1.2	1,107	19.1	17	0.3	*	*	*
13. North East	89	152	1.7	1,939	21.8	213	2.4	13	11	12.4
14. North West	28	47	1.7	948	33.9	22	0.8	6	*	*

¹ The denominator includes all patients in the Oral Cavity Cancer Resection Cohort.

* In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

ED = emergency department; CCAC = Community Care Access Centre; ICU = intensive care unit.

EXHIBIT 2.3 Hospital admission for oral cavity surgery among adults in the Oral Cavity Cancer Resection Cohort in the 12 months before and 12 months after diagnosis, by Local Health Integration Network of residence and of treatment, in Ontario, 2003 to 2010

Key Findings

- Half (49%) of all oral cavity resections were done outside the Local Health Integration Networks (LHINs) where the patients resided at the time of diagnosis. (Note: Some data are suppressed due to small cell size.)
- Approximately 18% of oral cavity resection procedures undertaken in hospitals in the Toronto Central LHIN were performed on patients who lived in this LHIN when their cancers were diagnosed. The majority of oral cavity resection procedures undertaken in the Toronto Central LHIN were performed on patients who lived in other LHINs, including the Central (23%) and Central East (22%) LHINs.
- Across the province, 78% of oral cavity resection procedures undergone by patients in the cohort were performed in hospitals in the South West, Hamilton Niagara Haldimand Brant, and Toronto Central LHINs.

EXHIBIT 2.3 continued

LHIN of Residence	LHIN of Treatment														Ontario
	1. Erie St. Clair	2. South West	3. Waterloo Wellington	4. Hamilton Niagara Haldimand Brant	5. Central West	6. Mississauga Halton	7. Toronto Central	8. Central	9. Central East	10. South East	11. Champlain	12. North Simcoe Muskoka	13. North East	14. North West	
Admissions, n (Column %, Row %) ¹															
1. Erie St. Clair	*	79 (83.2, 28.7)					*								95 (5.8, 100.0)
2. South West		143 (92.3, 52.0)	*	*			6 (3.9, 0.8)								155 (5.9, 100.0)
3. Waterloo Wellington	*	43 (44.3, 15.6)	*	27 (27.8, 12.4)			20 (20.6, 2.6)								97 (5.9, 100.0)
4. Hamilton Niagara Haldimand Brant		*		184 (90.6, 84.4)			12 (5.9, 1.5)				*				203 (12.4, 100.0)
5. Central West					*		73 (91.3, 9.4)	*							80 (4.9, 100.0)
6. Mississauga Halton		*		*		7 (6.4, 100.0)	98 (89.1, 12.6)								110 (6.7, 100.0)
7. Toronto Central		*					140 (97.2, 18.0)	*	*						144 (8.8, 100.0)
8. Central							175 (94.6, 22.5)	*	*						185 (11.3, 100.0)
9. Central East				*			168 (88.9, 21.6)		16 (8.5, 76.2)	*					189 (11.5, 100.0)
10. South East							8 (12.3, 1.0)			45 (69.2, *)	12 (18.5, 7.7)				65 (4.0, 100.0)
11. Champlain							*				*				142 (8.7, 100.0)
12. North Simcoe Muskoka							45 (77.6, 5.8)	*			*	8 (13.8, 100.0)	*		58 (3.5, 100.0)
13. North East		*					*						71 (79.8, *)		89 (5.4, 100.0)
14. North West							15 (53.6, 1.9)							13 (46.4, 100.0)	28 (1.7, 100.0)
Ontario	16 (100.0, 1.0)	275 (100.0, 16.8)	10 (100.0, 0.6)	218 (100.0, 13.3)	*	7 (100.0, 0.4)	778 (100.0, 47.4)	11 (100.0, 0.7)	21 (100.0, 1.3)	*	155 (100.0, 9.5)	8 (100.0, 0.5)	*	13 (100.0, 0.8)	1,640 (100.0, 100.0)

¹ Column % = the proportion of patients having oral cavity cancer surgery in a given LHIN who were residents of that LHIN when diagnosed, and the proportion who were residents of other LHINs. Row % = the proportion of patients having oral cavity cancer surgery in a given LHIN who had surgery in their LHIN of residence, and the proportion who had the surgery in other LHINs.

*In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated. Totals may not sum due to small-cell suppression.

EXHIBIT 2.4 Type of definitive resection procedure among adults in the Oral Cavity Cancer Resection Cohort, by sex, age group, neighbourhood income quintile, community size and Local Health Integration Network of residence and of treatment, in Ontario, 2003 to 2010

Key Findings

- Only 2% of maxilla, mandible and mandibular alveolus resections were performed outside of the Local Health Integration Networks with designated head and neck cancer treatment centres, indicating that these resections are highly regionalized.
- With increasing age, patients were more likely to have a maxilla or mandibular alveolus resection and less likely to receive a tongue resection. For example, 3% of patients aged 55 to 64 received a maxilla resection compared to 10% of those aged 75 or older.
- In the Oral Cavity Resection Cohort, the rate of maxilla resection was lowest among those living in the lowest-income neighbourhoods (4%) and highest among those living in the highest-income neighbourhoods (8%). A similar trend was observed for mandibular alveolus resection. The opposite trend was observed for floor of mouth resection.

Characteristic	Cohort, N	Definitive Resection Procedure													
		Maxilla		Mandible		Mandibular alveolus		Buccal		Floor of mouth		Tongue		Lip	
		n	%	n	%	n	%	n	%	n	%	n	%	n	%
Ontario	1,640	91	5.5	307	18.7	55	3.4	111	6.8	251	15.3	795	48.5	30	1.8
Sex															
Female	620	43	6.9	116	18.7	31	5.0	46	7.4	76	12.3	301	48.5	7	1.1
Male	1,020	48	4.7	191	18.7	24	2.4	65	6.4	175	17.2	494	48.4	23	2.3
Age group,³ years															
18–54	442	18	4.1	63	14.3	*	*	24	5.4	61	13.8	271	61.3	*	*
55–64	488	13	2.7	95	19.5	20	4.1	29	5.9	85	17.4	243	49.8	*	*
65–69	206	11	5.3	52	25.2	7	3.4	5	2.4	43	20.9	85	41.3	*	*
70–74	185	16	8.6	42	22.7	*	*	16	8.6	27	14.6	70	37.8	8	4.3
≥75	319	33	10.3	55	17.2	19	6.0	37	11.6	35	11.0	126	39.5	14	4.4
Neighbourhood income quintile															
Q1 (lowest)	331	13	3.9	66	19.9	7	2.1	16	4.8	68	20.5	155	46.8	6	1.8
Q2	370	17	4.6	78	21.1	14	3.8	34	9.2	51	13.8	173	46.8	*	*
Q3	311	18	5.8	49	15.8	11	3.5	24	7.7	44	14.1	157	50.5	8	2.6
Q4	305	16	5.2	56	18.4	11	3.6	19	6.2	44	14.4	153	50.2	*	*
Q5 (highest)	323	27	8.4	58	18.0	12	3.7	18	5.6	44	13.6	157	48.6	7	2.2
Community size (population)															
≥1,500,000	600	35	5.8	113	18.8	20	3.3	51	8.5	72	12.0	296	49.3	13	2.2
100,000–1,499,999	649	42	6.5	111	17.1	19	2.9	38	5.9	107	16.5	321	49.5	11	1.7
<100,000	391	14	3.6	83	21.2	16	4.1	22	5.6	72	18.4	178	45.5	6	1.5

*In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

EXHIBIT 2.4 *continued*

Characteristic	Cohort, N	Definitive Resection Procedure													
		Maxilla		Mandible		Mandibular alveolus		Buccal		Floor of mouth		Tongue		Lip	
		n	%	n	%	n	%	n	%	n	%	n	%	n	%
LHIN of residence															
1. Erie St. Clair	95	6	6.3	17	17.9	*	*	8	8.4	16	16.8	44	46.3	*	*
2. South West	155	6	3.9	35	22.6	11	7.1	6	3.9	31	20.0	65	41.9	*	*
3. Waterloo Wellington	97	8	8.2	16	16.5	*	*	7	7.2	*	*	50	51.5	*	*
4. Hamilton Niagara Haldimand Brant	203	8	3.9	34	16.7	*	*	13	6.4	42	20.7	99	48.8	*	*
5. Central West	80	6	7.5	16	20.0	*	*	11	13.8	12	15.0	32	40.0	*	*
6. Mississauga Halton	110	*	*	26	23.6	*	*	12	10.9	10	9.1	56	50.9	0	0.0
7. Toronto Central	144	8	5.6	21	14.6	*	*	7	4.9	15	10.4	84	58.3	*	*
8. Central	185	9	4.9	36	19.5	8	4.3	14	7.6	25	13.5	89	48.1	*	*
9. Central East	189	13	6.9	38	20.1	12	6.3	11	5.8	21	11.1	89	47.1	*	*
10. South East	65	*	*	*	*	*	*	*	*	19	29.2	30	46.2	*	*
11. Champlain	142	10	7.0	35	24.6	*	*	9	6.3	17	12.0	70	49.3	0	0.0
12. North Simcoe Muskoka	58	*	*	6	10.3	*	*	*	*	11	19.0	31	53.4	*	*
13. North East	89	*	*	17	19.1	*	*	6	6.7	17	19.1	41	46.1	*	*
14. North West	28	0	0.0	*	*	0	0.0	*	*	*	*	15	53.6	*	*
LHIN of treatment															
1. Erie St. Clair	16	0	0.0	0	0.0	0	0.0	*	*	*	*	9	56.3	*	*
2. South West	275	*	*	59	21.5	15	5.5	15	5.5	48	17.5	122	44.4	*	*
3. Waterloo Wellington	10	0	0.0	*	*	*	*	*	*	*	*	*	*	*	*
4. Hamilton Niagara Haldimand Brant	218	12	5.5	34	15.6	*	*	13	6.0	40	18.3	112	51.4	*	*
5. Central West	*	*	*	0	0.0	0	0.0	*	*	*	*	*	*	*	*
6. Mississauga Halton	7	0	0.0	0	0.0	*	*	0	0.0	0	0.0	*	*	0	0.0
7. Toronto Central	778	51	6.6	160	20.6	28	3.6	58	7.5	91	11.7	383	49.2	7	0.9
A. University Health Network	459	32	7.0	97	21.1	11	2.4	35	7.6	45	9.8	237	51.6	*	*
B. Sunnybrook Health Sciences Centre	151	10	6.6	31	20.5	13	8.6	7	4.6	28	18.5	62	41.1	0	0.0
C. Mount Sinai Hospital	142	9	6.3	30	21.1	*	*	13	9.2	16	11.3	69	48.6	*	*
D. Other	26	0	0.0	*	*	*	*	*	*	*	*	15	57.7	*	*
8. Central	11	*	*	0	0.0	0	0.0	0	0.0	*	*	*	*	*	*
9. Central East	21	0	0.0	*	*	0	0.0	*	*	6	28.6	6	28.6	*	*
10. South East	*	0	0.0	*	*	0	0.0	*	*	*	*	*	*	*	*
11. Champlain	155	11	7.1	35	22.6	*	*	8	5.2	23	14.8	75	48.4	*	*
12. North Simcoe Muskoka	8	0	0.0	0	0.0	0	0.0	*	*	*	*	*	*	*	*
13. North East	*	*	*	12	16.4	*	*	*	*	*	*	*	*	*	*
14. North West	13	0	0.0	0	0.0	0	0.0	0	0.0	*	*	8	61.5	*	*

*In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

EXHIBIT 2.5 Proportion of adults in the Overall Oral Cavity Cancer Cohort who received an oral cavity resection as a definitive procedure, by Local Health Integration Network of residence, in Ontario, 2003 to 2010

Key Finding

- Among patients in the Overall Oral Cavity Cancer Cohort, the proportion who received an oral cavity resection within 12 months of diagnosis ranged from a high of 85% of patients residing in the South West LHIN to a low of 64% of those residing in the North West LHIN.

Characteristic	Cohort, N	Patients with Definitive Procedure		LHIN Rate vs. Ontario Rate ¹
		n	%	
Ontario	2,196	1,640	74.7	0.0
LHIN of residence				
1. Erie St. Clair	130	95	73.1	-2.1
2. South West	182	155	85.2	14.1
3. Waterloo Wellington	124	97	78.2	4.7
4. Hamilton Niagara Haldimand Brant	258	203	78.7	5.4
5. Central West	108	80	74.1	-0.8
6. Mississauga Halton	149	110	73.8	-1.2
7. Toronto Central	201	144	71.6	-4.1
8. Central	246	185	75.2	0.7
9. Central East	256	189	73.8	-1.2
10. South East	96	65	67.7	-9.4
11. Champlain	207	142	68.6	-8.2
12. North Simcoe Muskoka	79	58	73.4	-1.7
13. North East	116	89	76.7	2.7
14. North West	44	28	63.6	-14.9

¹ Ontario rate = 74.7%

EXHIBIT 2.6A Overall pattern of surgical care provided to adults in the Oral Cavity Cancer Resection Cohort, by physician specialty, in Ontario, 2003 to 2010**Key Findings**

- Of physicians who performed oral cavity cancer resection in Ontario between 2003 and 2010, 89% were otolaryngology–head and neck surgeons, and the remainder were general surgeons and plastic surgeons.
- General surgeons were more likely to perform tongue resections, and otolaryngology–head and neck surgeons were more likely to perform mandible and mandibular alveolus resections.
- The majority of patients (91%) were treated by otolaryngology–head and neck surgeons.

Physician Specialty	Physicians Performing Oral Cavity Cancer Surgery		Surgeries Performed		Patients Treated		Definitive Procedure (Resection)													
							Maxilla		Mandible		Mandibular alveolus		Buccal		Floor of mouth		Tongue		Lip	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Ontario	80	100.0	1,960	100.0	1,529	100.0	87	5.7	295	19.3	52	3.4	103	6.7	229	15.0	744	48.7	19	1.2
Otolaryngology	71	88.8	1,789	91.3	1,386	90.6	80	5.8	277	20.0	51	3.7	95	6.9	209	15.1	663	47.8	11	0.8
General surgery	*	*	163	8.3	135	8.8	*	*	18	13.3	*	*	8	5.9	20	14.8	81	60.0	0	0.0
Plastic surgery	*	*	8	0.4	8	0.5	*	*	*	*	*	*	0	0.0	0	0.0	0	0.0	8	100

*In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

EXHIBIT 2.6B Overall pattern of surgical care provided to adults in the Oral Cavity Cancer Resection Cohort, by hospital type, in Ontario, 2003 to 2010

Key Findings

- Although head and neck cancer treatment centres constituted only 17% of the hospitals providing oral cavity resection in Ontario between 2003 and 2010, they performed 90% of the oral cavity resections done on the study cohort.
- Patients undergoing resection for oral cavity cancer at a designated head and neck cancer centre were more likely to have maxilla, mandible or mandibular alveolus resections compared with those who received care at other hospitals (some data were suppressed due to small cell sizes).

Physician Specialty	Hospitals Performing Oral Cavity Cancer Surgery		Surgeries Performed		Patients Treated		Definitive Procedure (Resection)													
							Maxilla		Mandible		Mandibular alveolus		Buccal		Floor of mouth		Tongue		Lip	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Ontario	52	100.0	2,001	100.0	1,640	100.0	91	5.5	307	18.7	55	3.4	111	6.8	251	15.3	795	48.5	30	1.8
Head and neck cancer centre	9	17.3	1,800	90.0	1,485	90.5	*	*	*	*	*	*	96	6.5	221	14.9	715	48.1	12	0.8
Other hospital	43	82.7	201	10.0	155	9.5	*	*	*	*	*	*	15	9.7	30	19.4	80	51.6	18	11.6

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EXHIBIT 2.7A Diagnostic and adjunctive procedures received by adults in the Oral Cavity Cancer Resection Cohort in the 12 months before and 12 months after their definitive surgery, by Local Health Integration Network of residence and of treatment, in Ontario, 2003 to 2010

Key Findings

- On average, patients in the Oral Cavity Surgery Cohort received 0.2 panendoscopies and 0.2 other endoscopies (bronchoscopy or esophagoscopy) in the 12 months before and after their definitive surgery. This suggests that the upper aerodigestive tracts of most patients were not being evaluated in the operating room or endoscopy suite in the 24-month period surrounding their surgery. This evaluation is not required for most oral cavity patients and is generally not the standard of care.

Characteristic	Cohort, N	Panendoscopy		Other Endoscopy		Oral Cavity Biopsy		Neck Open Biopsy		Fine-Needle Aspiration Biopsy	
		n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n
Ontario	1,640	379	0.2	333	0.2	828	0.5	45	0.0	143	0.1
LHIN of residence											
1. Erie St. Clair	95	17	0.2	12	0.1	34	0.4	*	*	6	0.1
2. South West	155	29	0.2	16	0.1	95	0.6	*	*	26	0.2
3. Waterloo Wellington	97	18	0.2	17	0.2	50	0.5	*	*	6	0.1
4. Hamilton Niagara Haldimand Brant	203	45	0.2	78	0.4	111	0.5	*	*	45	0.2
5. Central West	80	24	0.3	14	0.2	43	0.5	*	*	8	0.1
6. Mississauga Halton	110	29	0.3	23	0.2	51	0.5	*	*	10	0.1
7. Toronto Central	144	49	0.3	16	0.1	88	0.6	8	0.1	9	0.1
8. Central	185	49	0.3	31	0.2	68	0.4	13	0.1	10	0.1
9. Central East	189	55	0.3	45	0.2	88	0.5	8	0.0	7	0.0
10. South East	65	0	0.0	9	0.1	40	0.6	0	0.0	*	*
11. Champlain	142	9	0.1	19	0.1	78	0.5	*	*	*	*
12. North Simcoe Muskoka	58	14	0.2	10	0.2	39	0.7	*	*	10	0.2
13. North East	89	34	0.4	28	0.3	28	0.3	0	0.0	*	*
14. North West	28	7	0.3	15	0.5	15	0.5	0	0.0	*	*
LHIN of treatment											
1. Erie St. Clair	16	*	*	*	*	7	0.4	*	*	*	*
2. South West	275	46	0.2	22	0.1	143	0.5	6	0.0	36	0.1
3. Waterloo Wellington	10	*	*	*	*	6	0.6	0	0.0	*	*
4. Hamilton Niagara Haldimand Brant	218	44	0.2	94	0.4	122	0.6	*	*	44	0.2
5. Central West	*	*	*	0	0.0	6	1.0	0	0.0	0	0.0
6. Mississauga Halton	7	0	0.0	0	0.0	*	*	0	0.0	0	0.0
7. Toronto Central	778	237	0.3	147	0.2	384	0.5	29	0.0	57	0.1
A. University Health Network	459	158	0.3	102	0.2	249	0.5	10	0.0	51	0.1
B. Sunnybrook Health Sciences Centre	151	11	0.1	27	0.2	45	0.3	14	0.1	*	*
C. Mount Sinai Hospital	142	49	0.3	13	0.1	75	0.5	*	*	*	*
D. Other	26	19	0.7	5	0.2	15	0.6	*	*	*	*
8. Central	11	*	*	0	0.0	*	*	0	0.0	0	0.0
9. Central East	21	8	0.4	*	*	9	0.4	*	*	*	*
10. South East	*	0	0.0	7	0.1	30	0.6	0	0.0	0	0.0
11. Champlain	155	9	0.1	21	0.1	84	0.5	*	*	*	*
12. North Simcoe Muskoka	8	0	0.0	0	0.0	*	*	0	0.0	0	0.0
13. North East	*	29	0.4	23	0.3	19	0.3	0	0.0	0	0.0
14. North West	13	*	*	11	0.8	8	0.6	0	0.0	*	*

¹ The denominator includes all patients in the Oral Cavity Cancer Resection Cohort.

* In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

EXHIBIT 2.7A *continued***Key Findings**

- Neck dissections (removal of the lymph nodes in the neck) were conducted on 67% of patients, with considerable variability by Local Health Integration Network (LHIN) of patient residence and treatment. The dissection rate was lowest for patients living in the South East LHIN at the time of diagnosis (35%). Among patients treated in LHINs with head and neck cancer treatment centres, those treated in the South East LHIN had the lowest rate of neck dissection (number suppressed due to small sample size).
- Nearly 47% of patients undergoing an oral cavity resection received a free flap in the two-year period surrounding the definitive procedure; this rate varied by LHIN of residence and LHIN of treatment. Of the high-volume LHINs of treatment, patients in the South East and Hamilton Niagara Haldimand Brant LHINs were least likely to receive a free flap (14% and 35%, respectively).

Characteristic	Neck Dissection			Free Flap			Reconstructive Procedure		Tracheostomy		Gastrostomy Tube	
	n	Avg ¹ per patient, n	Patients receiving, %	n	Avg ¹ per patient, n	Patients receiving, %	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n
Ontario	1,279	0.8	67.3	826	0.5	46.6	1,142	0.7	826	0.5	396	0.2
LHIN of residence												
1. Erie St. Clair	72	0.8	66.3	50	0.5	50.5	68	0.7	57	0.6	21	0.2
2. South West	132	0.9	74.8	86	0.6	51.0	121	0.8	88	0.6	34	0.2
3. Waterloo Wellington	69	0.7	70.1	40	0.4	38.1	57	0.6	46	0.5	20	0.2
4. Hamilton Niagara Haldimand Brant	147	0.7	59.6	76	0.4	34.5	114	0.6	102	0.5	75	0.4
5. Central West	70	0.9	77.5	51	0.6	60.0	70	0.9	43	0.5	18	0.2
6. Mississauga Halton	93	0.8	69.1	55	0.5	49.1	74	0.7	57	0.5	34	0.3
7. Toronto Central	113	0.8	68.8	66	0.5	43.1	89	0.6	65	0.5	27	0.2
8. Central	143	0.8	67.0	99	0.5	50.3	140	0.8	92	0.5	37	0.2
9. Central East	167	0.9	74.6	104	0.6	52.4	150	0.8	99	0.5	44	0.2
10. South East	26	0.4	35.4	17	0.3	24.6	33	0.5	19	0.3	6	0.1
11. Champlain	108	0.8	69.0	95	0.7	57.0	108	0.8	78	0.5	34	0.2
12. North Simcoe Muskoka	51	0.9	65.5	26	0.4	37.9	40	0.7	23	0.4	13	0.2
13. North East	72	0.8	68.5	49	0.6	49.4	57	0.6	46	0.5	25	0.3
14. North West	16	0.6	46.4	12	0.4	39.3	21	0.8	11	0.4	8	0.3
LHIN of treatment												
1. Erie St. Clair	6	0.4	31.3	0	0.0	0.0	0	0.0	0	0.0	0	0.0
2. South West	232	0.8	75.3	153	0.6	52.4	210	0.8	167	0.6	63	0.2
3. Waterloo Wellington	*	*	*	*	*	*	*	*	*	*	*	*
4. Hamilton Niagara Haldimand Brant	157	0.7	60.1	82	0.4	35.3	122	0.6	115	0.5	84	0.4
5. Central West	*	*	*	*	*	*	*	*	0	0.0	0	0.0
6. Mississauga Halton	*	*	*	0	0.0	0.0	0	0.0	0	0.0	0	0.0
7. Toronto Central	682	0.9	74.6	436	0.6	52.4	604	0.8	411	0.5	183	0.2
A. University Health Network	428	0.9	76.7	271	0.6	54.9	338	0.7	247	0.5	124	0.3
B. Sunnybrook Health Sciences Centre	139	0.9	81.5	116	0.8	72.2	192	1.3	118	0.8	26	0.2
C. Mount Sinai Hospital	101	0.7	66.2	42	0.3	28.2	62	0.4	39	0.3	28	0.2
D. Other	14	0.5	42.3	7	0.3	26.9	12	0.5	7	0.3	*	*
8. Central	0	0.0	0.0	0	0.0	0.0	*	*	0	0.0	*	*
9. Central East	6	0.3	19.0	*	*	*	*	*	*	*	*	*
10. South East	*	*	*	8	0.2	14.3	22	0.4	10	0.2	*	*
11. Champlain	120	0.8	69.7	101	0.7	56.1	115	0.7	83	0.5	35	0.2
12. North Simcoe Muskoka	*	*	*	0	0.0	0.0	*	*	0	0.0	*	*
13. North East	52	0.7	64.4	40	0.5	*	44	0.6	36	0.5	21	0.3
14. North West	0	0.0	0.0	*	*	49.3	7	0.5	*	*	*	*

¹ The denominator includes all patients in the Oral Cavity Cancer Resection Cohort.

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EXHIBIT 2.7B Radiologic services received by adults in the Oral Cavity Cancer Resection Cohort in the 12 months before and 12 months after their definitive surgery, by Local Health Integration Network of residence and of treatment, in Ontario, 2003 to 2010

Key Findings

- The computed tomography (CT) scan was the major modality used to image the head and neck in the Oral Cavity Cancer Resection Cohort. Patients averaged 1.4 CT scans in the 12 months before and 12 months after their definitive oral cavity resection procedure.
- A significant number of chest X-rays (3.2 per patient, on average) and CT scans of the chest (0.8 per patient, on average) were done on patients in this cohort.
- Other less common imaging tests undergone by patients in this cohort included abdominal CT scans (0.3 per patient, on average) and abdominal ultrasound (0.4 per patient, on average).
- Magnetic resonance imaging (MRI) was infrequently used to diagnose or stage oral cavity cancer in this cohort (0.4 per patient, on average).
- Only 8 positron emission tomography (PET) scans were undertaken to diagnose or stage oral cavity cancer in the cohort (data not shown due to small sample sizes).

EXHIBIT 2.7B *continued*

Characteristic	Cohort, N	Head and Neck						Chest				Abdomen			
		Ultrasound		CT Scan		MRI Scan		X-Ray		CT Scan		Ultrasound		CT Scan	
		n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n
Ontario	1,640	294	0.2	2,350	1.4	602	0.4	5,261	3.2	1,390	0.8	581	0.4	465	0.3
LHIN of residence															
1. Erie St. Clair	95	25	0.3	148	1.6	11	0.1	322	3.4	80	0.8	40	0.4	26	0.3
2. South West	155	15	0.1	251	1.6	9	0.1	549	3.5	162	1.0	55	0.4	65	0.4
3. Waterloo Wellington	97	14	0.1	116	1.2	12	0.1	256	2.6	71	0.7	40	0.4	23	0.2
4. Hamilton Niagara Haldimand Brant	203	22	0.1	221	1.1	50	0.2	644	3.2	107	0.5	50	0.2	28	0.1
5. Central West	80	26	0.3	134	1.7	43	0.5	270	3.4	88	1.1	48	0.6	25	0.3
6. Mississauga Halton	110	14	0.1	187	1.7	64	0.6	363	3.3	113	1.0	43	0.4	38	0.3
7. Toronto Central	144	47	0.3	238	1.7	87	0.6	457	3.2	168	1.2	57	0.4	47	0.3
8. Central	185	39	0.2	268	1.4	102	0.6	493	2.7	131	0.7	83	0.4	44	0.2
9. Central East	189	30	0.2	274	1.4	91	0.5	652	3.4	148	0.8	61	0.3	61	0.3
10. South East	65	21	0.3	65	1.0	40	0.6	204	3.1	40	0.6	26	0.4	16	0.2
11. Champlain	142	20	0.1	198	1.4	24	0.2	502	3.5	123	0.9	34	0.2	27	0.2
12. North Simcoe Muskoka	58	*	*	70	1.2	25	0.4	158	2.7	39	0.7	9	0.2	*	*
13. North East	89	12	0.1	138	1.6	31	0.3	276	3.1	108	1.2	29	0.3	50	0.6
14. North West	28	*	*	42	1.5	13	0.5	115	4.1	12	0.4	6	0.2	*	*
LHIN of treatment															
1. Erie St. Clair	16	*	*	11	0.7	*	*	30	1.9	*	*	*	*	*	*
2. South West	275	38	0.1	433	1.6	13	0.0	950	3.5	266	1.0	113	0.4	100	0.4
3. Waterloo Wellington	10	*	*	10	1.0	0	0.0	11	1.1	8	0.8	*	*	*	*
4. Hamilton Niagara Haldimand Brant	218	22	0.1	235	1.1	50	0.2	698	3.2	119	0.5	56	0.3	36	0.2
5. Central West	*	*	*	7	1.2	*	*	22	3.7	*	*	*	*	*	*
6. Mississauga Halton	7	0	0.0	*	*	*	*	16	2.3	*	*	*	*	0	0.0
7. Toronto Central	778	165	0.2	1,236	1.6	431	0.6	2,564	3.3	744	1.0	294	0.4	233	0.3
A. University Health Network	459	97	0.2	725	1.6	285	0.6	1,443	3.1	447	1.0	168	0.4	118	0.3
B. Sunnybrook Health Sciences Centre	151	26	0.2	214	1.4	42	0.3	684	4.5	99	0.7	62	0.4	63	0.4
C. Mount Sinai Hospital	142	22	0.2	260	1.8	89	0.6	354	2.5	170	1.2	55	0.4	31	0.2
D. Other	26	20	0.8	37	1.4	15	0.6	83	3.2	28	1.1	9	0.3	21	0.8
8. Central	11	*	*	10	0.9	0	0.0	21	1.9	*	*	7	0.6	*	*
9. Central East	21	9	0.4	12	0.6	8	0.4	32	1.5	*	*	8	0.4	*	*
10. South East	*	19	0.4	47	1.0	35	0.7	150	3.1	22	0.4	18	0.4	14	0.3
11. Champlain	155	21	0.1	210	1.4	25	0.2	535	3.5	133	0.9	42	0.3	30	0.2
12. North Simcoe Muskoka	8	0	0.0	*	*	*	*	7	0.9	*	*	0	0.0	0	0.0
13. North East	*	8	0.1	112	1.5	26	0.4	189	2.6	80	1.1	25	0.3	33	0.5
14. North West	13	*	*	17	1.3	6	0.5	36	2.8	*	*	*	*	*	*

¹ The denominator includes all patients in the Oral Cavity Cancer Resection Cohort.

*In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

EXHIBIT 2.7C Consultations and services received by adults in the Oral Cavity Cancer Resection Cohort in the 12 months before and 12 months after their definitive surgery, by Local Health Integration Network of residence and of treatment, in Ontario, 2003 to 2010

Key Findings

- Approximately 76% of all patients in the Oral Cavity Cancer Resection Cohort saw a radiation oncologist during the 12 months before and after their definitive oral cavity resection procedure. About 43% of the cohort received radiation therapy as a part of treatment.
- The rate of referral to a radiation oncologist was lowest among patients living in the North Simcoe Muskoka Local Health Integration Network (LHIN) at the time of their diagnosis (48%) and highest among patients living in the North West LHIN (93%).
- Exactly half of patients in this cohort were seen by a medical oncologist in the 24 months surrounding their definitive oral cavity resection procedure. This rate ranged from a low of 31% among people residing in the South East LHIN at the time of diagnosis to a high of 65% among those living in the South West LHIN.
- More than one in eight patients in this cohort (13%) received chemotherapy as part of their treatment for oral cavity cancer. The highest rate (25%) was observed among those living in the North West LHIN at the time of diagnosis; the lowest rate was found among those residing in the South East LHIN (number suppressed due to small sample size).
- On average, patients in the cohort visited surgeons 8.3 times in the 12 months before and 12 months after their definitive oral cavity resection procedure.
- Eleven percent of patients in the cohort received a palliative care consultation in the 12 months before and 12 months after their definitive oral cavity resection. The highest consultation rate (16%) was observed among those living in the Champlain LHIN at the time of diagnosis.
- Low rates of referral to palliative care in the low-volume LHINs of treatment may be an indication that these LHINs are referring more challenging tumours to designated head and neck cancer treatment centres. Staging data would be required to confirm this assertion.

EXHIBIT 2.7C *continued*

Characteristic	Cohort, N	Radiation Oncology Consultations		Radiation Therapy Treatments		Medical Oncology Consultations		Chemotherapy Treatments		Surgery Consultations		Palliative Care Consultations
		Patients receiving, %	Avg ¹ per patient, n	Patients receiving, %	Avg ¹ per patient, n	Patients receiving, %	Avg ¹ per patient, n	Patients receiving, %	Avg ¹ per patient, n	Patients receiving, %	Avg ¹ per patient, n	Patients receiving, %
Ontario	1,640	75.7	0.9	42.7	0.5	50.2	1.0	13.2	0.5	99.2	8.3	11.2
LHIN of residence												
1. Erie St. Clair	95	76.8	0.9	46.3	0.5	63.2	1.2	24.2	1.1	97.9	7.1	12.6
2. South West	155	74.2	0.8	51.0	0.5	64.5	1.3	21.3	0.7	99.4	7.7	14.8
3. Waterloo Wellington	97	73.2	0.8	37.1	0.5	48.5	0.8	10.3	0.3	99.0	7.5	6.2
4. Hamilton Niagara Haldimand Brant	203	83.7	0.9	39.9	0.5	48.8	1.0	20.2	1.1	99.0	7.8	11.3
5. Central West	80	82.5	0.9	51.3	0.6	55.0	1.3	10.0	0.3	100.0	9.4	*
6. Mississauga Halton	110	60.9	0.7	37.3	0.5	46.4	1.0	9.1	0.2	99.1	8.8	13.6
7. Toronto Central	144	75.0	0.9	37.5	0.6	63.2	1.4	9.7	0.3	99.3	8.6	11.8
8. Central	185	78.4	0.9	40.0	0.6	49.7	0.8	8.1	0.4	98.9	8.8	10.3
9. Central East	189	72.0	0.8	43.4	0.6	46.6	0.9	9.5	0.2	99.5	8.4	10.1
10. South East	65	67.7	1.1	44.6	0.6	30.8	0.6	*	*	96.9	8.2	10.8
11. Champlain	142	81.0	1.0	54.9	0.7	47.9	1.1	11.3	0.6	100.0	9.1	15.5
12. North Simcoe Muskoka	58	48.3	0.6	25.9	0.3	41.4	0.6	*	*	100.0	8.7	*
13. North East	89	87.6	1.0	42.7	0.4	32.6	0.6	14.6	0.6	100.0	7.9	9.0
14. North West	28	92.9	1.1	32.1	0.4	39.3	0.9	25.0	0.5	100.0	9.8	*
LHIN of treatment												
1. Erie St. Clair	16	37.5	0.4	*	*	37.5	0.9	0.0	0.0	87.5	8.1	0.0
2. South West	275	78.5	0.9	48.7	0.5	66.2	1.3	21.5	0.8	99.6	7.5	13.8
3. Waterloo Wellington	10	*	*	*	*	*	*	*	*	90.0	6.8	0.0
4. Hamilton Niagara Haldimand Brant	218	85.3	0.9	41.7	0.5	47.7	0.9	20.6	1.1	99.1	7.7	12.4
5. Central West	*	*	*	*	*	*	*	*	*	100.0	7.8	0.0
6. Mississauga Halton	7	*	*	0.0	0.0	*	*	0.0	0.0	100.0	8.7	0.0
7. Toronto Central	778	73.7	0.8	42.0	0.6	51.0	1.0	9.9	0.3	99.7	8.7	10.5
A. University Health Network	459	63.8	0.8	41.6	0.5	48.6	1.0	10.7	0.3	100.0	8.5	10.2
B. Sunnybrook Health Sciences Centre	151	96.0	1.1	51.0	0.6	56.3	1.1	13.9	0.5	100.0	9.4	15.9
C. Mount Sinai Hospital	142	89.4	0.9	38.0	0.6	51.4	1.0	4.2	0.1	99.3	8.6	7.0
D. Other	26	30.8	0.3	*	*	61.5	1.8	*	*	96.2	9.7	*
8. Central	11	*	*	*	*	*	*	0.0	0.0	81.8	6.8	0.0
9. Central East	21	42.9	0.5	*	*	42.9	0.8	*	*	95.2	8.1	0.0
10. South East	*	67.3	1.2	44.9	0.6	30.6	0.6	8.2	0.8	95.9	7.2	12.2
11. Champlain	155	81.3	1.0	53.5	0.7	45.8	1.0	10.3	0.6	100.0	9.1	14.8
12. North Simcoe Muskoka	8	*	*	*	*	*	*	*	*	100.0	8.4	0.0
13. North East	*	93.2	1.0	42.5	0.5	28.8	0.3	13.7	0.6	100.0	7.4	*
14. North West	13	84.6	1.0	0.0	0.0	*	*	0.0	0.0	100.0	13.3	*

¹ The denominator includes all patients in the Oral Cavity Cancer Resection Cohort.

*In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

EXHIBIT 2.8A Diagnostic and adjunctive procedures received by adults in the Oral Cavity Cancer/No Resection Cohort in the 12 months before and 12 months after diagnosis, by Local Health Integration Network of residence, in Ontario, 2003 to 2010

Key Findings

- Patients in the Oral Cavity Cancer/No Resection Cohort received very few diagnostic procedures in the 24 months surrounding their diagnosis. These included panendoscopy (0.1 per patient, on average) and other endoscopies such as esophagoscopy and bronchoscopy (0.1 per patient). Patients in the No Resection Cohort were less likely than patients in the Resection Cohort to receive these procedures (see [Exhibit 2.7A](#)).
- Compared to patients in the Resection Cohort, patients in the No Resection Cohort were less likely to receive a neck dissection, any reconstructive procedure or a gastrostomy tube (a feeding tube through the abdominal wall) (see [Exhibit 2.7A](#)).
- Rates of procedures for neck open biopsy, free flaps and tracheostomy were very low in the No Resection Cohort (data not shown due to small sample sizes).

Characteristic	Cohort, N	Panendoscopy		Other Endoscopy		Oral Cavity Biopsy		Fine-Needle Aspiration Biopsy		Radical Neck Dissection		Reconstructive Procedure		Gastrostomy Tube	
		n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n
Ontario	556	46	0.1	63	0.1	255	0.5	26	0.0	30	0.1	24	0.0	124	0.2
LHIN of residence															
1. Erie St. Clair	35	*	*	0	0.0	11	0.3	*	*	0	0.0	0	0.0	9	0.3
2. South West	27	*	*	0	0.0	10	0.4	*	*	*	*	0	0.0	*	*
3. Waterloo Wellington	27	*	*	*	*	9	0.3	*	*	*	*	0	0.0	*	*
4. Hamilton Niagara Haldimand Brant	55	6	0.1	12	0.2	32	0.6	*	*	*	*	*	*	11	0.2
5. Central West	28	*	*	*	*	14	0.5	*	*	*	*	0	0.0	12	0.4
6. Mississauga Halton	39	*	*	*	*	17	0.4	*	*	*	*	*	*	7	0.2
7. Toronto Central	57	9	0.2	13	0.2	23	0.4	*	*	*	*	*	*	22	0.4
8. Central	61	*	*	10	0.2	33	0.5	*	*	*	*	*	*	12	0.2
9. Central East	67	*	*	8	0.1	28	0.4	*	*	7	0.1	7	0.1	20	0.3
10. South East	31	0	0.0	*	*	12	0.4	0	0.0	0	0.0	0	0.0	*	*
11. Champlain	65	7	0.1	6	0.1	37	0.6	*	*	6	0.1	*	*	*	*
12. North Simcoe Muskoka	21	*	*	*	*	12	0.6	*	*	*	*	*	*	8	0.4
13. North East	27	*	*	*	*	7	0.3	*	*	*	*	*	*	7	0.3
14. North West	16	*	*	*	*	10	0.6	*	*	0	0.0	0	0.0	*	*

¹ The denominator includes all patients in the Oral Cavity Cancer/No Resection Cohort.

* In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

EXHIBIT 2.8B Radiologic services received by adults in the Oral Cavity Cancer/No Resection Cohort in the 12 months before and 12 months after their definitive surgery, by Local Health Integration Network of residence, in Ontario, 2003 to 2010

Key Findings

- Patients in the Oral Cavity Cancer/No Resection Cohort received a number of radiologic services in the 12 months before and after their diagnosis. These included computed tomography (CT) scans of the head and neck (1.4 per patient, on average), chest X-rays (2.3 per patient), chest CT scans (0.7 per patient), abdominal ultrasound imaging (0.3 per patient) and abdominal CT scans (0.3 per patient).
- Patients who did not undergo resection received slightly fewer radiologic imaging services overall compared to those who had a resection surgery (see [Exhibit 2.7B](#)). This was most prominent in the chest imaging category.
- There was little variation in the use of radiologic services provided to patients in this cohort across different Local Health Integration Networks of patient residence.
- Patients in this cohort received very few bone scans (n=35), swallow studies (n=39), MRIs (n<6) or PET scans (n<6) (exact numbers are not shown due to small cell sizes).

Characteristic	Cohort, N	Head and Neck						Chest				Abdomen			
		Ultrasound		CT Scan		MRI Scan		X-Ray		CT Scan		Ultrasound		CT Scan	
		n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n
Ontario	556	92	0.2	757	1.4	212	0.4	1,263	2.3	400	0.7	175	0.3	148	0.3
LHIN of residence															
1. Erie St. Clair	35	7	0.2	52	1.5	6	0.2	58	1.7	10	0.3	11	0.3	*	*
2. South West	27	*	*	23	0.9	*	*	33	1.2	14	0.5	*	*	*	*
3. Waterloo Wellington	27	6	0.2	31	1.1	*	*	41	1.5	19	0.7	6	0.2	12	0.4
4. Hamilton Niagara Haldimand Brant	55	7	0.1	50	0.9	14	0.3	186	3.4	18	0.3	22	0.4	12	0.2
5. Central West	28	*	*	43	1.5	15	0.5	48	1.7	25	0.9	11	0.4	*	*
6. Mississauga Halton	39	*	*	56	1.4	25	0.6	52	1.3	35	0.9	9	0.2	8	0.2
7. Toronto Central	57	21	0.4	96	1.7	31	0.5	207	3.6	74	1.3	22	0.4	25	0.4
8. Central	61	*	*	89	1.5	27	0.4	121	2.0	41	0.7	14	0.2	18	0.3
9. Central East	67	9	0.1	102	1.5	31	0.5	145	2.2	50	0.7	22	0.3	17	0.3
10. South East	31	7	0.2	27	0.9	22	0.7	55	1.8	15	0.5	6	0.2	8	0.3
11. Champlain	65	*	*	95	1.5	6	0.1	149	2.3	37	0.6	14	0.2	11	0.2
12. North Simcoe Muskoka	21	7	0.3	29	1.4	16	0.8	56	2.7	24	1.1	*	*	11	0.5
13. North East	27	*	*	43	1.6	6	0.2	68	2.5	31	1.1	15	0.6	11	0.4
14. North West	16	*	*	21	1.3	*	*	44	2.8	7	0.4	13	0.8	*	*

¹ The denominator includes all patients in the Oral Cavity Cancer/No Resection Cohort.

*In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

EXHIBIT 2.8C Consultations and services received by adults in the Oral Cavity Cancer/No Resection Cohort in the 12 months before and 12 months after their definitive surgery, by Local Health Integration Network of residence, in Ontario, 2003 to 2010

Key Findings

- Approximately 80% of all patients in the Oral Cavity/No Resection Cohort saw a radiation oncologist during the 12 months before and after their diagnosis. About 58% of this cohort received radiation therapy as a part of treatment.
- The rate of referral to a radiation oncologist was lowest (59%) among patients who lived in the South West Local Health Integration Network (LHIN) at the time of their diagnosis.
- A similar proportion (50%) of patients in this cohort were seen by a medical oncologist in the 24 months surrounding their diagnosis as compared to the cohort that received a resection (see [Exhibit 2.7C](#)).
- Despite not having received an oral cavity resection, patients in this cohort averaged 4.5 visits with surgeons in the 12 months before and 12 months after their diagnosis; this is approximately half as many visits as those who received a definitive oral cavity resection procedure (see [Exhibit 2.7C](#)). Despite not receiving the procedure, nearly all patients (92%) in the No Resection Cohort saw a surgeon in the same period.
- Thirty percent of patients in the cohort received a palliative care consultation in the 12 months before and 12 months after their diagnosis, which is much higher than in the resection cohort (11%) (see [Exhibit 2.7C](#)).

Characteristic	Cohort, N	Radiation Oncology Consultation		Radiation Therapy Treatments		Medical Oncology Consultation		Chemotherapy Treatments		Surgery Consultation		Palliative Care Consultation
		Patients receiving, %	Avg ¹ per patient, n	Patients receiving, %	Avg ¹ per patient, n	Patients receiving, %	Avg ¹ per patient, n	Patients receiving, %	Avg ¹ per patient, n	Patients receiving, %	Avg ¹ per patient, n	Patients receiving, %
Ontario	556	79.7	0.9	57.7	0.8	50.2	1.0	16.0	0.8	91.7	4.5	30.2
LHIN of residence												
1. Erie St. Clair	35	77.1	0.9	65.7	0.7	65.7	0.9	45.7	1.7	88.6	2.5	37.1
2. South West	27	59.3	0.6	22.2	0.2	44.4	0.7	*	*	85.2	2.9	*
3. Waterloo Wellington	27	77.8	1.0	51.9	0.6	33.3	0.7	*	*	100.0	4.2	40.7
4. Hamilton Niagara Haldimand Brant	55	74.5	0.8	45.5	0.5	50.9	1.1	12.7	0.3	87.3	4.3	25.5
5. Central West	28	75.0	0.8	57.1	0.8	57.1	1.2	*	*	96.4	4.5	28.6
6. Mississauga Halton	39	76.9	0.8	61.5	0.9	59.0	1.2	15.4	0.4	92.3	5.0	30.8
7. Toronto Central	57	80.7	0.9	64.9	1.1	59.6	1.7	14.0	0.3	94.7	5.5	38.6
8. Central	61	85.2	0.9	52.5	0.7	41.0	1.0	13.1	0.9	93.4	4.8	26.2
9. Central East	67	79.1	0.9	56.7	0.8	53.7	1.0	16.4	0.3	92.5	4.9	32.8
10. South East	31	77.4	1.0	58.1	0.8	32.3	0.5	*	*	74.2	3.6	*
11. Champlain	65	92.3	1.0	75.4	1.0	46.2	1.0	*	*	96.9	4.6	32.3
12. North Simcoe Muskoka	21	71.4	0.9	57.1	1.1	61.9	0.9	*	*	95.2	5.8	33.3
13. North East	27	92.6	1.0	70.4	0.7	48.1	0.6	22.2	3.3	92.6	5.0	37.0
14. North West	16	75.0	0.8	50.0	0.7	43.8	0.6	*	*	87.5	3.8	*

¹ The denominator includes all patients in the Larynx/Hypopharynx Cancer Resection Cohort.

* In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

Discussion and Conclusions

Summary of findings and clinical implications

Oral cavity cancer is the 13th most common newly diagnosed cancer and the 15th most common cause of death from cancer in Canada. Oral cavity cancer is the most common head and neck cancer diagnosed in Ontario. Our analysis of Ontarians diagnosed with oral cavity cancer between 2003 and 2010 found that incidence rates were higher among men than women and higher among older adults than younger adults (regardless of sex). Incidence rates of oral cavity cancer were relatively similar across the province's 14 Local Health Integration Networks (LHINs).

Although nearly 85% of Ontario adults newly diagnosed with oral cavity cancer underwent a cancer-related surgical procedure for their disease within a year of diagnosis, only 75% had a definitive surgical procedure (an oral cavity resection). Older people (those aged 75 or older) newly diagnosed with oral cavity cancer were less likely to have any cancer-related surgery (or oral cavity resection) than younger people with this disease. There was considerable variation in the proportion of patients with oral cavity cancer who underwent a cancer-related surgical procedure across the LHINs.

Among the 75% of patients in the study cohort who underwent a resection procedure for oral cavity cancer, nearly half (49%) had a tongue resection. The more complex maxilla, mandible and mandibular alveolus resection procedures were more likely to be performed at one of the nine head and neck cancer treatment centres in the province. These resections are a significant portion (25%) of the procedures required by this cohort.

A large majority (90%) of oral cavity cancer resection procedures performed in Ontario between 2003 and 2010 were done at head and neck cancer treatment centres. These procedures were largely performed by otolaryngologists or high-volume general surgeons. Half (51%) of all hospital admissions for oral cavity cancer surgery occurred outside the LHINs where patients were living at the time of their diagnosis; a large majority (78%) of admissions occurred in three LHINs: Toronto Central, South West and Hamilton Niagara Haldimand Brant. Oral cavity surgical care is largely regionalized in Ontario.

Care for patients with oral cavity cancer is resource intensive, requiring a significant number of diagnostic tests and procedures and multidisciplinary care involving a number of different oncologists. Within a year of resection, patients in this cohort had used a large number of services provided by Community Care Access Centres (an average of 27 days of service per person).

Patients with oral cavity cancer were largely imaged with computed tomography; there was little use of magnetic resonance imaging to diagnose or stage this subsite of cancer. Surgery, chemotherapy

and radiotherapy for oral cavity cancer varied according to the LHIN of patient residence. Large variations existed among the nine major head and neck cancer treatment centres in rates of consultation with radiation oncologists and medical oncologists. Similar variations were observed in the use of radiotherapy and chemotherapy in this group. There was also significant variation in the use of palliative care consultation across the LHINs. This may represent a group of patients presenting with very late-stage disease or it may be the result of reduced access to palliative services in certain LHINs. Patients not undergoing a resection would still have used considerable surgical and other health care resources, including palliative care consultation. Palliative care consultation rates varied significantly by LHIN of treatment and LHIN of residence.

Supplementary data from this study were used to describe variations in incidence and resection rates of patients with oral cavity cancer in Ontario; these have been published separately.⁵

Implications for policy and planning

Our analyses have shown that the incidence of oral cavity cancer increases with age. As the Ontario population ages, there may be increasing demand for health services related to the diagnosis and treatment of oral cavity cancer. Appropriate policy and planning initiatives will be necessary to provide adequate care for this population.

We noted variations in the use of surgical procedures and referral to specialists among oral cavity patients residing in one LHIN and being treated in another. More research is necessary to understand the causes of this variation and whether access to appropriate medical care requires improvement in some regions in Ontario.

Although largely regionalized to designated head and neck cancer treatment centres, a significant number of oral cavity cancer cases are performed at very low-volume centres (those treating less than 10% of the patients in the Oral Cavity Cancer Resection Cohort). Quality improvement initiatives could further regionalize the care of oral cavity cancer. This would potentially increase the volumes of some of the moderate- to high-volume head and neck cancer treatment centres across the province.

Although care is largely regionalized to the designated head and neck cancer treatment centres, there are significant variations in the diagnostic workup, treatment approach, use of adjunctive procedures, and consultations for patients residing in one LHIN and being treated in another; this is evident even among the three LHINs with the highest treatment volumes. We believe that province-wide quality improvement programs should be designed with input from the nine major head and neck cancer treatment centres to standardize care, monitor and improve compliance with guidelines, and study outcomes in the oral cavity cancer group.

Future research

For our analyses, we did not have access to appropriate cancer stage data or comorbidity information in order to examine variations in the stage at diagnosis, general health status of patients, and other metrics. Additional research to assess case-mix differences across the nine major head and neck cancer treatment centres is needed to more thoroughly analyze variations among centres. Further studies delineating processes of care (preoperative imaging and metastatic workup, multidisciplinary consultation and cancer care conferences, and appropriate follow-up care), adherence to guidelines, and their association with outcomes are needed in order to better assess the quality of care provided to patients with oral cavity cancer.

Although cancer care is regionalized, volumes vary significantly among head and neck cancer treatment centres. Further regionalization of oral cavity cancer care may be associated with improved care. This is particularly important for this cancer because resection often negatively affects speech, taste and swallowing. Rehabilitation requires a large interprofessional team (including dietitians, speech-language pathologists and physiotherapists) with expertise in treating this patient group at high-volume centres. Implementing agreed upon evidence-based algorithms of care across the province may improve outcomes for this patient group. Further work is needed to measure improvements in patient outcomes associated with the regionalization of care and to monitor outcomes and quality of patient care following the implementation of new provincial care algorithms.

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3 Surgery for Larynx/ Hypopharynx Cancer

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Summary

Issue

Cancer of the larynx and hypopharynx cancer is the 21st most common newly diagnosed cancer and the 20th most common cause of death due to cancer in Canada. Due to a modest decrease in incidence rates and the complexity of treating this cancer, care should be highly regionalized.

Study

This chapter provides a snapshot of treatment patterns for adults newly diagnosed with larynx or hypopharynx cancer in Ontario between January 1, 2003, and December 31, 2010. We focus on the delivery of surgical care and related health services and, where possible, include data regarding patient factors (i.e., sex, age, socioeconomic status and place of residence) and provider factors (i.e., surgical specialty and the type and location of hospital delivering services). We also assess the influence of patient and provider factors on the services provided.

Key findings

- Nearly 69% of adults newly diagnosed with larynx/hypopharynx cancer in Ontario underwent a cancer-related surgical procedure for their

disease within a year of diagnosis, and 15% of adults had a definitive surgical procedure (laryngectomy).

- People aged 75 or older and newly diagnosed with larynx/hypopharynx cancer were less likely to have any cancer-related surgery (or laryngectomy) than younger people with this disease.
- Among Ontario's nine major head and neck cancer treatment centres, approaches to initial treatment varied greatly. Some centres were more likely to treat with a surgical procedure, while others were more likely to initiate radiotherapy with or without chemotherapy.
- Of the 15% of patients in the cohort who underwent a laryngectomy procedure for larynx/hypopharynx cancer, nearly half (46%) had a total laryngectomy. The more complex partial laryngectomy procedure was performed on only 4% of patients in the cohort and at only six of the nine head and neck cancer treatment centres. The remainder of the cohort that underwent a resection (50%) also had a pharyngolaryngectomy (removal of the larynx and pharynx).
- Nearly all (98%) of larynx/hypopharynx cancer resection procedures done in Ontario between 2003 and 2010 were performed at head and neck cancer treatment centres.

- There were variations across Local Health Integration Networks (LHINs) of patient residence in the use of surgery and radiation therapy to treat patients newly diagnosed with larynx/hypopharynx cancer. There was also significant variation in rates of palliative care consultation, which may reflect the availability of this service in the LHINs.

Implications

- We noted variations in the use of surgical procedures and referral to specialists among larynx/hypopharynx cancer patients who reside in one LHIN and are treated in another. More research is necessary to understand this observation.
- The incidence of larynx/hypopharynx cancer increases with age. As the Ontario population ages, there may be increasing demand for health services related to the diagnosis and treatment of this cancer.
- Although care is highly regionalized to designated head and neck cancer treatment centres, there are significant variations in the diagnostic workup, treatment, use of adjunctive procedures, and consultations for patients who reside in one LHIN and are treated in another.

Introduction

Tumours of the voice box (larynx) alone constitute approximately 3.5% of all new malignant cancers diagnosed annually worldwide and account for approximately 1.0% of all deaths from cancers.¹ Squamous cell carcinoma of the larynx used to be the most common cancer of the upper aerodigestive tract although this is no longer the case due to decreasing incidence of larynx cancer and increasing incidence of oropharynx cancer. In Canada, larynx cancer is the 21st most common newly diagnosed cancer and the 20th most common cause of death due to cancer for men and women. Recently published data estimated that 1,050 Canadians (880 men and 170 women) would be diagnosed with larynx cancer in 2015, and another 380 Canadians (310 men and 75 women) would die of this disease.²

Larynx/hypopharynx cancer is divided into two major groups according to histology (tissue type) of the tumour. The majority (90%) of larynx cancers are of the squamous cell carcinoma type. The remainder involve a range of rare histologies. This chapter focuses on squamous cell carcinoma of the larynx and hypopharynx.

Anatomically, the larynx is the entryway into the airway (tracheobronchial tree), and the hypopharynx is the entryway into the swallowing passage (esophagus). Because of difficulty identifying and potential misclassification of these two subsites, because the involvement of one often involves the other, and because of their similar risk factors and

treatment approaches, we report results for tumours of these two contiguous subsites together in this chapter. Although a distinct difference exists between the two subsites anatomically, they are often misclassified by physicians and they have similar treatment approaches.

While some larynx/hypopharynx cancers are diagnosed at an early stage after a patient seeks evaluation for changes in voice or swallowing, most patients with larynx/hypopharynx cancer have advanced-stage disease at time of diagnosis. Patients are often treated for a sore throat (laryngitis) and other more common noncancerous diseases before investigations ultimately lead to a cancer diagnosis.

The role of surgery in diagnosis and staging

A definitive diagnosis of larynx/hypopharynx cancer usually involves upper aerodigestive tract endoscopy—inspection of the larynx, pharynx, esophagus and trachea using a fibre optic examination telescope (either flexible or rigid) passed through the mouth or nose. Most often, an endoscopic examination under anesthesia, referred to as a panendoscopy or quadroscope, is required to fully determine the extent of disease and facilitate biopsy. More recently, with the development of digital imaging and flexible fibre optic transnasal esophagoscopes, this procedure can be performed in a clinic under local anesthetic. This allows for visualization to assess the extent and, if necessary, for biopsy (sampling or removal) of a suspicious lesion.

Treatment of squamous cell carcinoma of the larynx/hypopharynx

After patients are diagnosed, they should undergo appropriate tests to assess the local, regional and distant extent of their disease (a process called staging). There are two main curative treatment modalities for larynx/hypopharynx cancer: radiation with or without chemotherapy, and surgery. The goal of treatment is to cure the cancer while preserving a functioning larynx, referred to as an organ preservation strategy. Organ preservation strategies include radiation with or without chemotherapy, and partial laryngeal surgery either through open approaches or transoral laser partial resections. Total laryngectomy with partial or total pharyngectomy as the primary treatment is usually reserved for locally advanced disease at presentation. Postoperative radiation, with or without chemotherapy, is indicated in patients with advanced disease undergoing primary surgery. Total laryngectomy is also performed as ‘salvage treatment’ when there is either persistent or recurrent cancer after partial surgery or radiation (or chemoradiation) or when partial surgery is not possible due to the extent of the tumour, which is the majority of cases. Patients who have received radiation therapy and/or chemotherapy before an operation often have higher rates of postoperative complications.³

Since most patients who develop larynx/hypopharynx cancer have a significant history of tobacco and/or alcohol use, they typically have other comorbid conditions, such as heart disease, chronic

lung disease and alcohol-related liver disease. The presence of these health problems can sometimes limit the use of potentially curative therapy for larynx/hypopharynx cancer.

Type of surgical resection

For early-stage and localized cancers, minimally invasive surgical resections can be performed through the mouth (transorally) with a microscope and laser. In the health administrative data, it is challenging to reliably distinguish these resections from biopsy procedures. For this reason, we identified definitive surgical procedures in this chapter based on open (nonendoscopic) resections of the larynx/hypopharynx (laryngectomy); these can be divided into partial resections, total resections or resections involving the pharynx. The type of definitive procedure depends on tumour factors (location, extent), patient factors (comorbidities, preferences) and surgeon factors (ability to perform procedure). A partial laryngectomy involves removing either the left or right side of the larynx (a vertical partial laryngectomy) or a portion of the larynx above the vocal cords (a horizontal partial laryngectomy). Of note, many transoral laser procedures may be billed as a partial laryngectomy, as they achieve an oncologic resection to a similar extent as an open procedure. A total laryngectomy involves removal of the entire larynx (voice box). If a total laryngectomy involves removal of a portion of the pharynx (the entry to the swallowing passage), it is called a pharyngolaryngectomy.

How the study cohorts were defined

This chapter provides detailed information on surgical services and related health services delivered to adults newly diagnosed with larynx/hypopharynx cancer in Ontario from 2003 to 2010.

The study population for this chapter included all adults 18 years of age or older identified with larynx/hypopharynx cancer in the Ontario Cancer Registry and whose diagnosis date fell between January 1, 2003, and December 31, 2010. These individuals are referred to as the **Overall Larynx/Hypopharynx Cancer Cohort**.

The Overall Larynx/Hypopharynx Cancer Cohort was then divided into two pairs of smaller groups.

For Exhibits 3.1A to 3.1C, the Overall Larynx/Hypopharynx Cancer Cohort was divided as follows:

- The **Larynx/Hypopharynx Surgery Cohort** included those who had surgery related to their larynx/hypopharynx cancer in the 12 months before or 12 months after their diagnosis date.
- The **Larynx/Hypopharynx/No Surgery Cohort** included those who did not have surgery related to their larynx/hypopharynx cancer in the 12 months before or 12 months after their diagnosis date.

For Exhibits 3.2A to 3.8C, the Overall Larynx/Hypopharynx Cancer Cohort was divided as follows:

- The **Larynx/Hypopharynx Resection Cohort** included those who had a definitive resection (laryngectomy) in the 12 months before or 12 months after their diagnosis date.
- The **Larynx/Hypopharynx/No Resection Cohort** included those who did not have resection (laryngectomy) in the 12 months before or 12 months after their diagnosis date. This group includes all individuals who did not have surgery and those whose definitive surgery was limited to a surgical biopsy or adjunctive procedures (tracheostomy, gastrostomy tube).

List of Exhibits

EXHIBIT 3.1A Incidence of larynx/hypopharynx cancer and use of surgery among adults in the Overall Larynx/Hypopharynx Cancer Cohort, by sex, age group, neighbourhood income quintile, community size and Local Health Integration Network of residence, in Ontario, 2003 to 2010

EXHIBIT 3.1B Incidence of larynx/hypopharynx cancer and use of surgery among men in the Overall Larynx/Hypopharynx Cancer Cohort, by age group, neighbourhood income quintile, community size and Local Health Integration Network of residence, in Ontario, 2003 to 2010

EXHIBIT 3.1C Incidence of larynx/hypopharynx cancer and use of surgery among women in the Overall Larynx/Hypopharynx Cancer Cohort, by age group, neighbourhood income quintile, community size and Local Health Integration Network of residence, in Ontario, 2003 to 2010

EXHIBIT 3.2A Health care use among adults in the Larynx/Hypopharynx Cancer Resection Cohort, by sex, age group, neighbourhood income quintile, community size, and Local Health Integration Network of residence and of treatment, in Ontario, 2003 to 2010

EXHIBIT 3.2B Health care use among adults in the Larynx/Hypopharynx Cancer Resection Cohort, by Local Health Integration Network of residence and of treatment, in Ontario, 2003 to 2010

EXHIBIT 3.3 Hospital admissions for larynx/hypopharynx surgery among adults in the Larynx/Hypopharynx Cancer Resection Cohort in the 12 months before and 12 months after their diagnosis, by Local Health Integration Network of residence and of treatment, in Ontario, 2003 to 2010

EXHIBIT 3.4 Type of definitive resection procedure among adults in the Larynx/Hypopharynx Cancer Resection Cohort, by sex, age group, neighbourhood income quintile, community size, and Local Health Integration Network of residence and of treatment, in Ontario, 2003 to 2010

EXHIBIT 3.5 Proportion of adults in the Overall Larynx/Hypopharynx Cancer Cohort who received a laryngectomy as a definitive procedure, by Local Health Integration Network of residence, in Ontario, 2003 to 2010

EXHIBIT 3.6A Overall pattern of surgical care provided to adults in the Larynx/Hypopharynx Cancer Resection Cohort, by physician specialty, in Ontario, 2003 to 2010

EXHIBIT 3.6B Overall pattern of surgical care provided to adults in the Larynx/Hypopharynx Cancer Resection Cohort, by hospital type, in Ontario, 2003 to 2010

EXHIBIT 3.7A Diagnostic and adjunctive procedures received by adults in the Larynx/Hypopharynx Cancer Resection Cohort in the 12 months before and 12 months after their definitive surgery, by Local Health Integration Network of residence and of treatment, in Ontario, 2003 to 2010

EXHIBIT 3.7B Radiologic services received by adults in the Larynx/Hypopharynx Cancer Resection Cohort in the 12 months before and 12 months after their definitive surgery, by Local Health Integration Network of residence and of treatment, in Ontario, 2003 to 2010

EXHIBIT 3.7C Consultations and services received by adults in the Larynx/Hypopharynx Cancer Resection Cohort in the 12 months before and 12 months after their definitive surgery, by Local Health Integration Network of residence and of treatment, in Ontario, 2003 to 2010

EXHIBIT 3.8A Diagnostic and adjunctive procedures received by adults in the Larynx/Hypopharynx Cancer/No Resection Cohort in the 12 months before and 12 months after their diagnosis, by Local Health Integration Network of residence, in Ontario, 2003 to 2010

EXHIBIT 3.8B Radiologic services received by adults in the Larynx/Hypopharynx Cancer/No Resection Cohort in the 12 months before and 12 months after their diagnosis, by Local Health Integration Network of residence, in Ontario, 2003 to 2010

EXHIBIT 3.8C Consultations and services received by adults in the Larynx/Hypopharynx Cancer/No Resection Cohort in the 12 months before and 12 months after their diagnosis, by Local Health Integration Network of residence, in Ontario, 2003 to 2010

EXHIBIT 3.1A Incidence of larynx/hypopharynx cancer and use of surgery among adults in the Overall Larynx/Hypopharynx Cancer Cohort, by sex, age group, neighbourhood income quintile, community size and Local Health Integration Network of residence, in Ontario, 2003 to 2010

Key Findings

- Men constituted 84% of all larynx/hypopharynx cancer patients in Ontario from 2003 to 2010. Rates of larynx/hypopharynx cancer in the Overall Larynx/Hypopharynx Cancer Cohort were higher among men (52.7 cases per 100,000) than women (8.6 cases per 100,000).
- The incidence of larynx/hypopharynx cancer increases with age. More than half of newly diagnosed larynx/hypopharynx cancers occurred in people aged 65 or older, while less than 16% occurred in those younger than 55.
- Larynx/hypopharynx incidence of surgery declined with increasing neighbourhood income. The proportion of Ontarians with larynx/hypopharynx cancer who underwent cancer-related surgery decreased with increasing income.
- Larynx/hypopharynx incidence increased with smaller community size. The proportion of Ontarians with larynx/hypopharynx cancer who underwent cancer-related surgery decreased with smaller community size.
- There were variations in the incidence of larynx/hypopharynx cancer across Local Health Integration Network (LHINs) of patient residence. The Central LHIN had the lowest incidence rate (21 cases per 100,000) and the North East LHIN had the highest (37 cases per 100,000).
- The probability of undergoing surgery was lowest among those aged 75 or older (approximately 61%) compared to the younger age groups (all greater than 66%).
- There were variations in rates of surgery use for larynx/hypopharynx cancer across LHINs of patient residence. The proportion of patients in the study cohort who had surgery for their disease ranged from a low of 42% among those living in the Champlain LHIN at the time of diagnosis to a high of 81% among those residing in the South East LHIN.

EXHIBIT 3.1A *continued*

Characteristic	Age-standardized ¹ Incidence per 100,000	Overall Larynx/Hypopharynx Cancer Cohort					
		Total		Had surgery		Did not have surgery	
		N	%	n	Age-standardized ² % of total	n	Age-standardized ² % of total
Ontario	29.0	3,034	100.0	2,007	68.5	1,027	31.5
Sex³							
Female	8.6	482	15.9	328	67.2	154	32.8
Male	52.7	2,552	84.1	1,679	68.8	873	31.2
Age group,³ years							
18–54	7.8	474	15.6	330	68.4	144	31.6
55–64	68.4	921	30.4	604	66.8	317	33.2
65–69	110.4	504	16.6	345	71.0	159	29.0
70–74	115.6	448	14.8	307	69.8	141	30.2
≥75	104.4	687	22.6	421	61.4	266	38.6
Neighbourhood income quintile							
Q1 (lowest)	36.0	703	23.2	471	67.9	232	32.1
Q2	32.4	693	22.8	470	72.9	223	27.1
Q3	28.7	599	19.7	399	68.3	200	31.7
Q4	25.9	558	18.4	361	67.6	197	32.4
Q5 (highest)	21.5	481	15.9	306	62.0	175	38.0
Community size (population)							
≥1,500,000	23.8	969	31.9	693	69.8	276	30.2
100,000–1,499,999	30.4	1,214	40.0	773	67.3	441	32.7
<100,000	34.3	851	28.0	541	66.6	310	33.4
LHIN of residence							
1. Erie St. Clair	33.3	195	6.4	118	72.1	77	27.9
2. South West	32.1	275	9.1	178	65.0	97	35.0
3. Waterloo Wellington	28.9	165	5.4	108	67.2	57	32.8
4. Hamilton Niagara Haldimand Brant	28.8	373	12.3	227	79.3	146	20.7
5. Central West	25.3	134	4.4	105	76.9	29	20.3
6. Mississauga Halton	22.5	176	5.8	119	44.1	57	55.9
7. Toronto Central	27.5	263	8.7	192	73.7	71	26.3
8. Central	21.3	272	9.0	183	53.2	89	46.8
9. Central East	23.3	303	10.0	217	73.6	86	26.4
10. South East	30.2	155	5.1	110	80.7	45	19.3
11. Champlain	30.3	312	10.3	182	42.2	130	57.8
12. North Simcoe Muskoka	32.5	133	4.4	94	62.9	39	37.1
13. North East	37.2	212	7.0	136	72.4	76	27.6
14. North West	30.2	66	2.2	38	44.9	28	18.8

¹ Standardized to the 1991 Canadian census.² Standardized to the Overall Larynx/Hypopharynx Cancer Cohort.³ Sex-specific rates have been adjusted for age; age-specific rates have been adjusted for sex.

EXHIBIT 3.1B Incidence of larynx/hypopharynx cancer and use of surgery among men in the Overall Larynx/Hypopharynx Cancer Cohort, by age group, neighbourhood income quintile, community size and Local Health Integration Network of residence, in Ontario, 2003 to 2010

Key Findings

- The findings shown in this exhibit are similar to those in **Exhibit 3.1A**; that is, both the incidence of larynx/hypopharynx cancer and the proportion of men who had surgery were related to age, average neighbourhood income and community size.
- Men living in the North Simcoe Local Health Integration Network (LHIN) when they were diagnosed had the highest incidence of larynx/hypopharynx cancer (64 cases per 100,000 males); the lowest incidence among men was in the Central LHIN (37 cases per 100,000).
- Among men with larynx/hypopharynx cancer, those living in large urban centres at the time of their diagnosis were more likely to have surgery than men living in smaller communities.
- Men living in the North Simcoe Muskoka LHIN at the time of diagnosis were the most likely to have larynx/hypopharynx cancer-related surgery (83%); those living in the Champlain LHIN were the least likely (59%).

Characteristic	Age-standardized ¹ Incidence per 100,000	Overall Larynx/Hypopharynx Cancer Cohort - Men					
		Total		Had surgery		Did not have surgery	
		N	%	n	Age-standardized ² % of total	n	Age-standardized ² % of total
Ontario	52.7	2,552	100.0	1,679	68.8	873	31.2
Age group,³ years							
18–54	5.1	399	15.6	280	70.2	119	29.8
55–64	65.9	788	30.9	513	65.1	275	34.9
65–69	84.4	421	16.5	283	67.2	138	32.8
70–74	102.5	374	14.7	254	67.9	120	32.1
≥75	117.3	570	22.3	349	61.2	221	38.8
Neighbourhood income quintile							
Q1 (lowest)	59.4	561	22.0	377	70.4	184	29.6
Q2	55.2	575	22.5	391	69.0	184	31.0
Q3	49.6	511	20.0	339	68.1	172	31.9
Q4	45.2	483	18.9	306	68.9	177	31.1
Q5 (highest)	37.8	422	16.5	266	68.4	156	31.6
Community size (population)							
≥1,500,000	40.9	816	32.0	585	71.4	231	28.6
100,000–1,499,999	52.1	1021	40.0	646	69.8	375	30.2
<100,000	57.7	715	28.0	448	64.5	267	35.5
LHIN of residence							
1. Erie St. Clair	54.5	160	6.3	94	70.5	66	29.5
2. South West	55.4	234	9.2	149	65.2	85	34.8
3. Waterloo Wellington	51.3	145	5.7	96	64.2	49	35.8
4. Hamilton Niagara Haldimand Brant	51.0	325	12.7	193	67.9	132	32.1
5. Central West	41.9	109	4.3	85	77.5	24	22.5
6. Mississauga Halton	39.2	152	6.0	100	66.4	52	33.6
7. Toronto Central	47.0	219	8.6	162	72.7	57	27.3
8. Central	36.9	232	9.1	157	70.5	75	29.5
9. Central East	40.3	258	10.1	187	71.9	71	28.1
10. South East	52.1	133	5.2	92	66.1	41	33.9
11. Champlain	47.4	241	9.4	144	59.0	97	41.0
12. North Simcoe Muskoka	55.1	112	4.4	79	82.7	33	17.3
13. North East	63.8	180	7.1	114	69.5	66	30.5
14. North West	48.0	52	2.0	27	67.0	25	33.0

¹ Standardized to the 1991 Canadian census.

² Standardized to the Overall Larynx/Hypopharynx Cancer Cohort.

³ Age-specific rates have not been standardized.

EXHIBIT 3.1C Incidence of larynx/hypopharynx cancer and use of surgery among women in the Overall Larynx/Hypopharynx Cancer Cohort, by age group, neighbourhood income quintile, community size and Local Health Integration Network of residence, in Ontario, 2003 to 2010

Key Findings

- Among Ontario women, the incidence of larynx/hypopharynx cancer from 2003 to 2010 increased markedly with decreasing neighbourhood income and community size. The rate was highest among women living in the lowest-income neighbourhoods (14 cases per 100,000) and in communities with fewer than 100,000 people (12 cases per 100,000).
- Across the Local Health Integration Networks (LHINs) of patient residence, the highest incidence of larynx/hypopharynx cancer was among women living in the Champlain LHIN at the time of diagnosis (14 cases per 100,000). The lowest incidence was among women who resided in the Central or Mississauga Halton LHINs (6 cases per 100,000 each).
- Women in the Overall Larynx/Hypopharynx Cancer Cohort who were younger than age 75 at the time of their diagnosis were more likely to undergo surgery related to their cancer than similarly aged men in the same cohort.
- The age-standardized proportion of women in this study cohort who underwent surgery related to their larynx/hypopharynx cancers in the 12 months before and after diagnosis was highest among those living in the South East LHIN and lowest among those living in the Mississauga Halton LHIN (data not shown due to small sample sizes).

EXHIBIT 3.1C *continued*

Characteristic	Age-standardized ¹ Incidence per 100,000	Overall Larynx/Hypopharynx Cancer Cohort - Women					
		Total		Had surgery		Did not have surgery	
		N	%	n	Age-standardized ² % of total	n	Age-standardized ² % of total
Ontario	8.6	482	100.0	328	67.2	154	32.8
Age group,³ years							
18–54	1.0	75	15.6	50	66.7	25	33.3
55–64	10.8	133	27.6	91	68.4	42	31.6
65–69	14.1	83	17.2	62	74.7	21	25.3
70–74	15.7	74	15.4	53	71.6	21	28.4
≥75	14.5	117	24.3	72	61.5	45	38.5
Neighbourhood income quintile							
Q1 (lowest)	13.5	142	29.5	94	65.4	48	34.6
Q2	10.5	118	24.5	79	76.7	39	23.3
Q3	8.6	88	18.3	60	68.6	28	31.4
Q4	7.4	75	15.6	55	66.4	20	33.6
Q5 (highest)	5.8	59	12.2	40	55.7	19	44.3
Community size (population)							
≥1,500,000	7.4	153	31.7	108	68.2	45	31.8
100,000–1,499,999	9.6	193	40.0	127	64.9	66	35.1
<100,000	11.7	136	28.2	93	68.5	43	31.5
LHIN of residence							
1. Erie St. Clair	13.1	35	7.3	24	73.6	11	26.4
2. South West	9.7	41	8.5	29	64.8	12	35.2
3. Waterloo Wellington	7.4	20	4.1	12	70.2	8	29.8
4. Hamilton Niagara Haldimand Brant	7.4	48	10.0	34	90.3	14	9.7
5. Central West	9.3	25	5.2	*	*	*	*
6. Mississauga Halton	6.4	24	5.0	*	*	*	*
7. Toronto Central	8.8	44	9.1	30	74.6	14	25.4
8. Central	6.4	40	8.3	26	36.6	14	63.4
9. Central East	6.9	45	9.3	30	75.2	15	24.8
10. South East	9.1	22	4.6	*	*	*	*
11. Champlain	13.9	71	14.7	38	26.0	33	74.0
12. North Simcoe Muskoka	10.8	21	4.4	15	43.8	6	56.2
13. North East	11.7	32	6.6	22	75.2	10	24.8
14. North West	13.2	14	2.9	*	*	*	*

¹ Standardized to the 1991 Canadian census.² Standardized to the Overall Larynx/Hypopharynx Cancer Cohort.³ Age-specific rates have not been standardized.

* In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

EXHIBIT 3.2A Health care services used by adults in the Larynx/Hypopharynx Cancer Resection Cohort, by sex, age group, neighbourhood income quintile, community size, and Local Health Integration Network of residence and of treatment, in Ontario, 2003 to 2010

Key Findings

- Men and older adults were more likely to be treated with radiation therapy with or without chemotherapy. There were significant variations by Local Health Integration Network (LHIN) of patient residence in the proportion of patients who received resection (laryngectomy) and either radiotherapy or chemotherapy prior to surgery. Similar variations were noted for resection rates by LHIN of patient treatment.
- In this cohort, 59% of hospital admissions for patients were for inpatient care; the remaining 41% were ambulatory (same-day) admissions.
- Ninety-four percent of patients in this cohort had more than one hospital admission in the 12 months before and after their cancer diagnosis
- Patients treated in seven of the LHINs (Erie St. Clair, Waterloo Wellington, Central West, Mississauga Halton, Central, Central East and North Simcoe Muskoka) had very short hospital stays (less than three days) for their oral cavity resection procedures. These patients may have had smaller resections that do not require a long hospital stay.
- Patients residing in the Hamilton Niagara Haldimand Brant LHIN at the time of diagnosis had the highest rate of same-day admission (57%) in the 12 months before and after their laryngectomy.
- Patients in this cohort had 5.5 visits, on average, with their treating surgeon in the 12 months before and after their laryngectomy.
- Patients in this cohort had a 23.5-day length of stay, on average, for their inpatient laryngectomy procedure.
- Patients treated in the Hamilton Niagara Haldimand Brant, South West, and North East LHINs had the shortest lengths of stay (15 to 18 days) for their inpatient laryngectomy procedure.

EXHIBIT 3.2A *continued*

Characteristic	Cohort, N	Patients who had surgical resection, %	Patients with preoperative XRT or chemotherapy, %	Visits with treating surgeon, avg per patient, ¹ n	Patients with more than one hospital admission, %	Total hospital admissions, ² n	Admissions, avg per patient, ² n	Same-day surgery as % of total admissions	Inpatient admissions as % of total admissions	Avg length of stay, days	Median length of stay (IQR), days
Ontario	448	14.8	35.5	5.5	94.2	1,782	4.0	40.9	59.1	23.5	15 (12–25.5)
Sex³											
Female	52	*	30.8	5.2	92.3	206	4.0	36.9	63.1	24.5	15.5 (11–29.5)
Male	396	15.5	36.1	5.5	94.4	1,576	4.0	41.4	58.6	23.4	15 (12–25)
Age group,³ years											
18–54	80	16.9	28.8	5.4	93.8	298	3.7	40.3	59.7	19.9	14 (11–21)
55–64	153	16.6	37.3	5.8	94.8	641	4.2	38.2	61.8	21.0	15 (12–25)
65–69	88	17.5	35.2	5.5	93.2	347	3.9	43.8	56.2	23.9	15 (11–24)
70–74	54	12.1	31.5	5.2	98.1	213	3.9	39.4	60.6	22.1	15 (13–23)
≥75	73	10.6	42.5	5.2	91.8	283	3.9	44.9	55.1	33.4	22 (14–36)
Neighbourhood income quintile											
Q1 (lowest)	119	16.9	39.5	5.3	94.1	458	3.8	36.7	63.3	24.4	16 (12–26)
Q2	110	15.9	36.4	5.8	92.7	438	4.0	43.8	56.2	25.0	16.5 (12–28)
Q3	78	13.0	26.9	5.1	93.6	311	4.0	41.8	58.2	21.1	15 (13–25)
Q4	73	13.1	31.5	5.6	94.5	287	3.9	41.1	58.9	22.1	14 (11–18)
Q5 (highest)	68	14.1	41.2	5.6	97.1	288	4.2	41.7	58.3	23.9	17 (11.5–26.5)
Community size (population)											
≥1,500,000	108	11.1	43.5	5.6	96.3	418	3.9	33.0	67.0	30.2	17 (14–34)
100,000–1,499,999	208	17.1	27.9	5.6	91.3	780	3.8	44.1	55.9	21.1	15 (11–24.5)
<100,000	132	15.5	40.9	5.2	97.0	584	4.4	42.1	57.9	22.0	15 (11.5–23.5)

¹ The time frame for surgeon visits was 6 months before to 6 months after the first surgery.² The time frame for hospital admissions was 12 months before to 12 months after the first surgery.³ Standardized to the Overall Larynx/Hypopharynx Cancer Cohort; sex-specific rates have been adjusted for age; age-specific rates have been adjusted for sex.

*In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

XRT = external beam radiotherapy; IQR = interquartile range.

EXHIBIT 3.2A continued

Characteristic	Cohort, N	Patients who had surgical resection, %	Patients with preoperative XRT or chemotherapy, %	Visits with treating surgeon, avg per patient, ¹ n	Patients with more than one hospital admission, %	Total hospital admissions, ² n	Admissions, avg per patient, ² n	Same-day surgery as % of total admissions	Inpatient admissions as % of total admissions	Avg length of stay, days	Median length of stay (IQR), days
LHIN of residence											
1. Erie St. Clair	38	19.5	34.2	4.5	94.7	134	3.5	37.3	62.7	15.0	13.5 (10-18)
2. South West	66	24.0	25.8	5.2	80.3	215	3.3	32.6	67.4	20.6	14 (10-24)
3. Waterloo Wellington	27	*	25.9	5.2	100.0	105	3.9	38.1	61.9	14.4	12 (10-16)
4. Hamilton Niagara Haldimand Brant	61	16.4	26.2	6.6	96.7	292	4.8	57.2	42.8	18.1	12 (7-20)
5. Central West	15	*	40.0	4.5	86.7	47	3.1	36.2	63.8	32.1	19 (14-31)
6. Mississauga Halton	17	*	35.3	5.1	100.0	70	4.1	41.4	58.6	17.5	14 (8-17)
7. Toronto Central	32	*	43.8	6.0	100.0	127	4.0	27.6	72.4	38.1	18.5 (14-52.5)
8. Central	27	*	48.1	5.6	96.3	111	4.1	37.8	62.2	29.8	16 (14-35)
9. Central East	46	15.2	47.8	5.3	97.8	192	4.2	41.7	58.3	27.2	21 (14-30)
10. South East	30	19.4	10.0	5.3	96.7	112	3.7	41.1	58.9	23.0	15 (14-22)
11. Champlain	44	14.1	38.6	6.7	95.5	175	4.0	32.6	67.4	35.8	25 (16-33)
12. North Simcoe Muskoka	*	*	*	*	*	*	*	*	*	*	*
13. North East	30	*	53.3	5.5	96.7	132	4.4	51.5	48.5	16.2	15 (13-18)
14. North West	*	*	*	*	*	*	*	*	*	*	*
LHIN of treatment											
1. Erie St. Clair	**	**	**	**	**	**	**	**	**	**	**
2. South West	117	—	27.4	4.8	87.2	403	3.4	33.0	67.0	17.8	13 (11-21)
3. Waterloo Wellington	**	**	**	**	**	**	**	**	**	**	**
4. Hamilton Niagara Haldimand Brant	82	—	26.8	6.3	97.6	382	4.7	56.0	44.0	16.9	12 (7-20)
5. Central West	**	**	**	**	**	**	**	**	**	**	**
6. Mississauga Halton	**	**	**	**	**	**	**	**	**	**	**
7. Toronto Central	154	—	46.8	5.0	96.8	621	4.0	35.3	64.7	29.5	18 (14-35)
A. University Health Network	104	—	48.1	4.4	97.1	409	3.9	31.3	68.7	31.6	21 (14-36.5)
B. Sunnybrook Health Sciences Centre	35	—	45.7	6.6	94.3	144	4.1	47.9	52.1	24.4	16 (14-28)
C. Mount Sinai Hospital	15	—	40.0	6.0	100.0	68	4.5	32.4	67.6	26.2	15 (13-24)
8. Central	**	**	**	**	**	**	**	**	**	**	**
9. Central East	**	**	**	**	**	**	**	**	**	**	**
10. South East	19	—	5.3	5.8	100.0	71	3.7	53.5	46.5	23.2	14 (14-17)
11. Champlain	49	—	38.8	6.5	93.9	198	4.0	33.3	66.7	34.1	25 (16-32)
12. North Simcoe Muskoka	**	**	**	**	**	**	**	**	**	**	**
13. North East	25	—	52.0	6.0	96.0	101	4.0	55.4	44.6	14.8	14 (12-16)
14. North West	**	**	**	**	**	**	**	**	**	**	**

¹ The time frame for surgeon visits was 6 months before to 6 months after the first surgery.² The time frame for hospital admissions was 12 months before to 12 months after the first surgery.³ Standardized to the Overall Larynx/Hypopharynx Cancer Cohort; sex-specific rates have been adjusted for age; age-specific rates have been adjusted for sex.

* In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

** The LHIN did not treat any patients from the Cancer Resection Cohort (i.e., no laryngectomies were performed in the LHIN).

— A percentage could not be derived as it is difficult to determine the denominator of patients that presented to each treatment LHIN using administrative data.

XRT = external beam radiotherapy; IQR = interquartile range.

EXHIBIT 3.2B Health care use by adults in the Larynx/Hypopharynx Cancer Resection Cohort, by Local Health Integration Network of residence and of treatment, in Ontario, 2003 to 2010

Key Findings

- Patients treated by laryngectomy averaged 3.1 emergency department visits in the 12 months before and 12 months after their definitive laryngectomy procedure. This rate varied by Local Health Integration Network (LHIN) of residence at the time of diagnosis. Patients who were residents of the North East LHIN when diagnosed had the highest rate of emergency department visits (on average, 5.2 visits per patient).
- Patients treated by laryngectomy received, on average, 54.2 visits from Community Care Access Centres (CCACs) in the 12 months before and 12 months after their definitive laryngectomy procedure. The highest number of CCAC visits (73) was for patients residing in the Toronto Central LHIN at the time of diagnosis; patients residing in the South East LHIN received the lowest number of visits (36).
- Patients treated by laryngectomy averaged 1.5 days in the intensive care unit (ICU) during their laryngectomy admission. This varied by LHIN of the treating institution and may be related to whether an institution had established a head and neck surgery step-down unit, which is not considered an ICU in administrative data.
- Thirty percent of patients undergoing a laryngectomy procedure in Ontario from 2003 to 2010 were readmitted within 30 days of hospital discharge. The readmission rate varied from 46% for patients treated in the Hamilton Niagara Haldimand Brant LHIN to 0% for patients treated in the South East and Erie St. Clair LHINs.

EXHIBIT 3.2B *continued*

Characteristic	Cohort, N	ED Visits		CCAC Visits		ICU Days		Hospital Readmissions		
		n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Patients readmitted	
									n	%
Ontario	448	1,379	3.1	24,263	54.2	689	1.5	154	132	29.5
LHIN of residence										
1. Erie St. Clair	38	117	3.1	1,952	51.4	40	1.1	10	8	21.1
2. South West	66	168	2.5	3,575	54.2	22	0.3	24	19	28.8
3. Waterloo Wellington	27	70	2.6	1,802	66.7	51	1.9	11	9	33.3
4. Hamilton Niagara Haldimand Brant	61	167	2.7	3,872	63.5	14	0.2	35	30	49.2
5. Central West	15	37	2.5	848	56.5	23	1.5	*	*	*
6. Mississauga Halton	17	43	2.5	622	36.6	28	1.6	*	*	*
7. Toronto Central	32	90	2.8	2,329	72.8	121	3.8	7	7	21.9
8. Central	27	93	3.4	1,319	48.9	56	2.1	7	6	22.2
9. Central East	46	126	2.7	2,245	48.8	101	2.2	10	10	21.7
10. South East	30	94	3.1	1,066	35.5	20	0.7	*	*	*
11. Champlain	44	162	3.7	2,394	54.4	78	1.8	21	19	43.2
12. North Simcoe Muskoka	*	56	4.3	556	42.8	15	1.2	10	6	*
13. North East	30	155	5.2	1,594	53.1	117	3.9	11	11	36.7
14. North West	*	*	*	*	*	*	*	0	0	0.0
LHIN of treatment										
1. Erie St. Clair	*	*	*	*	*	0	0.0	0	0	0.0
2. South West	117	324	2.8	6,497	55.5	114	1.0	41	32	27.4
3. Waterloo Wellington	**	**	**	**	**	**	**	**	**	**
4. Hamilton Niagara Haldimand Brant	82	220	2.7	5,339	65.1	43	0.5	44	38	46.3
5. Central West	**	**	**	**	**	**	**	**	**	**
6. Mississauga Halton	**	**	**	**	**	**	**	**	**	**
7. Toronto Central	154	474	3.1	7,918	51.4	324	2.1	37	33	21.4
A. University Health Network	104	329	3.2	4,864	46.8	116	1.1	23	19	18.3
B. Sunnybrook Health Sciences Centre	35	100	2.9	2,090	59.7	155	4.4	8	8	22.9
C. Mount Sinai Hospital	15	45	3.0	964	64.3	53	3.5	*	*	*
8. Central	*	*	*	*	*	*	*	*	*	*
9. Central East	**	**	**	**	**	**	**	**	**	**
10. South East	19	45	2.4	507	26.7	10	0.5	0	0	0.0
11. Champlain	49	188	3.8	2,699	55.1	87	1.8	23	21	42.9
12. North Simcoe Muskoka	**	**	**	**	**	**	**	**	**	**
13. North East	25	118	4.7	1,255	50.2	104	4.2	7	7	28.0
14. North West	**	**	**	**	**	**	**	**	**	**

¹ The denominator includes all patients in the Larynx/Hypopharynx Cancer Resection Cohort.

* In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

** The LHIN did not treat any patients from the Cancer Resection Cohort (i.e., no laryngectomies were performed in the LHIN).

ED = emergency department; CCAC = Community Care Access Centre; ICU = intensive care unit.

EXHIBIT 3.3 Hospital admissions for larynx/hypopharynx surgery among adults in the Larynx/Hypopharynx Cancer Resection Cohort in the 12 months before and 12 months after their diagnosis, by Local Health Integration Network of residence and of treatment, in Ontario, 2003 to 2010

Key Findings

- Approximately half (46%) of laryngectomies were performed outside the Local Health Integration Network (LHIN) of patient residence at the time of diagnosis.
- Approximately 21% of laryngectomy procedures done in hospitals in the Toronto Central LHIN were performed on patients who resided in the LHIN at the time of diagnosis. The majority of laryngectomy procedures in Toronto Central LHIN hospitals were performed on patients who lived in other LHINs, such as the Central East LHIN (30%).
- Across the province, 79% of laryngectomy procedures undergone by patients in this cohort were performed at hospitals in the South West LHIN (London Health Sciences Centre), the Hamilton Niagara Haldimand Brant LHIN (St. Joseph's Hospital), and the Toronto Central LHIN (University Health Network, Sunnybrook Health Sciences Centre and Mount Sinai Hospital).

EXHIBIT 3.3 continued

LHIN of Residence	LHIN of Treatment														Ontario
	1. Erie St. Clair	2. South West	3. Waterloo Wellington	4. Hamilton Niagara Haldimand Brant	5. Central West	6. Mississauga Halton	7. Toronto Central	8. Central	9. Central East	10. South East	11. Champlain	12. North Simcoe Muskoka	13. North East	14. North West	
Admissions, n (Column %, Row %) ¹															
1. Erie St. Clair	*	*					*								38 (8.5, 100.0)
2. South West		*		*											66 (14.7, 100.0)
3. Waterloo Wellington		19 (70.4, 16.2)		*			*								27 (6.0, 100.0)
4. Hamilton Niagara Haldimand Brant				*			*								61 (13.6, 100.0)
5. Central West				*			*								15 (3.4, 100.0)
6. Mississauga Halton				9 (52.9, 11.0)			8 (47.1, 5.2)								17 (3.8, 100.0)
7. Toronto Central							32 (100.0, 20.8)								32 (7.1, 100.0)
8. Central							*	*							27 (6.0, 100.0)
9. Central East							46 (100.0, 29.9)								46 (10.3, 100.0)
10. South East							*			19 (63.3, 100.0)	*				30 (6.7, 100.0)
11. Champlain											*				44 (9.8, 100.0)
12. North Simcoe Muskoka							*								*
13. North East		*					*				*		25 (83.3, 100.0)		30 (6.7, 100.0)
14. North West							*								*
Ontario	*	117 (100.0, 26.1)		82 (100.0, 18.3)			154 (100.0, 34.4)	*		19 (100.0, 4.2)	49 (100.0, 10.9)		25 (100.0, 5.6)		448 (100.0, 100.0)

¹ Column % = the proportion of patients having larynx/hypopharynx cancer surgery in a given LHIN who were residents of that LHIN when diagnosed, and the proportion who were residents of other LHINs. Row % = the proportion of patients having larynx/hypopharynx cancer surgery in a given LHIN who had surgery in their LHIN of residence, and the proportion who had surgery in other LHINs.

*In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated. Totals may not sum due to small-cell suppression.

EXHIBIT 3.4 Type of definitive resection procedure among adults in the Larynx/Hypopharynx Cancer Resection Cohort, by sex, age group, neighbourhood income quintile, community size, and Local Health Integration Network of residence and of treatment, in Ontario, 2003 to 2010

Key Findings

- Partial and total laryngectomy procedures were more common among men than women.
- In the Larynx/Hypopharynx Resection Cohort, the rate of total laryngectomy declined with increasing neighbourhood income. The rate was highest among those living in the lowest-income neighbourhoods (52%) and lowest among those living in the highest-income neighbourhoods (40%).
- Partial laryngectomy procedures were rarely performed (4%; not displayed due to suppression of small cell sizes). They were most common in patients treated in the Toronto Central Local Health Integration Network (LHIN), followed by the South West and North East LHINs (data suppressed due to small sample sizes).

Characteristic	Cohort, N	Definitive Resection Procedure			
		Laryngectomy		Pharyngolaryngectomy	
		n	%	n	%
Ontario	448	207	46.2	222	49.6
Sex					
Female	52	18	34.6	32	61.5
Male	396	189	47.7	190	48.0
Age group, years					
18–54	80	36	45.0	41	51.3
55–64	153	58	37.9	88	57.5
65–69	88	38	43.2	46	52.3
70–74	54	30	55.6	22	40.7
≥75	73	45	61.6	25	34.2
Neighbourhood income quintile					
Q1 (lowest)	119	62	52.1	54	45.4
Q2	110	53	48.2	50	45.5
Q3	78	33	42.3	41	52.6
Q4	73	32	43.8	39	53.4
Q5 (highest)	68	27	39.7	38	55.9
Community size (population)					
≥1,500,000	108	45	41.7	56	51.9
100,000–1,499,999	208	99	47.6	105	50.5
<100,000	132	63	47.7	61	46.2

EXHIBIT 3.4 *continued*

Characteristic	Cohort, N	Definitive Resection Procedure			
		Laryngectomy		Pharyngolaryngectomy	
		n	%	n	%
LHIN of residence					
1. Erie St. Clair	38	*	*	22	57.9
2. South West	66	*	*	35	53.0
3. Waterloo Wellington	27	15	55.6	12	44.4
4. Hamilton Niagara Haldimand Brant	61	39	63.9	*	*
5. Central West	15	12	80.0	*	*
6. Mississauga Halton	17	*	*	11	64.7
7. Toronto Central	32	11	34.4	20	62.5
8. Central	27	13	48.1	13	48.1
9. Central East	46	17	37.0	24	52.2
10. South East	30	20	66.7	10	33.3
11. Champlain	44	11	25.0	33	75.0
12. North Simcoe Muskoka	*	*	*	7	53.8
13. North East	30	18	60.0	*	*
14. North West	*	*	*	0	0.0
LHIN of treatment					
1. Erie St. Clair	*	*	*	0	0.0
2. South West	117	45	38.5	67	57.3
3. Waterloo Wellington	**	**	**	**	**
4. Hamilton Niagara Haldimand Brant	82	50	61.0	*	*
5. Central West	**	**	**	**	**
6. Mississauga Halton	**	**	**	**	**
7. Toronto Central	154	65	42.2	79	51.3
A. University Health Network	104	50	48.1	47	45.2
B. Sunnybrook Health Sciences Centre	35	*	*	23	65.7
C. Mount Sinai Hospital	15	*	*	9	60.0
8. Central	*	*	*	0	0.0
9. Central East	**	**	**	**	**
10. South East	19	17	89.5	*	*
11. Champlain	49	12	24.5	37	75.5
12. North Simcoe Muskoka	**	**	**	**	**
13. North East	25	16	64.0	*	*
14. North West	**	**	**	**	**

* In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

** The LHIN did not treat any patients from the Cancer Resection Cohort (i.e., no laryngectomies were performed in the LHIN).

EXHIBIT 3.5 Proportion of adults in the Overall Larynx/Hypopharynx Cancer Cohort who received a laryngectomy as a definitive procedure, by Local Health Integration Network of residence, in Ontario, 2003 to 2010

Key Findings

- The proportion of patients in the Overall Larynx/Hypopharynx Cancer Cohort who received a major resection (laryngectomy) within 12 months of their diagnosis varied according to the Local Health Integration Network (LHIN) of residence at the time of diagnosis. The resection rate was highest among patients living in the South West LHIN (24%) and lowest among patients in the North West LHIN (data suppressed due to small sample sizes).
- Some patients residing in the North West LHIN may have been treated in neighbouring Manitoba; nonetheless, there was significant variation in laryngectomy rates at one year among the remainder of the LHINs.

Characteristic	Cohort, N	Laryngectomy		LHIN Rate vs. Ontario Rate ¹
		Patients receiving, n	Patients receiving, %	
Ontario	3,034	448	14.8	0.0
LHIN of residence				
1. Erie St. Clair	195	38	19.5	31.8
2. South West	275	66	24.0	62.2
3. Waterloo Wellington	165	27	16.4	10.8
4. Hamilton Niagara Haldimand Brant	373	61	16.4	10.8
5. Central West	134	15	11.2	-24.3
6. Mississauga Halton	176	17	9.7	-34.5
7. Toronto Central	263	32	12.2	-17.6
8. Central	272	27	9.9	-33.1
9. Central East	303	46	15.2	2.7
10. South East	155	30	19.4	31.1
11. Champlain	312	44	14.1	-4.7
12. North Simcoe Muskoka	133	*	*	*
13. North East	212	30	14.2	-4.1
14. North West	66	*	*	*

¹ Ontario rate = 14.8%

* In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

EXHIBIT 3.6A Overall pattern of surgical care provided to adults in the Larynx/Hypopharynx Cancer Resection Cohort, by physician specialty, in Ontario, 2003 to 2010

Key Findings

- Otolaryngology–head and neck surgeons performed 90% of the laryngectomies done in Ontario during the study period; the remainder were performed by general surgeons.
- General surgeons were more likely to perform a total laryngectomy. Otolaryngology–head and neck surgeons were more likely to perform partial laryngectomy and pharyngolaryngectomy (data not shown due to small cell sizes).
- Ninety percent of patients were treated by otolaryngology–head and neck surgeons.

Physician Specialty	Physicians Performing Laryngectomy		Surgeries Performed		Patients Treated		Definitive Resection Procedure					
	n	%	n	%	n	%	Partial Laryngectomy		Total Laryngectomy		Pharyngolaryngectomy	
Ontario	28	100.0	454	100.0	448	100.0	19	4.2	207	46.2	222	49.6
Otolaryngology	*	*	408	89.9	405	90.4	*	*	176	43.5	*	*
General surgery	*	*	46	10.1	43	9.6	*	*	31	73.8	*	*

* In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

EXHIBIT 3.6B Overall pattern of surgical care provided to adults in the Larynx/Hypopharynx Cancer Resection Cohort, by hospital type, in Ontario, 2003 to 2010

Key Findings

- Head and neck cancer treatment centres accounted for 69% of the hospitals providing larynx/hypopharynx resection in Ontario during the study period, yet they performed 97% of all such resections in this cohort.
- Patients undergoing resection for larynx/hypopharynx cancer at designated head and neck cancer treatment centres were more likely to have a partial laryngectomy compared with those who received care at other hospitals.

Hospital Type	Hospitals Performing Larynx/Hypopharynx Cancer Surgery		Surgeries Performed		Patients Treated		Definitive Resection Procedure					
							Partial Laryngectomy		Total Laryngectomy		Pharyngolaryngectomy	
	n	%	n	%	n	%	n	%	n	%	n	%
Ontario	13	100.0	454	100.0	448	100.0	19	4.2	207	46.2	222	49.6
Head and neck cancer centre	9	69.2	442	97.4	437	97.5	19	4.3	*	*	216	49.4
Other hospital	4	30.8	12	2.6	11	2.5	0	0.0	*	*	6	54.5

* In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

EXHIBIT 3.7A Diagnostic and adjunctive procedures received by adults in the Larynx/Hypopharynx Cancer Resection Cohort in the 12 months before and 12 months after their definitive surgery, by Local Health Integration Network of residence and of treatment, in Ontario, 2003 to 2010

Key Findings

- On average, patients in the Larynx/Hypopharynx Resection Cohort received 1.1 panendoscopies and 2.0 other endoscopies (bronchoscopy or esophagoscopy) in the 12 months before and after their definitive surgery. This suggests that many patients had more than three upper aerodigestive tract endoscopy procedures in that period.
- In the year before and after their definitive surgery, 62% of patients in the cohort received a tracheoesophageal fistula (the creation of a passage between the breathing and swallowing passages) to assist with voice rehabilitation after laryngectomy. The rate varied considerably across Local Health Integration Networks (LHINs) of residence and, more importantly, of treatment.
- Neck dissections were conducted in 95% of patients. There was considerable variability across LHINs of patient residence and LHINs of patient treatment. The neck dissection rate was lowest for patients living in the South East LHIN (77%).
- On average, patients undergoing a laryngectomy received 0.3 free flaps in the 24 months surrounding the definitive procedure. Among the high-volume LHINs of treatment, the Hamilton Niagara Haldimand Brant LHIN had the lowest proportion of patients receiving a free flap (8%). Similar trends were observed when any reconstructive procedure was assessed.
- Very few head and neck fine-needle biopsies (44) and neck open biopsies (22) were performed in this cohort. (Detailed data are not shown due to the suppression of small cells.)

EXHIBIT 3.7A *continued*

Characteristic	Cohort, N	Tracheoesophageal Fistula		Panendoscopy		Other Endoscopy		Oral Cavity Biopsy	
		n	Patients receiving, %	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n
Ontario	448	276	61.6	499	1.1	914	2.0	205	0.5
LHIN of residence									
1. Erie St. Clair	38	25	65.8	47	1.2	44	1.2	14	0.4
2. South West	66	39	59.1	81	1.2	93	1.4	24	0.4
3. Waterloo Wellington	27	20	74.1	26	1.0	58	2.1	11	0.4
4. Hamilton Niagara Haldimand Brant	61	33	54.1	42	0.7	169	2.8	26	0.4
5. Central West	15	13	86.7	21	1.4	29	1.9	9	0.6
6. Mississauga Halton	17	8	47.1	16	0.9	36	2.1	10	0.6
7. Toronto Central	32	22	68.8	54	1.7	75	2.3	15	0.5
8. Central	27	20	74.1	37	1.4	70	2.6	17	0.6
9. Central East	46	25	54.3	77	1.7	113	2.5	26	0.6
10. South East	30	20	66.7	*	*	45	1.5	15	0.5
11. Champlain	44	40	90.9	16	0.4	99	2.3	26	0.6
12. North Simcoe Muskoka	*	*	*	17	1.3	24	1.8	*	*
13. North East	30	6	20.0	50	1.7	51	1.7	8	0.3
14. North West	*	*	*	*	*	8	4.0	*	*
LHIN of treatment									
1. Erie St. Clair	*	*	*	*	*	*	*	0	0.0
2. South West	117	75	64.1	147	1.3	165	1.4	42	0.4
3. Waterloo Wellington	**	**	**	**	**	**	**	**	**
4. Hamilton Niagara Haldimand Brant	82	45	54.9	54	0.7	222	2.7	35	0.4
5. Central West	**	**	**	**	**	**	**	**	**
6. Mississauga Halton	**	**	**	**	**	**	**	**	**
7. Toronto Central	154	91	59.1	240	1.6	353	2.3	83	0.5
A. University Health Network	104	52	50.0	160	1.5	219	2.1	61	0.6
B. Sunnybrook Health Sciences Centre	35	28	80.0	60	1.7	86	2.5	16	0.5
C. Mount Sinai Hospital	15	11	73.3	20	1.3	48	3.2	*	*
8. Central	*	*	*	0	0.0	*	*	*	*
9. Central East	**	**	**	**	**	**	**	**	**
10. South East	19	15	78.9	*	*	32	1.7	8	0.4
11. Champlain	49	44	89.8	18	0.4	106	2.2	28	0.6
12. North Simcoe Muskoka	**	**	**	**	**	**	**	**	**
13. North East	*	*	*	37	1.5	34	1.4	7	0.3
14. North West	**	**	**	**	**	**	**	**	**

¹ The denominator includes all patients in the Larynx/Hypopharynx Cancer Resection Cohort.

* In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

** The LHIN did not treat any patients from the Cancer Resection Cohort (i.e., no laryngectomies were performed in the LHIN).

EXHIBIT 3.7A continued

Characteristic	Neck Dissection				Free Flap		Reconstructive Procedure		Tracheostomy		Gastrostomy Tube	
	n	Avg ¹ per patient, n	Patients receiving, n	Patients receiving, %	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n
Ontario	462	1.0	424	94.6	142	0.3	332	0.7	290	0.6	193	0.4
LHIN of residence												
1. Erie St. Clair	42	1.1	37	97.4	16	0.4	35	0.9	24	0.6	16	0.4
2. South West	73	1.1	63	95.5	26	0.4	55	0.8	37	0.6	17	0.3
3. Waterloo Wellington	30	1.1	27	100.0	*	*	19	0.7	17	0.6	14	0.5
4. Hamilton Niagara Haldimand Brant	56	0.9	54	88.5	*	*	16	0.3	36	0.6	27	0.4
5. Central West	15	1.0	15	100.0	0	0.0	*	*	13	0.9	*	*
6. Mississauga Halton	15	0.9	15	88.2	*	*	*	*	11	0.6	7	0.4
7. Toronto Central	34	1.1	31	96.9	9	0.3	29	0.9	31	1.0	22	0.7
8. Central	33	1.2	26	96.3	14	0.5	32	1.2	16	0.6	13	0.5
9. Central East	48	1.0	44	95.7	25	0.5	47	1.0	34	0.7	24	0.5
10. South East	23	0.8	23	76.7	7	0.2	16	0.5	13	0.4	10	0.3
11. Champlain	46	1.0	44	100.0	17	0.4	42	1.0	27	0.6	7	0.2
12. North Simcoe Muskoka	*	*	*	*	*	*	12	0.9	*	*	8	0.6
13. North East	32	1.1	30	100.0	11	0.4	16	0.5	20	0.7	21	0.7
14. North West	*	*	*	*	0	0.0	0	0.0	*	*	*	*
LHIN of treatment												
1. Erie St. Clair	0	0.0	0	0.0	0	0.0	0	0.0	*	*	*	*
2. South West	131	1.1	114	97.4	46	0.4	103	0.9	71	0.6	39	0.3
3. Waterloo Wellington	**	**	**	**	**	**	**	**	**	**	**	**
4. Hamilton Niagara Haldimand Brant	77	0.9	75	91.5	6	0.1	23	0.3	49	0.6	38	0.5
5. Central West	**	**	**	**	**	**	**	**	**	**	**	**
6. Mississauga Halton	**	**	**	**	**	**	**	**	**	**	**	**
7. Toronto Central	163	1.1	148	96.1	58	0.4	142	0.9	120	0.8	86	0.6
A. University Health Network	107	1.0	99	95.2	34	0.3	92	0.9	84	0.8	61	0.6
B. Sunnybrook Health Sciences Centre	39	1.1	35	100.0	22	0.6	44	1.3	21	0.6	15	0.4
C. Mount Sinai Hospital	17	1.1	14	93.3	*	*	*	*	15	1.0	10	0.7
8. Central	*	*	*	*	0	0.0	*	*	*	*	0	0.0
9. Central East	**	**	**	**	**	**	**	**	**	**	**	**
10. South East	*	*	*	*	*	*	6	0.3	*	*	*	*
11. Champlain	51	1.0	49	100.0	20	0.4	47	1.0	28	0.6	10	0.2
12. North Simcoe Muskoka	**	**	**	**	**	**	**	**	**	**	**	**
13. North East	26	1.0	25	100.0	9	0.4	10	0.4	15	0.6	15	0.6
14. North West	**	**	**	**	**	**	**	**	**	**	**	**

¹ The denominator includes all patients in the Larynx/Hypopharynx Cancer Resection Cohort.

*In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

** The LHIN did not treat any patients from the Cancer Resection Cohort (i.e., no laryngectomies were performed in the LHIN).

EXHIBIT 3.7B Radiologic services received by adults in the Larynx/Hypopharynx Cancer Resection Cohort in the 12 months before and 12 months after their definitive surgery, by Local Health Integration Network of residence and of treatment, in Ontario, 2003 to 2010

Key Findings

- The computed tomography (CT) scan is the major modality used to image the head and neck. A large number of CT scans (2.2 per patient) were performed on patients in the Larynx/Hypopharynx Resection Cohort in the two-year period surrounding the definitive laryngectomy procedure.
- A large number of chest X-rays (6.5 per patient) and CT scans of the chest (1.5 per patient) were performed on patients in this cohort.
- Other less common imaging tests administered to patients in this cohort included abdominal CT scans (0.4 per patient) and abdominal ultrasound (0.3 per patient).
- Magnetic resonance imaging was seldom used to diagnose or stage larynx/hypopharynx cancer in this group of patients.
- No PET scans were performed in this cohort to diagnose or stage larynx/hypopharynx cancer.

EXHIBIT 3.7B continued

Characteristic	Cohort, N	Head and Neck						Chest				Abdomen			
		Ultrasound		CT Scan		MRI Scan		X-Ray		CT Scan		Ultrasound		CT Scan	
		n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n
Ontario	448	114	0.3	999	2.2	68	0.2	2,923	6.5	668	1.5	155	0.3	185	0.4
LHIN of residence															
1. Erie St. Clair	38	19	0.5	80	2.1	*	*	203	5.3	52	1.4	10	0.3	19	0.5
2. South West	66	8	0.1	104	1.6	*	*	340	5.2	67	1.0	18	0.3	19	0.3
3. Waterloo Wellington	27	*	*	64	2.4	*	*	190	7.0	38	1.4	13	0.5	*	*
4. Hamilton Niagara Haldimand Brant	61	8	0.1	86	1.4	*	*	407	6.7	43	0.7	18	0.3	14	0.2
5. Central West	15	6	0.4	44	2.9	*	*	118	7.9	29	1.9	7	0.5	7	0.5
6. Mississauga Halton	17	*	*	35	2.1	*	*	102	6.0	*	*	13	0.8	7	0.4
7. Toronto Central	32	8	0.3	104	3.3	11	0.3	261	8.2	75	2.3	*	*	18	0.6
8. Central	27	13	0.5	83	3.1	*	*	174	6.4	47	1.7	19	0.7	16	0.6
9. Central East	46	17	0.4	136	3.0	7	0.2	351	7.6	91	2.0	17	0.4	17	0.4
10. South East	30	12	0.4	63	2.1	22	0.7	152	5.1	39	1.3	8	0.3	16	0.5
11. Champlain	44	8	0.2	83	1.9	*	*	346	7.9	62	1.4	7	0.2	14	0.3
12. North Simcoe Muskoka	*	*	*	39	3.0	*	*	65	5.0	35	2.7	*	*	10	0.8
13. North East	30	*	0.1	72	2.4	7	0.2	206	6.9	65	2.2	16	0.5	20	0.7
14. North West	*	*	*	6	3.0	0	0.0	8	4.0	*	*	0	0.0	*	*
LHIN of treatment															
1. Erie St. Clair	*	*	8.0	*	*	0	0.0	*	*	0	0.0	0	0.0	0	0.0
2. South West	117	27	0.2	227	1.9	8	0.1	677	5.8	148	1.3	35	0.3	44	0.4
3. Waterloo Wellington	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
4. Hamilton Niagara Haldimand Brant	82	9	0.1	123	1.5	6	0.1	530	6.5	63	0.8	31	0.4	19	0.2
5. Central West	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
6. Mississauga Halton	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
7. Toronto Central	154	55	0.4	472	3.1	26	0.2	1,117	7.3	320	2.1	63	0.4	77	0.5
A. University Health Network	104	34	0.3	318	3.1	18	0.2	713	6.9	224	2.2	38	0.4	50	0.5
B. Sunnybrook Health Sciences Centre	35	15	0.4	104	3.0	*	*	274	7.8	59	1.7	21	0.6	17	0.5
C. Mount Sinai Hospital	15	6	0.4	50	3.3	*	*	130	8.7	37	2.5	*	*	10	0.7
8. Central	*	0	0.0	*	*	0	0.0	*	*	*	*	0	0.0	0	0.0
9. Central East	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10. South East	19	7	0.4	27	1.4	18	0.9	76	4.0	*	1.0	*	*	14	0.7
11. Champlain	49	11	0.2	94	1.9	*	*	374	7.6	66	1.3	10	0.2	14	0.3
12. North Simcoe Muskoka	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
13. North East	25	*	*	52	2.1	*	*	141	5.6	51	2.0	11	0.4	17	0.7
14. North West	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

¹ The denominator includes all patients in the Larynx/Hypopharynx Cancer Resection Cohort.

* In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

CT = computed tomography; MRI = magnetic resonance imaging.

EXHIBIT 3.7C Consultations and services received by adults in the Larynx/Hypopharynx Cancer Resection Cohort in the 12 months before and 12 months after their definitive surgery, by Local Health Integration Network of residence and of treatment, in Ontario, 2003 to 2010

Key Findings

- In the Larynx/Hypopharynx Resection Cohort, 95% of patients saw a radiation oncologist in the 12 months before and after their definitive laryngectomy procedure; 84% of patients received radiation therapy as part of their treatment.
- Rates of referral to a radiation oncologist were lowest (84%) among patients who lived in the Champlain Local Health Integration Network (LHIN) at the time of their diagnosis. Patients living in the Toronto Central and North East LHINs had a 100% radiation oncologist consultation rate.
- More than two-thirds (69%) of patients in this cohort were seen by a medical oncologist during the 24 months surrounding their definitive laryngectomy procedure. This rate ranged from a low of 53% among people residing in the North East LHIN at the time of diagnosis to a high of 90% among those living in the Erie St. Clair LHIN.
- More than one in five patients in this cohort (22%) received chemotherapy as part of their treatment for larynx/hypopharynx cancer. The highest chemotherapy rate (35%) was observed among those living in the South West LHIN at the time of diagnosis; those residing in the Central West LHIN had the lowest rate (0%).
- On average, patients in the cohort visited their surgeons 12.1 times in the period from 12 months before to 12 months after their definitive laryngectomy surgeries.
- Seventeen percent of patients in the cohort received a palliative care consultation in the 12 months before and after their definitive laryngectomy surgeries. The highest consultation rate (33%) was observed among those living in the Waterloo Wellington LHIN at the time of diagnosis; the lowest rate (0%) was among those residing in the Central West LHIN. Relatively infrequent use of palliative care services in this cohort resulted in some cells being suppressed due to small sample sizes.

EXHIBIT 3.7C *continued*

Characteristic	Cohort, N	Radiation Oncology Consultation		Radiation Therapy			Medical Oncology Consultation		Chemotherapy		Surgery Consultation		Palliative Care Consultation
		Patients receiving, %	Avg ¹ per patient, n	Patients receiving, %	Avg ¹ per patient, n	Patients receiving post-operatively, %	Patients receiving, %	Avg ¹ per patient, n	Patients receiving, %	Avg ¹ per patient, n	Patients receiving, %	Avg ¹ per patient, n	Patients receiving, %
Ontario	448	95.1	1.1	84.2	1.1	58.9	69.2	1.8	22.1	0.9	100.0	12.1	17.0
LHIN of residence													
1. Erie St. Clair	38	92.1	1.2	84.2	0.9	65.8	89.5	2.3	28.9	1.0	100.0	11.1	13.2
2. South West	66	97.0	1.0	89.4	1.1	72.7	81.8	2.0	34.8	1.4	100.0	9.9	13.6
3. Waterloo Wellington	27	92.6	1.0	81.5	1.0	66.7	81.5	1.8	25.9	1.9	100.0	11.9	33.3
4. Hamilton Niagara Haldimand Brant	61	95.1	1.0	80.3	0.9	65.6	60.7	1.3	26.2	0.9	100.0	12.4	14.8
5. Central West	15	93.3	1.1	80.0	1.1	60.0	66.7	2.1	0.0	0.0	100.0	10.0	0.0
6. Mississauga Halton	17	94.1	1.1	76.5	0.9	41.2	58.8	1.9	*	*	100.0	11.9	*
7. Toronto Central	32	100.0	1.2	87.5	1.3	50.0	84.4	2.6	*	*	100.0	13.2	18.8
8. Central	27	96.3	1.0	85.2	1.3	40.7	70.4	2.1	22.2	0.4	100.0	14.0	*
9. Central East	46	95.7	1.2	84.8	1.3	54.3	63.0	2.0	19.6	0.6	100.0	12.5	15.2
10. South East	30	100.0	1.7	73.3	1.0	70.0	56.7	1.2	26.7	1.9	100.0	10.9	*
11. Champlain	44	84.1	1.0	84.1	1.0	52.3	59.1	2.0	*	*	100.0	13.4	20.5
12. North Simcoe Muskoka	*	*	*	*	*	*	*	*	*	*	*	*	*
13. North East	30	100.0	1.2	90.0	1.0	50.0	53.3	0.8	*	*	100.0	14.0	20.0
14. North West	*	*	*	*	*	*	*	*	*	*	*	*	*
LHIN of treatment													
1. Erie St. Clair	*	*	*	*	*	*	*	*	*	*	*	*	*
2. South West	117	94.0	1.1	87.2	1.0	71.8	89.7	2.2	34.2	1.5	100.0	10.6	17.1
3. Waterloo Wellington	**	**	**	**	**	**	**	**	**	**	**	**	**
4. Hamilton Niagara Haldimand Brant	82	96.3	1.0	78.0	0.9	61.0	59.8	1.3	24.4	0.8	100.0	12.2	15.9
5. Central West	**	**	**	**	**	**	**	**	**	**	**	**	**
6. Mississauga Halton	**	**	**	**	**	**	**	**	**	**	**	**	**
7. Toronto Central	154	96.8	1.2	84.4	1.2	47.4	66.9	2.0	16.2	0.4	100.0	12.7	18.2
A. University Health Network	104	96.2	1.2	84.6	1.3	44.2	63.5	1.8	13.5	0.4	100.0	11.7	17.3
B. Sunnybrook Health Sciences Centre	35	100.0	1.2	91.4	1.2	60.0	71.4	2.2	28.6	0.6	100.0	14.7	17.1
C. Mount Sinai Hospital	15	93.3	1.3	66.7	0.9	40.0	80.0	2.7	*	*	100.0	14.8	*
8. Central	*	*	*	*	*	*	*	*	*	*	*	*	*
9. Central East	**	**	**	**	**	**	**	**	**	**	**	**	**
10. South East	19	100.0	1.7	73.7	0.9	78.9	57.9	1.1	36.8	3.0	100.0	11.1	*
11. Champlain	49	85.7	1.0	83.7	1.0	51.0	59.2	1.9	*	*	100.0	13.2	22.4
12. North Simcoe Muskoka	**	**	**	**	**	**	**	**	**	**	**	**	**
13. North East	25	100.0	1.2	96.0	1.0	60.0	48.0	0.7	*	*	100.0	12.8	*
14. North West	**	**	**	**	**	**	**	**	**	**	**	**	**

¹ The denominator includes all patients in the Larynx/Hypopharynx Cancer Resection Cohort.

* In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

** The LHIN did not treat any patients from the Cancer Resection Cohort (i.e., no laryngectomies were performed in the LHIN).

EXHIBIT 3.8A Diagnostic and adjunctive procedures received by adults in the Larynx/Hypopharynx Cancer/No Resection Cohort in the 12 months before and 12 months after their diagnosis, by Local Health Integration Network of residence, in Ontario, 2003 to 2010

Key Findings

- Patients in the Larynx/Hypopharynx Cancer/No Resection Cohort underwent a number of diagnostic procedures in the 24 months surrounding their diagnosis. These included panendoscopy (1,172 procedures) and other endoscopies, including esophagoscopy and bronchoscopy, (3,161 procedures). Patients in this cohort were less likely to receive these procedures than patients in the Resection Cohort (see [Exhibit 3.7A](#)).
- Patients in the No Resection Cohort were less likely to receive neck dissections, free flaps, any reconstructive procedure, a tracheostomy (a breathing tube placed through the neck), or a gastrostomy tube (a feeding tube inserted through the abdominal wall) compared to patients in the Resection Cohort (see [Exhibit 3.7A](#)).
- Much lower rates of other procedures were performed on patients in this cohort, including 94 neck open biopsies, 157 head and neck fine-needle biopsies, 11 free flaps and 45 reconstructive procedures; all averaged less than 0.1 procedure per patient.

Characteristic	Cohort, N	Panendoscopy		Other Endoscopy		Oral Cavity Biopsy		Neck Dissection			Tracheostomy		Gastrostomy Tube	
		n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	Patients readmitted, %	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n
Ontario	2,586	1,172	0.5	3,161	1.2	1,475	0.6	97	0.0	3.3	450	0.2	723	0.3
LHIN of residence														
1. Erie St. Clair	157	49	0.3	147	0.9	91	0.6	*	*	*	21	0.1	39	0.2
2. South West	209	117	0.6	267	1.3	105	0.5	11	0.1	4.8	9	0.0	35	0.2
3. Waterloo Wellington	138	72	0.5	186	1.3	63	0.5	*	*	*	21	0.2	34	0.2
4. Hamilton Niagara Haldimand Brant	312	133	0.4	430	1.4	195	0.6	9	0.0	2.9	35	0.1	72	0.2
5. Central West	119	79	0.7	147	1.2	65	0.5	9	0.1	6.7	38	0.3	61	0.5
6. Mississauga Halton	159	81	0.5	192	1.2	91	0.6	9	0.1	4.4	27	0.2	54	0.3
7. Toronto Central	231	134	0.6	246	1.1	118	0.5	*	*	*	54	0.2	93	0.4
8. Central	245	105	0.4	312	1.3	162	0.7	*	*	*	38	0.2	71	0.3
9. Central East	257	108	0.4	297	1.2	162	0.6	7	0.0	2.3	59	0.2	86	0.3
10. South East	125	12	0.1	165	1.3	64	0.5	8	0.1	6.4	23	0.2	35	0.3
11. Champlain	268	59	0.2	302	1.1	181	0.7	17	0.1	4.5	63	0.2	37	0.1
12. North Simcoe Muskoka	120	74	0.6	142	1.2	67	0.6	*	*	*	23	0.2	46	0.4
13. North East	182	137	0.8	188	1.0	78	0.4	8	0.0	4.4	31	0.2	43	0.2
14. North West	64	12	0.2	140	2.2	33	0.5	0	0.0	0.0	8	0.1	17	0.3

¹ The denominator includes all patients in the Larynx/Hypopharynx Cancer Resection Cohort.

*In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

EXHIBIT 3.8B Radiologic services received by adults in the Larynx/Hypopharynx Cancer/No Resection Cohort in the 12 months before and 12 months after their diagnosis, by Local Health Integration Network of residence, in Ontario, 2003 to 2010

Key Findings

- Patients in the Larynx/Hypopharynx Cancer/No Resection Cohort received a number of radiologic services in the 12 months before and after their diagnosis. These included computed tomography (CT) scans of the head and neck (1.6 per patient, on average), chest X-rays (3.1 per patient), chest CT scans (0.9 per patient), abdominal ultrasound imaging (0.4 per patient) and abdominal CT scans (0.3 per patient).
- Patients who did not undergo resection received slightly fewer radiologic imaging services overall compared to those who did have a resection surgery (see [Exhibit 3.7B](#)). This was most prominent in the chest imaging category.
- In the No Resection Cohort, there was little variation in the use of radiologic services across Local Health Integration Networks of patient residence.
- Other radiologic services utilized infrequently in this cohort included MRI scans (29; average 0.0 per person), PET scans (8; average 0.0 per person) and bone scans (201, average 0.1 per person).

Characteristic	Head and Neck				Chest				Abdomen			
	MRI Scan		Swallow Study		X-Ray		CT Scan		Ultrasound		CT Scan	
	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n
Ontario	436	0.2	444	0.2	8,004	3.1	2,425	0.9	1,060	0.4	854	0.3
LHIN of residence												
1. Erie St. Clair	10	0.1	23	0.1	539	3.4	106	0.7	70	0.4	44	0.3
2. South West	14	0.1	29	0.1	598	2.9	166	0.8	53	0.3	66	0.3
3. Waterloo Wellington	20	0.1	32	0.2	394	2.9	111	0.8	58	0.4	45	0.3
4. Hamilton Niagara Haldimand Brant	41	0.1	27	0.1	870	2.8	170	0.5	143	0.5	70	0.2
5. Central West	22	0.2	37	0.3	361	3.0	153	1.3	62	0.5	37	0.3
6. Mississauga Halton	15	0.1	17	0.1	597	3.8	190	1.2	77	0.5	61	0.4
7. Toronto Central	40	0.2	53	0.2	764	3.3	282	1.2	100	0.4	100	0.4
8. Central	37	0.2	41	0.2	794	3.2	231	0.9	137	0.6	69	0.3
9. Central East	63	0.2	45	0.2	744	2.9	282	1.1	111	0.4	80	0.3
10. South East	107	0.9	23	0.2	359	2.9	93	0.7	41	0.3	51	0.4
11. Champlain	25	0.1	42	0.2	921	3.4	213	0.8	75	0.3	78	0.3
12. North Simcoe Muskoka	16	0.1	31	0.3	397	3.3	123	1.0	41	0.3	43	0.4
13. North East	15	0.1	29	0.2	448	2.5	264	1.5	74	0.4	83	0.5
14. North West	11	0.2	15	0.2	218	3.4	41	0.6	18	0.3	27	0.4

¹ The denominator includes all patients in the Larynx/Hypopharynx Cancer Resection Cohort.

* In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

MRI = magnetic resonance imaging; CT = computed tomography.

EXHIBIT 3.8C Consultations and services received by adults in the Larynx/Hypopharynx Cancer/No Resection Cohort in the 12 months before and 12 months after their diagnosis, by Local Health Integration Network of residence, in Ontario, 2003 to 2010

Key Findings

- Approximately 92% of patients in the Larynx/Hypopharynx Cancer/No Resection Cohort saw a radiation oncologist in the 12 months before and after their diagnosis. About 84% of patients received radiation therapy as a part of treatment.
- The rate of referral to a radiation oncologist was lowest among patients who lived in the North West
- Local Health Integration Network (LHIN) at the time of their diagnosis (78%).
- A lower proportion of patients in this cohort (50%) were seen by a medical oncologist during the 24 months surrounding their diagnosis as compared to the cohort that received a resection (69%) (see [Exhibit 3.7C](#)).
- On average, patients in the study cohort visited their surgeon 7.2 times in the 12 months before and 12 months after their diagnosis, which is almost half as often as those who received a definitive laryngectomy procedure (see [Exhibit 3.7C](#)). Despite not receiving a laryngectomy procedure, 99% of patients in the No Resection Cohort saw a surgeon during the same period.
- Fifteen percent of patients in the cohort received a palliative care consultation in the 12 months before and after their diagnosis, which is comparable to patients in the Resection Cohort (see [Exhibit 3.7C](#)).

Characteristic	Cohort, N	Radiation Oncology Consultation		Radiation Therapy		Medical Oncology Consultation		Chemotherapy		Surgery Consultation		Palliative Care Consultation
		Patients receiving, %	Avg ¹ per patient	Patients receiving, %	Avg ¹ per patient	Patients receiving, %	Avg ¹ per patient	Patients receiving, %	Avg ¹ per patient	Patients receiving, %	Avg ¹ per patient	Patients receiving, %
Ontario	2,586	91.5	1.0	84.4	1.0	50.0	1.0	18.1	1.0	99.3	7.2	14.8
LHIN of residence												
1. Erie St. Clair	157	91.1	1.0	82.8	0.9	61.1	1.2	31.8	1.2	98.7	6.4	9.6
2. South West	209	89.0	0.9	81.8	0.9	57.4	1.0	28.2	1.1	100.0	6.8	10.0
3. Waterloo Wellington	138	88.4	0.9	81.2	0.9	39.9	0.7	18.8	1.3	100.0	6.5	18.1
4. Hamilton Niagara Haldimand Brant	312	90.7	0.9	83.0	0.9	43.3	0.7	17.0	1.4	99.4	6.7	13.1
5. Central West	119	95.8	1.0	84.0	1.3	55.5	1.4	18.5	0.5	100.0	7.6	22.7
6. Mississauga Halton	159	95.0	1.0	88.7	1.2	47.8	1.1	10.7	0.8	100.0	7.8	15.7
7. Toronto Central	231	90.5	1.0	79.7	1.1	61.0	1.5	14.7	0.4	99.1	7.3	19.0
8. Central	245	91.0	1.0	84.5	1.1	47.3	1.1	15.1	0.6	98.4	7.5	13.5
9. Central East	257	91.8	1.0	82.5	1.1	53.7	1.1	17.1	1.1	98.4	7.5	16.0
10. South East	125	92.8	1.2	84.8	1.0	52.0	0.9	21.6	3.2	96.8	6.7	17.6
11. Champlain	268	91.4	1.0	85.8	1.0	43.3	0.9	13.8	0.8	100.0	7.3	18.3
12. North Simcoe Muskoka	120	96.7	1.0	90.0	1.2	49.2	0.8	10.0	0.5	100.0	8.3	10.0
13. North East	182	94.0	1.0	94.5	1.0	44.5	0.6	18.7	1.1	100.0	7.4	12.1
14. North West	64	78.1	0.8	79.7	0.8	45.3	0.8	23.4	1.0	98.4	7.8	9.4

¹ The denominator includes all patients in the Larynx/Hypopharynx Cancer Resection Cohort.

*In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

Discussion and Conclusions

Summary of findings and implications for clinical practice

Cancer of the larynx and hypopharynx is the 21st most common newly diagnosed cancer and the 20th most common cause of death due to cancer in Canada. Larynx/hypopharynx cancer is the second most common head and neck cancer diagnosed in Ontario.

Our analyses of Ontarians diagnosed with larynx/hypopharynx cancer from 2003 to 2010 found that incidence rates were more than six times higher among men than women and were highest among those aged 70 or older. Incidence rates varied widely across the province's 14 Local Health Integration Networks (LHINs).

Nearly 69% of Ontario adults newly diagnosed with larynx/hypopharynx cancer underwent a cancer-related surgical procedure for their disease within a year of diagnosis, while 15% had a definitive surgical procedure (laryngectomy). People aged 75 or older and newly diagnosed with larynx/hypopharynx cancer and people residing in smaller communities at the time of diagnoses were less likely to have any cancer-related surgery (or laryngectomy) than younger people with this disease and those residing in larger communities. The likelihood of receiving any cancer-related

procedure and laryngectomy varied significantly by the LHIN of patient residence. This lower rate of resection in less populated LHINs and in lower-income neighbourhoods may not be entirely explained by differences in patient preferences, cancer stage or comorbidity profile. These findings warrant further investigation.

Among the province's nine major head and neck cancer treatment centres, there were large variations in initial treatment approach and adjunctive procedures used (tracheoesophageal puncture, neck dissection, reconstructive procedure). Some centres were more likely to treat with a surgical procedure, while others were more likely to initiate radiotherapy with or without chemotherapy. This represents an important variation in practice, particularly for advanced disease.

Among the 15% of patients in the study cohort who underwent a laryngectomy procedure for larynx/hypopharynx cancer, nearly half (46%) had a total laryngectomy. The more complex partial laryngectomy procedure was performed on only 4% of patients in this cohort and at only six of the nine highly specialized head and neck cancer treatment centres. The remainder of the cohort that underwent a resection (50%) had a pharyngolaryngectomy. Nearly all (98%) laryngectomy procedures done in Ontario between 2003 and 2010 were performed at head and neck cancer treatment centres. These procedures were largely performed by otolaryngologists or high-volume general surgeons.

Most surgical admissions for larynx/hypopharynx cancer (54%) occurred outside the LHINs where patients were living at the time of their

diagnosis, with the vast majority (79%) of admissions occurring in three LHINs: Toronto Central, South West, and Hamilton Niagara Haldimand Brant. Larynx/hypopharynx surgical care is highly regionalized. Care for patients with larynx/hypopharynx cancer was resource intensive and required a significant number of diagnostic tests, procedures and care delivered by a number of different oncologists. There was little use of head and neck MRI in this cohort. The abdomen is not routinely imaged for staging in patients undergoing laryngectomy. Within a year of laryngectomy, patients in this cohort used a large number of services provided by Community Care Access Centres (on average, 54 days of service per person).

There were variations across LHINs of patient residence in the use of surgery and radiation therapy to treat persons newly diagnosed with larynx/hypopharynx cancer. There was also significant variation in the use of palliative care consultation, which may reflect the availability of this service in the various LHINs or differences in the stage (extent) of disease at presentation due to a delay in the diagnosis in some LHINs. Those who did not undergo a laryngectomy still used considerable surgical and other health care resources. We were surprised by the less-than-ideal rates of consultation with radiation oncologists and medical oncologists in this group.

Implications for policy and planning

We noted variations in the use of surgical procedures and referral to specialists among larynx/hypopharynx cancer patients who resided in one LHIN and were treated in another. More research is necessary to understand this observation and whether health resource planning initiatives are needed to improve access to care in some regions of the province.

The incidence of larynx/hypopharynx cancer increases with age. As the Ontario population ages, there may be increasing demand for health services related to the diagnosis and treatment of this cancer.

Although care is highly regionalized to the province's designated head and neck cancer treatment centres, there are significant variations in the diagnostic workup, treatment, use of adjunctive procedures, and consultations for patients who reside in one LHIN and are treated in another. We believe that province-wide quality improvement programs should be designed with input from the nine major head and neck cancer treatment centres to standardize care, monitor and improve compliance with guidelines, and study outcomes in the larynx/hypopharynx group. Communities of practice, led by Cancer Care Ontario clinical champions, have achieved significant improvements in the quality of delivered care in the thoracic, hepatobiliary, colorectal and urological cancer communities. The head and neck oncologic community may benefit from similar programs.

Future research

Cancer-stage data and comorbidity information to assess case mix across the nine major head and neck cancer treatment centres are needed to more thoroughly analyze differences between centres. Further studies should delineate processes of care (preoperative imaging and metastatic workup, multidisciplinary consultations and cancer care conferences, and appropriate follow-up care), adherence to guidelines, and their association with outcomes. Although larynx/hypopharynx cancer care is regionalized, volumes vary significantly among head and neck cancer treatment centres, and further regionalization may be associated with improved care. Alternatively, agreed upon evidence-based algorithms of care may improve outcomes for this patient group.

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4 Surgery for Salivary Gland Cancer

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Summary

Issue

Salivary gland cancers are of diverse histologies (cell types). This is challenging for pathologists and clinicians alike as it is difficult to acquire a significant volume of or experience with any given tumour histology. Because it can be difficult to differentiate between benign and malignant salivary gland tumours, a resection is often performed for diagnostic and therapeutic purposes. For this reason, tumours of this subsite are not necessarily referred to multidisciplinary oncology centres prior to surgical removal.

Malignant tumours can invade nearby structures, particularly nerves, affecting sensation, facial movement, cosmesis and, rarely, speech and swallowing. In such cases, postoperative reconstructive surgery can rehabilitate a patient's function, physical appearance and quality of life. In addition, postoperative adjuvant radiation is frequently required. For these reasons and due to the inherent complexity of treating these cancers, this chapter explores whether care is regionalized and whether disparities exist among patients with these cancers.

Study

This chapter provides a snapshot of treatment patterns for adults newly diagnosed with cancers of the major salivary gland (including the parotid and submandibular glands) in Ontario between January 1, 2003, and December 31, 2010. We focus on the delivery of surgical care and related health services and, where possible, include data regarding patient factors (sex, age, socioeconomic status and place of residence) and provider factors (surgical specialty and the type and location of hospitals delivering services). We also assess the influence of patient and provider factors on the services provided.

Key findings

- Nearly 93% of Ontario adults newly diagnosed with salivary gland cancer underwent a cancer-related surgical procedure (a resection or an adjunctive procedure) for their disease within a year of diagnosis. Of that group, only 82% had a definitive surgical procedure (parotid or submandibular gland resection).
- Compared to other age groups, adults aged 75 or older and newly diagnosed with salivary gland cancer were less likely to have any cancer-related surgery (or salivary gland resection).
- Among the nine major head and neck cancer treatment centres, there was large variation in rates of consultation with a radiation oncologist or medical oncologist. Similar variations were observed in rates of radiotherapy and chemotherapy for this cohort.
- More than half (57%) of salivary gland cancer resection procedures done in Ontario between 2003 and 2010 were performed at head and neck cancer treatment centres. A large majority of these procedures were performed by otolaryngologists (91%); the remainder were completed by general surgeons (9%) and plastic surgeons (1%).
- A third (35%) of all surgical admissions for salivary gland cancer surgery occurred outside the LHINs where patients were living at the time of their diagnosis; more than half (56%) of these admissions occurred in three LHINs: Toronto Central, South West, and Hamilton Niagara Haldimand Brant. Compared with cancers of the oral cavity and larynx/hypopharynx, surgical care for salivary gland cancer was far less concentrated in regional centres.
- Patients who did not undergo a resection still used considerable surgical and other health care resources.

Implications

- For patients with salivary gland cancer who reside in one LHIN and are treated in another, we note variations in the use of surgical procedures and referral to specialists. More research is necessary to understand this observation.
- The incidence of salivary gland cancer increases with age. As the Ontario population ages, there may be increasing demand for health services related to this cancer's diagnosis and treatment.
- Of the head and neck cancers presented in this atlas, salivary gland cancer treatment is the least regionalized. Benign parotid gland masses are far more common than malignant ones. A surgical resection is often used for both diagnostic and therapeutic purposes if a fine-needle aspiration biopsy does not provide a diagnosis. This is reflected in the number of surgeons and centres performing salivary gland cancer surgery. Although this is understandable, a significant proportion (75%) of patients had a resection without first undergoing a fine-needle biopsy attempt. Regional quality improvement initiatives could help address this rate and potentially improve compliance with provincial best practice guidelines, which have yet to be developed for this cancer subsite.
- Despite some regionalization to designated head and neck cancer treatment centres, there are significant variations in the diagnostic workup,

treatment, use of adjunctive procedures, and consultations for patients residing in one LHIN and being treated in another, even among the three LHINs with the highest treatment volumes.

Introduction

Malignant tumours of the salivary glands have a relatively low incidence compared to other head and neck cancers. Canadian cancer statistics do not specifically report on salivary gland cancers, including them with oral cancers.¹ Salivary gland tumours account for more than 0.5% of all malignancies and approximately 5% of all head and neck cancers.² They have a diverse histology, can present at multiple sites (including the face, neck and mouth) and require complex multidisciplinary treatment.

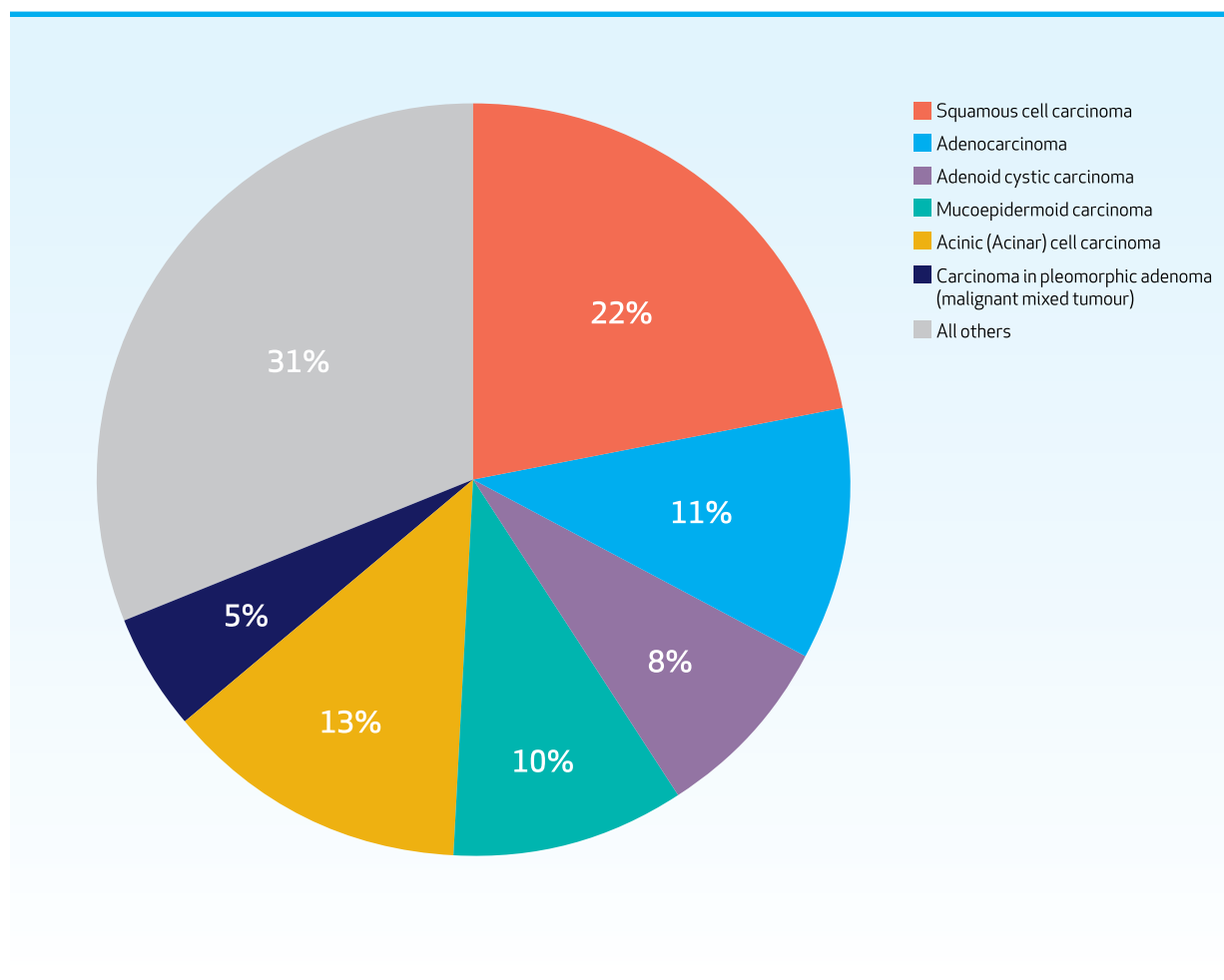
Salivary gland cancers present in one of four sites in decreasing order of incidence:

- the parotid glands (over the cheeks),
- the submandibular glands (below the jaw in the upper neck),
- the sublingual glands (deep to the floor of the mouth), and
- the minor salivary glands (throughout the mouth, sinuses, voice box and trachea).

The vast majority (more than 95%) of malignant tumours in Ontario present in the parotid or submandibular glands, and this chapter focuses on these tumours. We chose to exclude sublingual and minor salivary gland tumours as these require different surgical procedures and are not representative of the majority of salivary gland tumours.

Salivary gland cancers are of diverse histologies (cell types), many of which are very rare. This is challenging for pathologists and clinicians alike as it is difficult to acquire a significant volume of or experience with any given tumour histology or look to the literature for management recommendations. This chapter includes all histological types of salivary gland cancer except for lymphoma, which accounts for only 8% of histological types and is not treated with surgery.

In Ontario, many salivary gland cancers are classified as squamous cell carcinomas; however, the overwhelming majority of these are metastases from skin cancer to the lymph nodes lying within the parotid gland. These cases necessitate surgery to remove the potentially cancerous lymph nodes in the parotid gland. **Exhibit 4.0** presents the major nonlymphoma histologies for salivary gland cancers in Ontario from 2003 to 2010.

EXHIBIT 4.0 Distribution of salivary gland tumours, by histological type, in Ontario, 2003 to 2010

Source: Eskander et al. *J Otolaryngol Head Neck Surg.* 2014; 43:50.

Presentation

There is no screening program for salivary gland cancers because they are rare. Patients may present to a health care professional with facial weakness or numbness, unexplained pain or swelling in the face or neck, or most commonly, with an asymptomatic mass in and around the cheek, ear, neck or jaw. If the swelling is thought to be due to an infection or a stone in the salivary ducts, nonsurgical treatment is initiated before referral to a specialist for biopsy and other diagnostic tests ultimately lead to a cancer diagnosis. The likelihood of a lesion being malignant depends on the site of presentation. Approximately 25% of parotid tumours and 40% of submandibular tumours are malignant.^{2,3}

Diagnosis and staging

A parotid or submandibular gland cancer is diagnosed using a physical examination by a physician or dentist, which may result in a biopsy before or after appropriate radiological imaging. The cancer typically presents as a mass. A definitive diagnosis usually involves a fine-needle aspiration biopsy with or without imaging guidance. This is typically performed in an office setting unless imaging (ultrasound) is required, in which case it is performed in an imaging suite. Such needle biopsies when positive accurately predict 97% of malignancies; however, when reported as negative, 20%–30% of cancers are missed.^{4,5}

If a biopsy does not confirm cancer, patients can be re-biopsied, followed closely, or referred to a surgeon for diagnostic excision in cases where the suspicion is high or for cosmesis and symptom control. For the majority of salivary gland neoplasms, including suspected benign neoplasms, surgery is recommended to ensure there is no malignancy (given the high false negative rate) and to prevent progression to a malignancy in cases of pleomorphic adenoma. In addition, surgery is recommended when growth occurs. Larger tumours may be more difficult to remove and also become of cosmetic concern. Despite the fact that surgery is recommended in most cases, a needle biopsy is still valuable as it is often able to determine malignancy, which can aid in the triage of patients to surgery and in counselling them regarding the extent of their surgery. If a biopsy confirms cancer, staging should be performed and a referral made to a surgeon with expertise in the evaluation and treatment of this cancer.

Treatment of parotid and submandibular gland cancers

Once patients are diagnosed, determining the extent of the local disease and of regional or distant metastases – a process called staging – requires a combination of physical examination and imaging with computed tomography and/or magnetic resonance imaging.

The main curative treatment modality for parotid and submandibular cancers is surgery to remove the cancer with a surrounding portion of normal tissue. Radiation with or without chemotherapy is rarely used with the intent to cure the patient as the initial treatment; it is typically reserved for palliative cases. Radiation, however, is often used postoperatively to treat the primary site or the neck in certain high-risk cases. Resection is largely dependent on the location and extent of the tumour, whether it is resectable, whether the patient will tolerate a major operation, and functional considerations (i.e., how the resection will affect the patient's quality of life).

How the study cohorts were defined

This chapter provides detailed information on surgical services and related health services delivered to adults newly diagnosed with cancers of the major salivary glands — the parotid and submandibular glands — in Ontario from 2003 to 2010.

The study population for this chapter includes all men and women 18 years of age or older identified with salivary gland cancer in the Ontario Cancer Registry and whose diagnosis date fell between January 1, 2003, and December 31, 2010. This population is referred to as the **Overall Salivary Gland Cancer Cohort**.

The Overall Salivary Gland Cancer Cohort was divided into two pairs of smaller groups.

For Exhibits 4.1A to 4.1C, the Overall Salivary Gland Cancer Cohort was divided as follows:

- The **Salivary Gland Surgery Cohort** includes those persons who had surgery related to their salivary gland cancer within 12 months before or after their diagnosis date.
- The **Salivary Gland/No Surgery Cohort** includes those persons who did not have surgery related to their salivary gland cancer within 12 months before or after their diagnosis date.

For Exhibits 4.2A to 4.8C, the Overall Salivary Gland Cancer Cohort was divided as follows:

- The **Salivary Gland Resection Cohort** includes those persons who had resection of their primary tumour site within 12 months before or after their diagnosis date.
- The **Salivary Gland/No Resection Cohort** includes those persons who did not have resection of their primary tumour site within 12 months before or after their diagnosis date. This group includes all individuals who did not have surgery and those whose only surgery was an adjunctive procedure (reconstruction, tracheostomy, gastrostomy tube).

List of Exhibits

EXHIBIT 4.1A Incidence of salivary gland cancer and use of surgery among adults in the Overall Salivary Gland Cancer Cohort, by sex, age group, neighbourhood income quintile, community size and Local Health Integration Network of residence, in Ontario, 2003 to 2010

EXHIBIT 4.1B Incidence of salivary gland cancer and use of surgery among men in the Overall Salivary Gland Cancer Cohort, by age group, neighbourhood income quintile, community size and Local Health Integration Network of residence, in Ontario, 2003 to 2010

EXHIBIT 4.1C Incidence of salivary gland cancer and use of surgery among women in the Overall Salivary Gland Cancer Cohort, by age group, neighbourhood income quintile, community size and Local Health Integration Network of residence, in Ontario, 2003 to 2010

EXHIBIT 4.2A Health care use among adults in the Salivary Gland Cancer Resection Cohort, by sex, age group, neighbourhood income quintile, community size, and Local Health Integration Network of residence and of treatment, in Ontario, 2003 to 2010

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EXHIBIT 4.4 Type of definitive resection procedure among adults in the Salivary Gland Cancer Resection Cohort, by sex, age group, neighbourhood income quintile, community size, and Local Health Integration Network of residence and of treatment, in Ontario, 2003 to 2010

EXHIBIT 4.5 Proportion of adults in the Overall Salivary Gland Cancer Cohort who received a salivary gland resection as a definitive procedure, by Local Health Integration Network of residence, in Ontario, 2003 to 2010

EXHIBIT 4.6A Overall pattern of surgical care provided to adults in the Salivary Gland Cancer Resection Cohort, by physician specialty, in Ontario, 2003 to 2010

EXHIBIT 4.6B Overall pattern of surgical care provided to adults in the Salivary Gland Cancer Resection Cohort, by hospital type, in Ontario, 2003 to 2010

EXHIBIT 4.7A Diagnostic and adjunctive procedures received by adults in the Salivary Gland Cancer Resection Cohort in the 12 months before and 12 months after their definitive surgery, by Local Health Integration Network of residence and of treatment, in Ontario, 2003 to 2010

EXHIBIT 4.7B Radiologic services received by adults in the Salivary Gland Cancer Resection Cohort in the 12 months before and 12 months after their definitive surgery, by Local Health Integration Network of residence and of treatment, in Ontario, 2003 to 2010

EXHIBIT 4.7C Consultations and services received by adults in the Salivary Gland Cancer Resection Cohort in the 12 months before and 12 months after their definitive surgery, by Local Health Integration Network of residence and of treatment, in Ontario, 2003 to 2010

EXHIBIT 4.8A Diagnostic and adjunctive procedures received by adults in the Salivary Gland Cancer/No Resection Cohort in the 12 months before and 12 months after their diagnosis, by Local Health Integration Network of residence, in Ontario, 2003 to 2010

EXHIBIT 4.8B Radiologic services received by adults in the Salivary Gland Cancer/No Resection Cohort in the 12 months before and 12 months after their definitive surgery, by Local Health Integration Network of residence, in Ontario, 2003 to 2010

EXHIBIT 4.8C Consultations and services received by adults in the Salivary Gland Cancer/No Resection Cohort in the 12 months before and 12 months after their definitive surgery, by Local Health Integration Network of residence, in Ontario, 2003 to 2010

EXHIBIT 4.1A Incidence of salivary gland cancer and use of surgery among adults in the Overall Salivary Gland Cancer Cohort, by sex, age group, neighbourhood income quintile, community size and Local Health Integration Network of residence, in Ontario, 2003 to 2010

Key Findings

- Men constituted 59% of all salivary gland cancer patients in Ontario from 2003 to 2010. In the Overall Salivary Gland Cancer Cohort, the rate of salivary gland cancer per 100,000 population was higher among men (15.5 cases) than women (9.7 cases).
- The incidence of salivary gland cancer increases with age. Nearly half (47.1%) of newly-diagnosed salivary gland cancers occurred in people aged 65 or older.
- The incidence of salivary gland cancer is not related to neighbourhood income.
- The proportion of Ontarians with salivary gland cancer who underwent cancer-related surgery decreased with smaller community size.
- The Toronto Central LHIN had the lowest incidence rate of salivary gland cancer (9.1 cases per 100,000) while the South West LHIN had the highest incidence rate (14.5 cases per 100,000).
- The probability of undergoing surgery was lower for those aged 75 and older (76%) compared to the younger age groups (all above 90%).
- There were minor variations in rates of surgery for salivary gland cancer across LHINs of patient residence. The proportion of patients in the study cohort who had surgery related to their disease ranged from a low of 90% in the South East LHIN at the time of diagnosis, to a high of nearly 97% among those who resided in the North East LHIN.

EXHIBIT 4.1A *continued*

Characteristic	Age-standardized ¹ Incidence per 100,000	Overall Salivary Gland Cancer Cohort					
		Total		Had surgery		Did not have surgery	
		N	%	n	Age-standardized ² % of total	n	Age-standardized ² % of total
Ontario	12.2	1,240	100.0	1,089	92.8	151	7.2
Sex³							
Female	9.7	507	40.9	456	94.6	51	5.4
Male	15.5	733	59.1	633	91.1	100	8.9
Age group,³ years							
18–54	6.7	409	33.0	388	94.9	21	5.1
55–64	18.2	246	19.8	223	91.5	23	8.5
65–69	19.9	92	7.4	82	90.2	10	9.8
70–74	30.9	122	9.8	111	91.1	11	8.9
≥75	53.4	371	29.9	285	75.6	86	24.4
Neighbourhood income quintile							
Q1 (lowest)	11.8	240	19.4	195	87.8	45	12.2
Q2	9.5	202	16.3	185	97.1	17	2.9
Q3	12.9	260	21.0	232	94.2	28	5.8
Q4	12.6	259	20.9	231	92.3	28	7.7
Q5 (highest)	13.7	279	22.5	246	93.0	33	7.0
Community size (population)							
≥1,500,000	10.6	428	34.5	382	93.3	46	6.7
100,000–1,499,999	12.1	474	38.2	422	93.4	52	6.6
<100,000	14.7	338	27.3	285	91.2	53	8.8
LHIN of residence							
1. Erie St. Clair	13.3	75	6.0	66	90.9	9	9.1
2. South West	14.5	125	10.1	115	94.1	10	5.9
3. Waterloo Wellington	12.0	69	5.6	*	*	*	*
4. Hamilton Niagara Haldimand Brant	11.3	142	11.5	121	92.0	21	8.0
5. Central West	9.4	52	4.2	*	*	*	*
6. Mississauga Halton	11.5	92	7.4	82	91.7	10	8.3
7. Toronto Central	9.1	92	7.4	77	92.2	15	7.8
8. Central	9.8	126	10.2	112	94.0	14	6.0
9. Central East	13.3	169	13.6	150	93.1	19	6.9
10. South East	12.4	60	4.8	47	89.8	13	10.2
11. Champlain	9.2	96	7.7	83	96.0	13	4.0
12. North Simcoe Muskoka	12.5	50	4.0	43	93.0	7	7.0
13. North East	12.2	65	5.2	57	96.6	8	3.4
14. North West	12.9	27	2.2	*	*	*	*

¹ Standardized to the 1991 Canadian census.² Standardized to the Overall Salivary Gland Cancer Cohort.³ Sex-specific rates have been adjusted for age; age-specific rates have been adjusted for sex.

EXHIBIT 4.1B Incidence of salivary gland cancer and use of surgery among men in the Overall Salivary Gland Cancer Cohort, by age group, neighbourhood income quintile, community size and Local Health Integration Network of residence, in Ontario, 2003 to 2010

Key Findings

- The findings shown in this exhibit are similar to those in **Exhibit 4.1A**; that is, both the incidence of salivary gland cancer and the proportion of men who had surgery were related to age.
- Among men in this cohort, those in the lowest income group had the lowest proportion of salivary gland cancer-related surgeries, including both definitive resection and adjunctive cancer procedures (82%).
- The incidence of salivary gland cancer was highest for men living in smaller communities at the time of their diagnosis (17 cases per 100,000 cumulative 8-year incidence).
- Men living in the Champlain LHIN at the time of their diagnosis were the most likely to have salivary gland cancer-related surgery (96%); those living in the South East LHIN were the least likely (85%).

Characteristic	Age-standardized ¹ Incidence per 100,000	Overall Salivary Gland Cancer Cohort					
		Total		Had surgery		Did not have surgery	
		N	%	n	Age-standardized ² % of total	n	Age-standardized ² % of total
Ontario	15.5	733	100.0	633	91.1	100	8.9
Age group,³ years							
18-54	2.6	199	27.1	185	93.0	14	7.0
55-64	12.5	149	20.3	131	87.9	18	12.1
65-69	11.4	57	7.8	49	86.0	8	14.0
70-74	20.8	76	10.4	69	90.8	7	9.2
≥75	51.8	252	34.4	199	79.0	53	21.0
Neighbourhood income quintile							
Q1 (lowest)	14.3	143	19.5	111	81.5	32	18.5
Q2	10.6	113	15.4	104	98.7	9	1.3
Q3	16.4	164	22.4	143	92.8	21	7.2
Q4	15.1	156	21.3	136	90.6	20	9.4
Q5 (highest)	14.7	157	21.4	139	93.5	18	6.5
Community size (population)							
≥1,500,000	11.7	233	31.8	203	90.6	30	9.4
100,000-1,499,999	14.8	292	39.8	258	92.9	34	7.1
<100,000	17.4	208	28.4	172	90.7	36	9.3
LHIN of residence							
1. Erie St. Clair	17.1	49	6.7	*	*	*	*
2. South West	17.1	75	10.2	*	*	*	*
3. Waterloo Wellington	12.6	37	5.0	*	*	*	*
4. Hamilton Niagara Haldimand Brant	13.1	85	11.6	70	90.3	15	9.7
5. Central West	10.1	28	3.8	*	*	*	*
6. Mississauga Halton	10.6	42	5.7	*	*	*	*
7. Toronto Central	11.9	59	8.0	48	86.7	11	13.3
8. Central	11.0	70	9.5	60	92.7	10	7.3
9. Central East	15.3	98	13.4	86	92.0	12	8.0
10. South East	16.1	40	5.5	30	85.1	10	14.9
11. Champlain	12.1	63	8.6	54	96.4	9	3.6
12. North Simcoe Muskoka	11.7	26	3.5	*	*	*	*
13. North East	17.0	44	6.0	37	94.6	7	5.4
14. North West	16.7	17	2.3	*	*	*	*

¹ Standardized to the 1991 Canadian census.

² Standardized to the Overall Salivary Gland Cancer Cohort.

³ Age-specific rates have not been standardized.

* In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

EXHIBIT 4.1C Incidence of salivary gland cancer and use of surgery among women in the Overall Salivary Gland Cancer Cohort, by age group, neighbourhood income quintile, community size and Local Health Integration Network of residence, in Ontario, 2003 to 2010

Key Findings

- Salivary gland cancer incidence among Ontario women increased markedly with age from 2003 to 2010. The rate was highest among women aged 75 or older (15 cases per 100,000).
- The age-standardized incidence of salivary gland cancer ranged from a high of 13.3 per 100,000 in the North Simcoe Muskoka LHIN to a low of 6.4 per 100,000 in the Toronto Central LHIN.
- Salivary gland cancer incidence rates were highest for women living in smaller communities at the time of their diagnosis (an eight-year cumulative incidence rate of 12 cases per 100,000).

Characteristic	Age-standardized ¹ Incidence per 100,000	Overall Salivary Gland Cancer Cohort					
		Total		Had surgery		Did not have surgery	
		N	%	n	Age-standardized ² % of total	n	Age-standardized ² % of total
Ontario	9.7	507	100.0	456	94.6	51	5.4
Age group,³ years							
18–54	2.7	210	41.4	203	96.7	7	3.3
55–64	7.9	97	19.1	*	*	*	*
65–69	6	35	6.9	*	*	*	*
70–74	9.8	46	9.1	*	*	*	*
≥75	14.7	119	23.5	86	72.3	33	27.7
Neighbourhood income quintile							
Q1 (lowest)	9.4	97	19.1	84	93.8	13	6.2
Q2	8.5	89	17.6	81	95.5	8	4.5
Q3	9.6	96	18.9	89	95.6	7	4.4
Q4	10.3	103	20.3	95	94.0	8	6.0
Q5 (highest)	12.6	122	24.1	107	92.5	15	7.5
Community size (population)							
≥1,500,000	9.5	195	38.5	179	95.8	16	4.2
100,000–1,499,999	9.6	182	35.9	164	93.9	18	6.1
<100,000	12	130	25.6	113	91.8	17	8.2
LHIN of residence							
1. Erie St. Clair	9.7	26	5.1	*	*	*	*
2. South West	12.0	50	9.9	*	*	*	*
3. Waterloo Wellington	11.5	32	6.3	*	*	*	*
4. Hamilton Niagara Haldimand Brant	9.5	57	11.2	51	93.6	6	6.4
5. Central West	8.6	24	4.7	*	*	*	*
6. Mississauga Halton	12.4	50	9.9	*	*	*	*
7. Toronto Central	6.4	33	6.5	*	*	*	*
8. Central	8.7	56	11.0	*	*	*	*
9. Central East	11.3	71	14.0	64	94.0	7	6.0
10. South East	8.8	20	3.9	*	*	*	*
11. Champlain	6.5	33	6.5	*	*	*	*
12. North Simcoe Muskoka	13.3	24	4.7	*	*	*	*
13. North East	7.6	21	4.1	*	*	*	*
14. North West	9.1	10	2.0	10	95.6	0	4.4

¹ Standardized to the 1991 Canadian census.

² Standardized to the Overall Salivary Gland Cancer Cohort.

³ Age-specific rates have not been standardized.

* In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

EXHIBIT 4.2A Health care services used by adults in the Salivary Gland Cancer Resection Cohort, by sex, age group, neighbourhood income quintile, community size, and Local Health Integration Network of residence and of treatment, in Ontario, 2003 to 2010

Key Findings

- Approximately 66% of hospital admissions for patients in the Salivary Gland Resection Cohort were for inpatient care; the remaining 34% were for ambulatory (same-day) care.
- Forty-six percent of patients in this cohort had more than one hospital admission in the year around their cancer diagnosis.
- Patients in this cohort had 3.9 visits, on average, with their treating surgeon in the year surrounding their salivary gland resection.
- Patients in this cohort undergoing a salivary gland resection procedure had an average hospital length of stay of 2.9 days.
- Patients treated in Local Health Integration Networks (LHINs) with lower case volumes were less likely to have had radiation therapy or chemotherapy before their surgical resection. Patients in these LHINs also had shorter lengths of stay for the resection procedure.

EXHIBIT 4.2A *continued*

Characteristic	Cohort, N	Patients who had surgical resection, %	Patients with preoperative XRT or chemotherapy, %	Visits with treating surgeon, avg per patient, ¹ n	Patients with more than one hospital admission, %	Total hospital admissions, ² n	Hospital admissions, avg per patient, ² n	Same-day surgery as % of total admissions	Inpatient admissions as % of total admissions	Avg length of stay, days
Ontario	1,010	81.5	5.1	3.9	46.4	1,902	1.9	34.2	65.8	2.9
Sex³										
Female	424	83.6	2.4	4.0	40.8	717	1.7	31.5	68.5	2.0
Male	586	79.9	7.2	3.8	50.5	1,185	2.0	35.9	64.1	3.6
Age group,³ years										
18–54	374	91.4	1.6	3.8	32.1	557	1.5	28.9	71.1	1.5
55–64	204	82.9	3.4	4.0	41.2	384	1.9	29.9	70.1	2.7
65–69	77	83.7	*	3.7	46.8	144	1.9	34.7	65.3	2.5
70–74	99	81.1	9.1	4.0	56.6	211	2.1	43.1	56.9	3.0
≥75	256	69.0	10.9	3.8	67.6	606	2.4	38.6	61.4	5.2
Neighbourhood income quintile										
Q1 (lowest)	179	74.6	3.9	3.8	51.4	352	2.0	33.0	67.0	3.8
Q2	169	83.7	5.9	4.0	47.9	336	2.0	35.1	64.9	3.1
Q3	215	82.7	2.8	3.9	47.4	394	1.8	35.3	64.7	2.6
Q4	215	83.0	4.7	4.0	38.1	369	1.7	34.7	65.3	2.5
Q5 (highest)	232	83.2	8.2	3.8	48.3	451	1.9	33.3	66.7	2.7
Community size (population)										
≥1,500,000	351	82.0	3.4	4.5	46.2	644	1.8	32.8	67.2	3.1
100,000–1,499,999	392	82.7	6.4	3.6	46.9	752	1.9	37.0	63.0	2.8
<100,000	267	79.0	5.6	3.4	46.1	506	1.9	32.0	68.0	2.7

¹ The time frame for surgeon visits was 6 months before to 6 months after the first surgery.² The time frame for hospital admissions was 12 months before to 12 months after the first surgery.³ Standardized to the Overall Salivary Gland Cancer Cohort; sex-specific rates have been adjusted for age; age-specific rates have been adjusted for sex.

* In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

XRT = external beam radiotherapy; IQR = interquartile range.

EXHIBIT 4.2A continued

Characteristic	Cohort, N	Patients who had surgical resection, %	Patients with preoperative XRT or chemotherapy, %	Visits with treating surgeon, avg per patient, ¹ n	Patients with more than one hospital admission, %	Total hospital admissions, ² n	Hospital admissions, avg per patient, ² n	Same-day surgery as % of total admissions	Inpatient admissions as % of total admissions	Avg length of stay, days
LHIN of residence										
1. Erie St. Clair	60	80.0	*	3.7	51.7	126	2.1	35.7	64.3	3.8
2. South West	109	87.2	8.3	3.3	38.5	185	1.7	20.0	80.0	3.2
3. Waterloo Wellington	61	88.4	*	3.4	62.3	145	2.4	39.3	60.7	1.7
4. Hamilton Niagara Haldimand Brant	113	79.6	12.4	4.0	48.7	210	1.9	43.8	56.2	2.7
5. Central West	*	88.5	0.0	4.7	41.3	77	1.7	31.2	68.8	2.5
6. Mississauga Halton	79	85.9	*	4.5	38.0	137	1.7	24.8	75.2	3.6
7. Toronto Central	67	72.8	*	4.1	61.2	144	2.1	31.9	68.1	3.9
8. Central	101	80.2	6.9	4.6	50.5	199	2.0	41.2	58.8	2.7
9. Central East	136	80.5	*	3.9	39.7	240	1.8	39.6	60.4	2.7
10. South East	43	71.7	*	2.2	32.6	67	1.6	20.9	79.1	3.1
11. Champlain	78	81.3	*	4.4	34.6	121	1.6	29.8	70.2	2.2
12. North Simcoe Muskoka	40	80.0	0.0	3.6	62.5	90	2.3	34.4	65.6	3.7
13. North East	55	84.6	*	3.0	58.2	114	2.1	35.1	64.9	2.3
14. North West	*	81.5	*	4.1	45.5	47	2.1	38.3	61.7	3.2
LHIN of treatment										
1. Erie St. Clair	22	**	0.0	5.0	63.6	47	2.1	46.8	53.2	3.9
2. South West	160	**	8.1	3.2	43.8	310	1.9	21.9	78.1	3.3
3. Waterloo Wellington	33	**	*	3.8	60.6	70	2.1	47.1	52.9	0.8
4. Hamilton Niagara Haldimand Brant	125	**	11.2	3.9	48.0	229	1.8	45.0	55.0	2.9
5. Central West	28	**	0.0	4.8	42.9	44	1.6	27.3	72.7	1.4
6. Mississauga Halton	55	**	*	4.7	30.9	89	1.6	20.2	79.8	2.2
7. Toronto Central	281	**	4.6	3.9	52.0	581	2.1	35.8	64.2	4.3
A. University Health Network	165	**	*	3.2	53.3	350	2.1	34.0	66.0	5.0
B. Sunnybrook Health Sciences Centre	37	**	*	4.6	56.8	84	2.3	44.0	56.0	4.8
C. Mount Sinai Hospital	40	**	*	4.7	40.0	67	1.7	29.9	70.1	3.8
D. Other	39	**	0.0	5.2	53.8	80	2.1	40.0	60.0	1.3
8. Central	33	**	0.0	4.4	36.4	52	1.6	26.9	73.1	1.2
9. Central East	82	**	*	3.9	48.8	156	1.9	47.4	52.6	1.4
10. South East	27	**	*	2.2	29.6	42	1.6	23.8	76.2	2.0
11. Champlain	87	**	*	4.3	34.5	133	1.5	28.6	71.4	2.1
12. North Simcoe Muskoka	18	**	0.0	3.7	61.1	35	1.9	34.3	65.7	1.7
13. North East	45	**	*	3.2	55.6	92	2.0	35.9	64.1	2.3
14. North West	14	**	0.0	5.9	*	22	1.6	*	*	2.0

¹ The time frame for surgeon visits was 6 months before to 6 months after the first surgery.² The time frame for hospital admissions was 12 months before to 12 months after the first surgery.³ Standardized to the Overall Salivary Gland Cancer Cohort; sex-specific rates have been adjusted for age; age-specific rates have been adjusted for sex.

*In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

** A percentage could not be derived as it is difficult to determine the denominator of patients that presented to each treatment LHIN using administrative data.

XRT = external beam radiotherapy; IQR = interquartile range.

EXHIBIT 4.2B Health care services used by adults in the Salivary Gland Cancer Resection Cohort, by Local Health Integration Network of residence and of treatment, in Ontario, 2003 to 2010

Key Findings

- Patients treated by salivary gland resection had 1.2 emergency department visits, on average, in the 12 months before and 12 months after their definitive resection procedure.
- Patients treated by salivary gland resection received, on average, 11.4 days of Community Care Access Centre (CCAC) services in the 12 months before and 12 months after their definitive resection procedure. Across the Local Health Integration Networks (LHINs) of patient residence, the highest number of days of CCAC services rendered (20 days) was for patients from the Eric St. Clair LHIN at the time of diagnosis; the lowest number (5 days) was among those residing in the Mississauga Halton LHIN.
- Patients treated by salivary gland resection had very few days (0.3 days, on average) in the intensive care unit during their salivary gland resection admission. This varied by the LHIN of the treating institution, potentially reflecting differing sizes of tumours and variations in the complexity of procedures performed by different institutions.
- Nearly 8% of patients undergoing a salivary gland resection procedure in Ontario from 2003 to 2010 were readmitted within 30 days of discharge. Even among LHINs with the highest treatment volumes, there were variations in the readmission rate.

EXHIBIT 4.2B *continued*

Characteristic	Cohort, N	ED Visits		CCAC Visits		ICU Days		Hospital Readmissions		
		n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Patients readmitted	
									n	%
Ontario	1,010	1,197	1.2	11,508	11.4	316	0.3	87	76	7.5
LHIN of residence										
1. Erie St. Clair	60	100	1.7	1,169	19.5	21	0.4	*	*	*
2. South West	109	154	1.4	1,613	14.8	63	0.6	13	10	9.2
3. Waterloo Wellington	61	64	1.0	562	9.2	39	0.6	*	*	*
4. Hamilton Niagara Haldimand Brant	113	138	1.2	1,536	13.6	13	0.1	13	11	9.7
5. Central West	*	33	0.7	496	10.8	9	0.2	*	*	*
6. Mississauga Halton	79	63	0.8	363	4.6	8	0.1	*	*	*
7. Toronto Central	67	101	1.5	827	12.3	29	0.4	*	*	*
8. Central	101	80	0.8	798	7.9	35	0.3	*	*	*
9. Central East	136	135	1.0	1,157	8.5	32	0.2	17	17	12.5
10. South East	43	67	1.6	307	7.1	20	0.5	*	*	*
11. Champlain	78	101	1.3	1,167	15.0	9	0.1	*	*	*
12. North Simcoe Muskoka	40	58	1.5	517	12.9	7	0.2	*	*	*
13. North East	55	78	1.4	807	14.7	23	0.4	*	*	*
14. North West	*	25	1.1	189	8.6	8	0.4	*	*	*
LHIN of treatment										
1. Erie St. Clair	22	21	1.0	98	4.5	12	0.5	*	*	*
2. South West	160	268	1.7	2,868	17.9	103	0.6	15	12	7.5
3. Waterloo Wellington	33	23	0.7	204	6.2	9	0.3	*	*	*
4. Hamilton Niagara Haldimand Brant	125	145	1.2	1,526	12.2	10	0.1	15	13	10.4
5. Central West	28	21	0.8	112	4.0	0	0.0	*	*	*
6. Mississauga Halton	55	33	0.6	243	4.4	6	0.1	*	*	*
7. Toronto Central	281	326	1.2	3,555	12.7	124	0.4	21	19	6.8
A. University Health Network	165	182	1.1	2,104	12.8	46	0.3	10	8	4.8
B. Sunnybrook Health Sciences Centre	37	44	1.2	633	17.1	51	1.4	*	*	*
C. Mount Sinai Hospital	40	66	1.7	691	17.3	22	0.6	*	*	*
D. Other	39	34	0.9	127	3.3	*	*	*	*	*
8. Central	33	12	0.4	64	1.9	*	*	0	0	0.0
9. Central East	82	82	1.0	572	7.0	14	0.2	16	15	18.3
10. South East	27	29	1.1	205	7.6	6	0.2	*	*	*
11. Champlain	87	127	1.5	1,195	13.7	9	0.1	*	*	*
12. North Simcoe Muskoka	18	26	1.4	61	3.4	*	*	*	*	*
13. North East	45	72	1.6	779	17.3	20	0.4	*	*	*
14. North West	14	12	0.9	26	1.9	0	0.0	0	0	0.0

¹ The denominator includes all patients in the Salivary Gland Cancer Resection Cohort.

* In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

ED = emergency department; CCAC = Community Care Access Centre; ICU = intensive care unit.

EXHIBIT 4.3 Hospital admissions for salivary gland surgery among adults in the Salivary Gland Cancer Resection Cohort in the 12 months before and 12 months after their diagnosis, by Local Health Integration Network of residence and of treatment, in Ontario, 2003 to 2010

Key Findings

- Nearly two-thirds of salivary gland resections were performed in the Local Health Integration Networks (LHINs) where patients resided at the time they were diagnosed (exact number not shown due to suppression of small cells).
- Approximately 21% of salivary gland resection procedures done in hospitals in the Toronto Central LHIN were performed on patients who lived in the LHIN when their cancers were diagnosed. The majority of salivary gland resection procedures performed in Toronto Central LHIN hospitals involved patients who lived in other LHINs, such as the Central LHIN (24%) and the Central East LHIN (21%).
- Across the province, 56% of salivary gland resection procedures received by patients in this study cohort were done in hospitals in the South West, Hamilton Niagara Haldimand Brant, and Toronto Central LHINs (exact numbers not shown due to suppression of small cells).

EXHIBIT 4.3 continued

LHIN of Residence	LHIN of Treatment														Ontario
	1. Erie St. Clair	2. South West	3. Waterloo Wellington	4. Hamilton Niagara Haldimand Brant	5. Central West	6. Mississauga Halton	7. Toronto Central	8. Central	9. Central East	10. South East	11. Champlain	12. North Simcoe Muskoka	13. North East	14. North West	
Admissions, n (Column %, Row %) ¹															
1. Erie St. Clair	*	36 (60.0, 22.5)					*								60 (5.9, 100.0)
2. South West		104 (95.4, 65.0)	*	*	*		*								109 (10.8, 100.0)
3. Waterloo Wellington		15 (24.6, 9.4)	30 (49.2, 90.9)	10 (16.4, 8.0)			*	*							61 (6.0, 100.0)
4. Hamilton Niagara Haldimand Brant		*		105 (92.9, 84.0)		*	*								113 (11.2, 100.0)
5. Central West					21 (45.7, 75.0)	8 (17.4, 14.6)	12 (26.1, 4.3)	*	*						*
6. Mississauga Halton			*	*	*	41 (51.9, 74.6)	25 (31.7, 8.9)	*			*				79 (7.8, 100.0)
7. Toronto Central						*	59 (88.1, 21.0)	*	*						67 (6.6, 100.0)
8. Central			*		*	*	68 (67.3, 24.2)	21 (20.8, 63.6)	*						101 (10.0, 100.0)
9. Central East		*					58 (42.7, 20.6)	*	71 (52.2, 86.6)	*	*				136 (13.5, 100.0)
10. South East		*					9 (20.9, 3.2)	*	*	19 (63.3, 100.0)	*				43 (4.3, 100.0)
11. Champlain							*				*				78 (7.7, 100.0)
12. North Simcoe Muskoka		*					21 (52.5, 7.5)					*			40 (4.0, 100.0)
13. North East							7 (12.7, 2.5)		*		*		45 (81.8, 100.0)		55 (5.5, 100.0)
14. North West							*							*	*
Ontario	*	160 (100.0, 15.8)	33 (100.0, 3.3)	125 (100.0, 12.4)	28 (100.0, 2.8)	55 (100.0, 5.5)	281 (100.0, 27.8)	33 (100.0, 3.3)	82 (100.0, 8.1)	27 (100.0, 2.7)	87 (100.0, 8.6)	*	45 (100.0, 4.5)	*	1,010 (100.0, 100.0)

¹ Column % = the proportion of patients having salivary gland cancer surgery in a given LHIN who were residents of that LHIN when diagnosed, and the proportion who were residents of other LHINs. Row % = the proportion of patients having salivary gland cancer surgery in a given LHIN who had surgery in their LHIN of residence, and the proportion who had the surgery in other LHINs.

*In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated. Totals may not sum due to small-cell suppression.

EXHIBIT 4.4 Type of definitive resection procedure among adults in the Salivary Gland Cancer Resection Cohort, by sex, age group, neighbourhood income quintile, community size, and Local Health Integration Network of residence and of treatment, in Ontario, 2003 to 2010

Key Findings

- With increasing age, patients were more likely to have a total or radical resection. For example, 62% of patients aged 75 or older received a total or radical resection, while 45% of those aged 18–54 received the same procedure. This could be a reflection of more advanced disease in the older population.
- Among patients in the Salivary Gland Resection Cohort, the type of procedure performed was not related to neighbourhood income or community size.
- Local Health Integration Networks with higher treatment volumes were more likely to perform a total or radical resection on the Salivary Gland Resection Cohort.

Characteristic	Cohort, N	Definitive Resection Procedure			
		Partial or Subtotal Resection		Total or Radical Resection	
		n	%	n	%
Ontario	1,010	483	47.8	527	52.2
Sex					
Female	424	221	52.1	203	47.9
Male	586	262	44.7	324	55.3
Age group,³ years					
18–54	374	205	54.8	169	45.2
55–64	204	102	50.0	102	50.0
65–69	77	38	49.4	39	50.6
70–74	99	40	40.4	59	59.6
≥75	256	98	38.3	158	61.7
Neighbourhood income quintile					
Q1 (lowest)	179	83	46.4	96	53.6
Q2	169	84	49.7	85	50.3
Q3	215	104	48.4	111	51.6
Q4	215	103	47.9	112	52.1
Q5 (highest)	232	109	47.0	123	53.0
Community size (population)					
≥1,500,000	351	163	46.4	188	53.6
100,000–1,499,999	392	196	50.0	196	50.0
<100,000	267	124	46.4	143	53.6

EXHIBIT 4.4 *continued*

Characteristic	Cohort, N	Definitive Resection Procedure			
		Partial or Subtotal Resection		Total or Radical Resection	
		n	%	n	%
LHIN of residence					
1. Erie St. Clair	60	26	43.3	34	56.7
2. South West	109	48	44.0	61	56.0
3. Waterloo Wellington	61	30	49.2	31	50.8
4. Hamilton Niagara Haldimand Brant	113	68	60.2	45	39.8
5. Central West	*	*	45.7	*	54.3
6. Mississauga Halton	79	36	45.6	43	54.4
7. Toronto Central	67	33	49.3	34	50.7
8. Central	101	42	41.6	59	58.4
9. Central East	136	74	54.4	62	45.6
10. South East	43	18	41.9	25	58.1
11. Champlain	78	30	38.5	48	61.5
12. North Simcoe Muskoka	40	22	55.0	18	45.0
13. North East	55	22	40.0	33	60.0
14. North West	*	*	59.1	*	40.9
LHIN of treatment					
1. Erie St. Clair	*	*	*	*	*
2. South West	160	62	38.8	98	61.3
3. Waterloo Wellington	33	20	60.6	13	39.4
4. Hamilton Niagara Haldimand Brant	125	79	63.2	46	36.8
5. Central West	28	12	42.9	16	57.1
6. Mississauga Halton	55	30	54.5	25	45.5
7. Toronto Central	281	106	37.7	175	62.3
A. University Health Network	165	48	29.1	117	70.9
B. Sunnybrook Health Sciences Centre	37	14	37.8	23	62.2
C. Mount Sinai Hospital	40	23	57.5	17	42.5
D. Other	39	21	53.8	18	46.2
8. Central	33	14	42.4	19	57.6
9. Central East	82	54	65.9	28	34.1
10. South East	27	15	55.6	12	44.4
11. Champlain	87	35	40.2	52	59.8
12. North Simcoe Muskoka	*	*	*	*	*
13. North East	45	18	40.0	27	60.0
14. North West	*	*	*	*	*

*In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

EXHIBIT 4.5 Proportion of adults in the Overall Salivary Gland Cancer Cohort who received a salivary gland resection as a definitive procedure, by Local Health Integration Network of residence, in Ontario, 2003 to 2010

Key Finding

- The proportion of patients in this cohort who received a salivary gland resection in the 12 months following their diagnosis varied according to their Local Health Integration Network (LHIN) of residence at the time of diagnosis. It ranged from a high of 89% of patients living in the Central West LHIN to a low of 72% of those living in the South East LHIN.

Characteristic	Cohort, N	Salivary Gland Resection		LHIN Rate vs. Ontario Rate ¹
		Patients receiving, n	Patients receiving, %	
Ontario	1,240	1,011	81.5	0.0
LHIN of residence				
1. Erie St. Clair	75	60	80.0	-1.8
2. South West	125	109	87.2	7.0
3. Waterloo Wellington	69	61	88.4	8.5
4. Hamilton Niagara Haldimand Brant	142	113	79.6	-2.3
5. Central West	*	*	88.5	8.6
6. Mississauga Halton	92	79	85.9	5.4
7. Toronto Central	92	67	72.8	-10.7
8. Central	126	101	80.2	-1.6
9. Central East	169	137	81.1	-0.5
10. South East	60	43	71.7	-12.0
11. Champlain	96	78	81.3	-0.2
12. North Simcoe Muskoka	50	40	80.0	-1.8
13. North East	65	55	84.6	3.8
14. North West	*	*	81.5	0.0

¹ Ontario rate = 81.5%

* In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

EXHIBIT 4.6A Overall pattern of surgical care provided to adults in the Salivary Gland Cancer Resection Cohort, by physician specialty, in Ontario, 2003 to 2010**Key Findings**

- General surgeons accounted for 16% of physicians providing salivary gland resection in Ontario during the study period. They performed a disproportionately low proportion (9%) of all salivary gland resection procedures on the cohort. Similar trends were observed for plastic surgeons who performed resections on less than 1% of the cohort.
- General surgeons were more likely to perform partial or subtotal resections; otolaryngology–head and neck surgeons were more likely to perform total or radical resections.
- The majority (91%) of patients were treated by otolaryngology–head and neck surgeons.

Physician Specialty	Physicians Performing Salivary Gland Cancer Surgery		Surgeries Performed		Patients Treated		Definitive Procedure			
							Partial or Subtotal Resection		Total or Radical Resection	
	n	%	n	%	n	%	n	%	n	%
Ontario	134	100.0	941	100.0	941	100.0	431	45.8	510	54.2
Otolaryngology	107	79.9	854	90.8	854	90.8	54	67.5	*	*
General surgery	21	15.7	80	8.5	80	8.5	371	43.4	483	56.6
Plastic surgery	6	4.5	7	0.7	7	0.7	6	85.7	*	*

*In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

EXHIBIT 4.6B Overall pattern of surgical care provided to adults in the Salivary Gland Cancer Resection Cohort, by hospital type, in Ontario, 2003 to 2010

Key Findings

- Head and neck cancer centres accounted for 15% of the hospitals providing salivary gland resections in Ontario during the study period; however, these nine hospitals performed 57% of all salivary gland resections in this cohort.
- Patients undergoing resection for salivary gland cancer at a designated head and neck cancer centre were more likely to have a total/radical resection compared with those who received care at other hospitals.

Hospital Type	Hospitals Performing Oral Cavity Cancer Surgery		Surgeries Performed		Patients Treated		Definitive Procedure			
							Partial or Subtotal Resection		Total or Radical Resection	
	n	%	n	%	n	%	n	%	n	%
Ontario	62	100.0	1,010	100.0	1,010	100.0	483	47.8	527	52.2
Head and neck cancer centre	9	14.5	580	57.4	580	57.4	230	39.7	350	60.3
Other hospital	53	85.5	430	42.6	430	42.6	253	58.8	177	41.2

EXHIBIT 4.7A Diagnostic and adjunctive procedures received by adults in the Salivary Gland Cancer Resection Cohort in the 12 months before and 12 months after their definitive surgery, by Local Health Integration Network of residence and of treatment, in Ontario, 2003 to 2010

Key Findings

- On average, patients in the Salivary Gland Resection Cohort received 0.1 panendoscopies and 0.1 other endoscopies (bronchoscopy or esophagoscopy) in the year before and after their definitive surgery.
- Only 25% of the patients who underwent a resection received a fine-needle aspiration biopsy of the head and neck prior to their surgery.
- Neck dissections were performed on 49% of patients. There was considerable variability across LHINs of patient residence and LHINs where care was received. Use was the lowest for patients living in the South East LHIN at the time of diagnosis (37%). Among the LHINs with head and neck cancer treatment centres, the South East LHIN also had the lowest rate of neck dissections (19%). This may indicate differences in case-mix between the sites. Often, early-stage tumours do not warrant a neck dissection if there is no evidence of disease in the neck after a thorough examination by the doctor and after appropriate radiological imaging of the neck. This could also be a reflection of variations in availability or use of fine-needle aspiration biopsy preoperatively and whether this was diagnostic or not.
- Nine percent of patients who underwent a resection received a free flap within the two-year period surrounding the definitive procedure. This rate varied by LHIN of residence and LHIN of treatment. Among LHINs of treatment that had head and neck cancer treatment centres, patients in the South East LHIN were least likely to receive a free flap (0%).
- In the year before and after their salivary gland resection, 15% of patients received a facial reanimation procedure. This procedure is used for patients in whom the tumour has injured the nerve controlling the muscles of the face or in cases where this nerve was injured or removed during the resection. Patients receiving treatment at the South West and Toronto Central LHINs were most likely to receive the procedure. This likely indicates the greater complexity of cases being treated at these high-volume LHINs/institutions.

EXHIBIT 4.7A *continued*

Characteristic	Cohort, N	Panendoscopy		Other Endoscopy		Oral Cavity Biopsy		Neck Open Biopsy		Fine-Needle Aspiration Biopsy	
		n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n
Ontario	1,010	52	0.1	95	0.1	43	0.0	148	0.1	326	0.3
LHIN of residence											
1. Erie St. Clair	60	*	*	*	*	*	*	12	0.2	16	0.3
2. South West	109	*	*	*	*	*	*	13	0.1	48	0.4
3. Waterloo Wellington	61	*	*	*	*	0	0.0	12	0.2	21	0.3
4. Hamilton Niagara Haldimand Brant	113	*	*	18	0.2	*	*	9	0.1	62	0.5
5. Central West	*	6	0.1	10	0.2	6	0.1	10	0.2	24	0.5
6. Mississauga Halton	79	*	*	*	*	8	0.1	12	0.2	16	0.2
7. Toronto Central	67	*	*	*	*	*	*	7	0.1	19	0.3
8. Central	101	8	0.1	15	0.1	*	*	18	0.2	27	0.3
9. Central East	136	8	0.1	*	*	*	*	22	0.2	30	0.2
10. South East	43	0	0.0	*	*	0	0.0	6	0.1	*	*
11. Champlain	78	*	*	*	*	*	*	15	0.2	15	0.2
12. North Simcoe Muskoka	40	*	*	6	0.2	*	*	*	*	20	0.5
13. North East	55	*	*	8	0.1	7	0.1	6	0.1	6	0.1
14. North West	*	*	*	9	0.4	*	*	*	*	18	0.8
LHIN of treatment											
1. Erie St. Clair	*	0	0.0	*	*	*	*	*	*	*	*
2. South West	160	*	*	7	0.0	*	*	24	0.2	65	0.4
3. Waterloo Wellington	33	0	0.0	*	*	0	0.0	*	*	7	0.2
4. Hamilton Niagara Haldimand Brant	125	*	*	19	0.2	6	0.0	13	0.1	75	0.6
5. Central West	28	*	*	*	*	*	*	*	*	19	0.7
6. Mississauga Halton	55	*	*	*	*	6	0.1	6	0.1	*	*
7. Toronto Central	281	27	0.1	35	0.1	13	0.0	51	0.2	99	0.4
A. University Health Network	165	19	0.1	23	0.1	12	0.1	22	0.1	85	0.5
B. Sunnybrook Health Sciences Centre	37	*	*	*	*	0	0.0	14	0.4	*	*
C. Mount Sinai Hospital	40	*	*	*	*	0	0.0	10	0.3	*	*
D. Other	39	*	*	*	*	*	*	*	*	9	0.2
8. Central	33	0	0.0	7	0.2	0	0.0	13	0.4	*	*
9. Central East	82	*	*	*	*	*	*	7	0.1	16	0.2
10. South East	27	0	0.0	*	*	0	0.0	*	*	0	0.0
11. Champlain	87	*	*	*	*	*	*	17	0.2	15	0.2
12. North Simcoe Muskoka	*	*	*	*	*	0	0.0	0	0.0	*	0.7
13. North East	45	*	*	6	0.1	6	0.1	*	*	*	*
14. North West	*	*	*	*	*	0	0.0	*	*	*	0.6

¹ The denominator includes all patients in the Salivary Gland Cancer Resection Cohort.

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EXHIBIT 4.7A continued

Characteristic	Neck Dissection			Free Flap			Reconstructive Procedure		Tracheostomy		Gastrostomy Tube	
	n	Avg ¹ per patient, n	Patients receiving, %	n	Avg ¹ per patient, n	Patients receiving, %	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n
Ontario	550	0.5	49.2	98	0.1	9.3	298	0.3	16	0.0	31	0.0
LHIN of residence												
1. Erie St. Clair	30	0.5	50.0	8	0.1	13.3	14	0.2	*	*	*	*
2. South West	58	0.5	47.7	11	0.1	9.2	32	0.3	*	*	*	*
3. Waterloo Wellington	30	0.5	47.5	6	0.1	8.2	20	0.3	0	0.0	*	*
4. Hamilton Niagara Haldimand Brant	56	0.5	46.9	*	*	*	23	0.2	*	*	6	0.1
5. Central West	21	0.5	43.5	*	*	*	13	0.3	*	*	*	*
6. Mississauga Halton	50	0.6	53.2	7	0.1	8.9	28	0.4	0	0.0	*	*
7. Toronto Central	42	0.6	56.7	7	0.1	9.0	19	0.3	*	*	*	*
8. Central	65	0.6	58.4	15	0.1	14.9	45	0.4	*	*	*	*
9. Central East	77	0.6	44.9	21	0.2	14.7	44	0.3	*	*	*	*
10. South East	17	0.4	37.2	6	0.1	14.0	8	0.2	0	0.0	*	*
11. Champlain	34	0.4	39.7	*	*	*	11	0.1	*	*	0	0.0
12. North Simcoe Muskoka	26	0.7	62.5	*	*	*	11	0.3	*	*	*	*
13. North East	33	0.6	56.4	*	*	*	26	0.5	0	0.0	0	0.0
14. North West	11	0.5	45.5	*	*	*	*	*	0	0.0	*	*
LHIN of treatment												
1. Erie St. Clair	*	0.3	27.3	0	0.0	0.0	*	*	0	0.0	*	*
2. South West	90	0.6	52.5	21	0.1	12.5	51	0.3	*	*	*	*
3. Waterloo Wellington	8	0.2	21.2	*	*	*	6	0.2	0	0.0	0	0.0
4. Hamilton Niagara Haldimand Brant	66	0.5	50.4	*	*	*	26	0.2	*	*	8	0.1
5. Central West	9	0.3	28.6	0	0.0	0.0	8	0.3	0	0.0	0	0.0
6. Mississauga Halton	31	0.6	43.6	0	0.0	0.0	10	0.2	0	0.0	*	*
7. Toronto Central	225	0.8	73.3	59	0.2	20.3	133	0.5	6	0.0	13	0.0
A. University Health Network	149	0.9	83.6	41	0.2	23.6	82	0.5	*	*	9	0.1
B. Sunnybrook Health Sciences Centre	37	1.0	86.5	13	0.4	35.1	31	0.8	0	0.0	0	0.0
C. Mount Sinai Hospital	26	0.7	60	*	*	*	7	0.2	*	*	*	*
D. Other	13	0.3	30.8	0	0.0	0.0	13	0.3	0	0.0	*	*
8. Central	6	0.2	18.2	*	*	*	11	0.3	0	0.0	0	0.0
9. Central East	31	0.4	28.0	6	0.1	7.3	14	0.2	*	*	0	0.0
10. South East	6	0.2	18.5	0	0.0	0.0	0	0.0	0	0.0	0	0.0
11. Champlain	38	0.4	40.2	*	*	*	12	0.1	*	*	0	0.0
12. North Simcoe Muskoka	*	0.3	27.8	0	0.0	0.0	*	*	0	0.0	0	0.0
13. North East	25	0.6	51.1	*	*	*	23	0.5	0	0.0	0	0.0
14. North West	*	*	*	*	*	*	*	*	0	0.0	*	*

¹ The denominator includes all patients in the Salivary Gland Cancer Resection Cohort.

*In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

EXHIBIT 4.7B Radiologic services received by adults in the Salivary Gland Cancer Resection Cohort in the 12 months before and 12 months after their definitive surgery, by Local Health Integration Network of residence and of treatment, in Ontario, 2003 to 2010

Key Findings

- The major modality used to image the head and neck in the Salivary Gland Resection Cohort was the computed tomography (CT) scan. On average, more than one (1.3) CT scan was performed per patient within the two-year period surrounding the patients' definitive salivary gland resection procedure. Head and neck ultrasound imaging was also used on many patients (0.8 per patient).
- A significant number of chest X-rays (2.1 per patient on average) and CT scans of the chest (0.7 per patient) were done on patients in this cohort.
- Other less common imaging tests undergone by patients in this study cohort included abdominal CT scans and abdominal ultrasound (each averaging 0.3 per patient).
- Magnetic resonance imaging (MRI) was infrequently used to diagnose or stage salivary gland cancer in this cohort (an average of 0.6 per patient).
- Nearly 87% of patients in the resection cohort received some form of head and neck imaging prior to their definitive surgical resection. As the standard of care is some form of imaging, preferably CT or MRI, before surgical resection, this proportion was lower than expected.
- Bone scans were performed infrequently in this cohort (98 scans, an average of 0.1 per patient).

EXHIBIT 4.7B continued

Characteristic	Cohort, N	Head and Neck						Chest				Abdomen			
		Ultrasound		CT Scan		MRI Scan		X-Ray		CT Scan		Ultrasound		CT Scan	
		n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n
Ontario	1,010	759	0.8	1,318	1.3	624	0.6	2,089	2.1	660	0.7	296	0.3	300	0.3
LHIN of residence															
1. Erie St. Clair	60	52	0.9	89	1.5	22	0.4	169	2.8	27	0.5	23	0.4	16	0.3
2. South West	109	74	0.7	110	1.0	44	0.4	217	2.0	60	0.6	15	0.1	23	0.2
3. Waterloo Wellington	61	52	0.9	80	1.3	23	0.4	152	2.5	43	0.7	21	0.3	19	0.3
4. Hamilton Niagara Haldimand Brant	113	58	0.5	119	1.1	56	0.5	243	2.2	57	0.5	26	0.2	32	0.3
5. Central West	*	46	1.0	55	1.2	31	0.7	74	1.6	32	0.7	18	0.4	14	0.3
6. Mississauga Halton	79	76	1.0	105	1.3	61	0.8	130	1.6	42	0.5	21	0.3	18	0.2
7. Toronto Central	67	49	0.7	101	1.5	57	0.9	175	2.6	50	0.7	25	0.4	15	0.2
8. Central	101	58	0.6	139	1.4	81	0.8	238	2.4	75	0.7	51	0.5	38	0.4
9. Central East	136	136	1.0	174	1.3	105	0.8	219	1.6	98	0.7	32	0.2	39	0.3
10. South East	43	35	0.8	57	1.3	36	0.8	101	2.3	22	0.5	10	0.2	15	0.3
11. Champlain	78	45	0.6	98	1.3	35	0.4	115	1.5	39	0.5	22	0.3	20	0.3
12. North Simcoe Muskoka	40	34	0.9	60	1.5	33	0.8	79	2.0	38	1.0	12	0.3	19	0.5
13. North East	55	33	0.6	93	1.7	25	0.5	126	2.3	54	1.0	11	0.2	20	0.4
14. North West	*	11	0.5	38	1.7	15	0.7	51	2.3	23	1.0	9	0.4	12	0.5
LHIN of treatment															
1. Erie St. Clair	*	25	1.1	29	1.3	*	*	72	3.3	6	0.3	9	0.4	6	0.3
2. South West	160	114	0.7	204	1.3	62	0.4	390	2.4	95	0.6	40	0.3	46	0.3
3. Waterloo Wellington	33	24	0.7	25	0.8	14	0.4	53	1.6	13	0.4	9	0.3	*	*
4. Hamilton Niagara Haldimand Brant	125	68	0.5	144	1.2	56	0.4	286	2.3	64	0.5	32	0.3	34	0.3
5. Central West	28	27	1.0	23	0.8	15	0.5	41	1.5	18	0.6	9	0.3	*	*
6. Mississauga Halton	55	55	1.0	58	1.1	39	0.7	71	1.3	25	0.5	15	0.3	10	0.2
7. Toronto Central	281	225	0.8	442	1.6	275	1.0	685	2.4	268	1.0	105	0.4	114	0.4
A. University Health Network	165	121	0.7	267	1.6	170	1.0	367	2.2	163	1.0	49	0.3	68	0.4
B. Sunnybrook Health Sciences Centre	37	26	0.7	60	1.6	19	0.5	106	2.9	32	0.9	18	0.5	15	0.4
C. Mount Sinai Hospital	40	46	1.2	67	1.7	55	1.4	142	3.6	42	1.1	24	0.6	19	0.5
D. Other	39	32	0.8	48	1.2	31	0.8	70	1.8	31	0.8	14	0.4	12	0.3
8. Central	33	29	0.9	42	1.3	19	0.6	38	1.2	9	0.3	11	0.3	8	0.2
9. Central East	82	71	0.9	91	1.1	47	0.6	130	1.6	40	0.5	17	0.2	12	0.1
10. South East	27	25	0.9	32	1.2	19	0.7	32	1.2	15	0.6	*	*	14	0.5
11. Champlain	87	50	0.6	110	1.3	41	0.5	128	1.5	44	0.5	26	0.3	22	0.3
12. North Simcoe Muskoka	*	*	*	18	1.0	10	0.6	27	1.5	8	0.4	6	0.3	*	*
13. North East	45	23	0.5	76	1.7	12	0.3	112	2.5	43	1.0	8	0.2	17	0.4
14. North West	*	*	*	24	1.7	*	*	24	1.7	12	0.9	*	*	*	*

¹ The denominator includes all patients in the Salivary Gland Cancer Resection Cohort.

*In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

CT = computed tomography; MRI = magnetic resonance imaging.

EXHIBIT 4.7C Consultations and services received by adults in the Salivary Gland Cancer Resection Cohort in the 12 months before and 12 months after their definitive surgery, by Local Health Integration Network of residence and of treatment, in Ontario, 2003 to 2010

Key Findings

- Approximately 72% of all patients in the Salivary Gland Resection Cohort saw a radiation oncologist during the 12 months before and after their definitive salivary gland resection procedure. About 59% of this study cohort received radiation therapy as part of their treatment.
- Rates of referral to a radiation oncologist were lowest among patients who lived in the South West Local Health Integration Network (LHIN) at the time of their diagnosis (66%). Patients who lived in the North East LHIN at the time of their diagnosis had the highest referral rate to radiation oncology (82%).
- More than a third (37%) of patients in this cohort were seen by a medical oncologist during the 24 months surrounding their definitive salivary gland resection. This rate ranged from a low of 21% among people who resided in the South East LHIN at the time of diagnosis to a high of 55% among those living in the Erie St. Clair LHIN.
- Six percent of patients in this cohort received chemotherapy as part of their treatment for salivary gland cancer.
- On average, patients in the cohort visited surgeons 8.1 times in the 12 months before and 12 months after their definitive salivary gland resection.
- Seven percent of patients in the cohort received a palliative care consultation in the 12 months before and 12 months after their definitive salivary gland resection. The highest rate (13%) was observed among those living in the Waterloo Wellington LHIN at the time of diagnosis.

EXHIBIT 4.7C *continued*

Characteristic	Cohort, N	Radiation Oncology Consultations		Radiation Therapy		Medical Oncology Consultations		Chemotherapy		Surgery Consultation		Palliative Care Consultations
		Patients receiving, %	Avg ¹ per patient, n	Patients receiving, %	Avg ¹ per patient, n	Patients receiving, %	Avg ¹ per patient, n	Patients receiving, %	Avg ¹ per patient, n	Patients receiving, %	Avg ¹ per patient, n	Patients receiving, %
Ontario	1,010	72.2	0.8	59.3	0.7	36.5	0.6	6.1	0.4	99.6	8.1	7.2
LHIN of residence												
1. Erie St. Clair	60	70.0	0.9	56.7	0.6	55.0	0.8	11.7	1.3	100.0	7.7	*
2. South West	109	66.1	0.8	55.0	0.8	53.2	1.0	10.1	0.6	100.0	7.7	*
3. Waterloo Wellington	61	72.1	0.9	55.7	0.7	44.3	0.7	9.8	0.7	100.0	7.3	13.1
4. Hamilton Niagara Haldimand Brant	113	74.3	0.8	57.5	0.7	38.1	0.7	6.2	0.4	100.0	7.5	8.0
5. Central West	*	73.9	0.8	60.9	0.9	30.4	0.5	*	0.5	100.0	9.8	*
6. Mississauga Halton	79	69.6	0.7	46.8	0.5	29.1	0.4	*	0.4	100.0	8.5	*
7. Toronto Central	67	71.6	0.7	62.7	0.8	44.8	1.0	*	0.1	97.0	8.4	*
8. Central	101	79.2	1.0	62.4	0.7	29.7	0.6	5.9	0.4	100.0	9.6	5.9
9. Central East	136	72.1	0.8	61.0	0.7	29.4	0.5	*	0.4	99.3	7.9	6.6
10. South East	43	67.4	0.9	46.5	0.6	20.9	0.3	0.0	0.0	97.7	5.1	*
11. Champlain	78	66.7	0.8	65.4	0.8	25.6	0.4	*	0.1	100.0	8.7	9.0
12. North Simcoe Muskoka	40	75.0	0.9	67.5	0.8	45.0	0.8	*	0.2	100.0	10.4	*
13. North East	55	81.8	1.0	69.1	0.8	32.7	0.5	*	0.3	100.0	7.2	*
14. North West	*	72.7	0.8	77.3	0.8	27.3	0.4	*	0.9	100.0	8.5	*
LHIN of treatment												
1. Erie St. Clair	*	68.2	0.7	40.9	0.4	31.8	0.5	0.0	0.0	100.0	7.5	*
2. South West	160	67.5	0.9	58.8	0.8	60.0	1.1	13.1	1.1	100.0	7.5	8.8
3. Waterloo Wellington	33	63.6	0.7	42.4	0.5	21.2	0.3	*	0.2	100.0	7.5	0.0
4. Hamilton Niagara Haldimand Brant	125	73.6	0.9	55.2	0.7	39.2	0.6	8.0	0.5	100.0	7.6	8.8
5. Central West	28	60.7	0.7	50.0	0.8	35.7	0.4	*	0.5	100.0	9.1	*
6. Mississauga Halton	55	61.8	0.7	50.9	0.7	21.8	0.3	*	0.1	100.0	8.3	*
7. Toronto Central	281	82.9	1.0	69.4	0.9	36.7	0.7	6.0	0.3	99.6	9.3	8.2
A. University Health Network	165	83.0	0.9	69.7	0.9	33.3	0.6	6.7	0.3	100.0	8.8	8.5
B. Sunnybrook Health Sciences Centre	37	97.3	1.2	81.1	1.0	40.5	0.8	*	0.8	100.0	9.9	*
C. Mount Sinai Hospital	40	72.5	1.0	67.5	0.8	40.0	1.0	*	0.4	100.0	10.8	*
D. Other	39	79.5	0.9	59.0	0.8	43.6	0.8	*	0.0	97.4	9.1	*
8. Central	33	75.8	0.8	57.6	0.6	24.2	0.3	0.0	0.0	100.0	9.2	*
9. Central East	82	62.2	0.7	50.0	0.6	29.3	0.5	*	0.4	97.6	7.2	*
10. South East	27	59.3	0.8	40.7	0.5	*	0.3	*	0.6	96.3	4.0	*
11. Champlain	87	71.3	0.9	65.5	0.8	25.3	0.4	*	0.1	100.0	8.7	9.2
12. North Simcoe Muskoka	*	50.0	0.6	44.4	0.6	61.1	1.1	0.0	0.0	100.0	7.5	0.0
13. North East	45	82.2	1.0	68.9	0.8	28.9	0.4	*	0.3	100.0	7.0	*
14. North West	*	64.3	0.6	64.3	0.6	*	0.1	*	0.2	100.0	9.3	*

¹ The denominator includes all patients in the Salivary Gland Cancer Resection Cohort.

*In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

EXHIBIT 4.8A Diagnostic and adjunctive procedures received by adults in the Salivary Gland Cancer/No Resection Cohort in the 12 months before and 12 months after their diagnosis, by Local Health Integration Network of residence, in Ontario, 2003 to 2010

Key Findings

- Similar to patients in the Salivary Gland Resection Cohort, patients in the No Resection Cohort received an average of 0.1 panendoscopies (18 in Ontario) and 0.1 other endoscopies (bronchoscopy or esophagoscopy) (23 in Ontario) in the year before and after their diagnosis (data not shown due to small sample sizes).
- Neck dissections (removal of the lymph nodes in the neck) were conducted in approximately 17% of patients. There was considerable variability across LHINs of patient residence. The proportion was lowest (0%) for patients living in the Waterloo Wellington, South East and North East LHINs at the time of diagnosis.
- Very few patients in the Salivary Gland/No Resection Cohort received a free flap, any reconstructive procedure, tracheostomy or gastrostomy tube within the 24-month window surrounding their diagnosis.
- Oral cavity biopsies were performed infrequently in this cohort (15 in Ontario, an average of 0.1 per patient)

Characteristic	Cohort, N	Neck Open Biopsy		Head and Neck Fine-Needle Aspiration Biopsy		Neck Dissection			Free Flap			Reconstructive Procedure		Tracheostomy		Gastrostomy Tube	
		n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	Patients receiving, %	n	Avg ¹ per patient, n	Patients receiving, %	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n
Ontario	229	46	0.2	69	0.3	46	0.2	16.6	8	0.0	3.5	23	0.1	7	0.0	11	0.0
LHIN of residence																	
1. Erie St. Clair	15	*	*	*	*	*	*	*	*	*	*	*	*	0	0.0	*	*
2. South West	16	*	*	*	*	*	*	*	*	*	*	7	0.4	0	0.0	*	*
3. Waterloo Wellington	8	*	*	*	*	0	0.0	0.0	0	0.0	0.0	*	*	0	0.0	0	0.0
4. Hamilton Niagara Haldimand Brant	29	*	*	15	0.5	*	*	*	*	*	*	*	*	*	*	*	*
5. Central West	*	*	*	*	*	*	*	*	0	0.0	0.0	0	0.0	0	0.0	0	0.0
6. Mississauga Halton	13	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
7. Toronto Central	25	8	0.3	13	0.5	*	*	*	0	0.0	0.0	0	0.0	0	0.0	*	*
8. Central	25	*	*	*	*	9	0.4	32.0	*	*	*	*	*	*	*	*	*
9. Central East	32	10	0.3	9	0.3	7	0.2	18.8	*	*	*	*	*	0	0.0	0	0.0
10. South East	17	*	*	*	*	0	0.0	0.0	0	0.0	0.0	0	0.0	0	0.0	*	*
11. Champlain	18	6	0.3	*	*	*	*	*	0	0.0	0.0	0	0.0	*	*	0	0.0
12. North Simcoe Muskoka	10	*	*	9	0.9	*	*	*	*	*	*	*	*	0	0.0	0	0.0
13. North East	10	*	*	0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0	0	0.0	0	0.0
14. North West	*	0	0.0	*	*	*	*	*	0	0.0	0.0	0	0.0	0	0.0	0	0.0

¹ The denominator includes all patients in the Salivary Gland Cancer/No Resection Cohort.

*In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

EXHIBIT 4.8B Radiologic services received by adults in the Salivary Gland Cancer/No Resection Cohort in the 12 months before and 12 months after their definitive surgery, by Local Health Integration Network of residence, in Ontario, 2003 to 2010

Key Findings

- Patients in the Salivary Gland/No Resection Cohort received a number of radiologic services in the 12 months before and after their diagnosis. These included computed tomography (CT) scans of the head and neck (1.7 per patient, on average), chest X-rays (2.5 per patient), chest CT scans (0.9 per patient), abdominal ultrasounds (0.4 per patient), and abdominal CT scans (0.5 per patient).
- Patients who did not undergo resection received slightly fewer radiologic imaging services overall compared to those who did have a resection surgery (see [Exhibit 4.7B](#)). This was most prominent in the chest imaging category.
- There was little variation in the use of radiologic services provided to patients in this cohort across different Local Health Integration Networks of patient residence.
- Very few MRI scans of the abdomen were performed on patients in this cohort (less than 6 in total).

Characteristic	Cohort, N	Head and Neck						Chest				Abdomen			
		Ultrasound		CT Scan		MRI Scan		X-Ray		CT Scan		Ultrasound		CT Scan	
		n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n	n	Avg ¹ per patient, n
Ontario	229	154	0.7	378	1.7	120	0.5	582	2.5	202	0.9	95	0.4	117	0.5
LHIN of residence															
1. Erie St. Clair	15	12	0.8	25	1.7	8	0.5	34	2.3	*	*	*	*	*	*
2. South West	16	9	0.6	26	1.6	7	0.4	45	2.8	14	0.9	9	0.6	*	*
3. Waterloo Wellington	8	*	*	13	1.6	*	*	15	1.9	*	*	*	*	*	*
4. Hamilton Niagara Haldimand Brant	29	18	0.6	45	1.6	9	0.3	65	2.2	19	0.7	13	0.4	8	0.3
5. Central West	*	*	*	*	*	*	*	9	1.5	*	*	0	0.0	*	*
6. Mississauga Halton	13	11	0.8	27	2.1	*	*	29	2.2	17	1.3	*	*	10	0.8
7. Toronto Central	25	17	0.7	47	1.9	13	0.5	55	2.2	23	0.9	13	0.5	11	0.4
8. Central	25	14	0.6	48	1.9	21	0.8	62	2.5	30	1.2	11	0.4	24	1.0
9. Central East	32	30	0.9	61	1.9	19	0.6	88	2.8	45	1.4	23	0.7	25	0.8
10. South East	17	13	0.8	18	1.1	12	0.7	17	1.0	12	0.7	*	*	7	0.4
11. Champlain	18	13	0.7	26	1.4	10	0.6	92	5.1	12	0.7	6	0.3	11	0.6
12. North Simcoe Muskoka	10	7	0.7	16	1.6	8	0.8	37	3.7	7	0.7	*	*	*	*
13. North East	10	*	*	14	1.4	*	*	24	2.4	9	0.9	*	*	7	0.7
14. North West	*	*	*	*	*	0	0.0	10	2.0	*	*	0	0.0	0	0.0

¹ The denominator includes all patients in the Salivary Gland Cancer/No Resection Cohort.

* In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

CT = computed tomography; MRI = magnetic resonance imaging.

EXHIBIT 4.8C Consultations and services received by adults in the Salivary Gland Cancer/No Resection Cohort in the 12 months before and 12 months after their definitive surgery, by Local Health Integration Network of residence, in Ontario, 2003 to 2010

Key Findings

- Approximately 69% of patients in the Salivary Gland/No Resection Cohort saw a radiation oncologist in the 12 months before and after their diagnosis. About 57% of this cohort received radiation therapy as a part of treatment.
- Rates of referral to a radiation oncologist varied widely across the Local Health Integration Network (LHINs). The rate was highest among patients living in the Hamilton Niagara Haldimand Brant LHIN at the time of their diagnosis (86%).
- A higher proportion of patients in this cohort (58%) were seen by a medical oncologist in the 24 months surrounding their diagnosis as compared to the cohort that received a resection (see [Exhibit 4.7C](#)).
- Despite not having received a salivary gland resection, patients in this cohort visited surgeons an average of 5.1 times in the 12 months before and 12 months after their diagnosis; this was less often than those who received a definitive resection procedure (see [Exhibit 4.7C](#)). Nearly all patients in the No Resection Cohort (94%) saw a surgeon in that same period.
- Thirty-one percent of patients in the No Resection Cohort received a palliative care consultation in the 12 months before and 12 months after their diagnosis; only 7% of patients in the Resection Cohort had this consultation (see [Exhibit 4.7C](#)).

Characteristic	Cohort, N	Radiation Oncology Consultation		Radiation Therapy		Medical Oncology Consultation		Chemotherapy		Surgery Consultation		Palliative Care Consultation
		Patients receiving, %	Avg ¹ per patient, n	Patients receiving, %	Avg ¹ per patient, n	Patients receiving, %	Avg ¹ per patient, n	Patients receiving, %	Avg ¹ per patient, n	Patients receiving, %	Avg ¹ per patient, n	Patients receiving, %
Ontario	229	68.6	0.9	57.2	0.8	58.1	1.1	10.9	0.8	93.9	5.1	30.6
LHIN of residence												
1. Erie St. Clair	15	80.0	0.9	73.3	0.9	66.7	1.1	40.0	1.4	100.0	6.6	*
2. South West	16	*	*	*	*	56.3	0.6	*	*	68.8	3.4	*
3. Waterloo Wellington	8	*	*	*	*	*	*	*	*	100.0	6.4	*
4. Hamilton Niagara Haldimand Brant	29	86.2	0.9	65.5	1.0	55.2	0.8	*	*	96.6	5.2	27.6
5. Central West	*	*	*	*	*	*	*	0.0	0.0	*	*	*
6. Mississauga Halton	13	69.2	0.8	61.5	1.2	61.5	1.1	*	*	92.3	4.6	*
7. Toronto Central	25	72.0	0.8	64.0	0.8	56.0	1.3	0.0	0.0	92.0	4.0	40.0
8. Central	25	68.0	0.8	52.0	0.8	68.0	1.8	*	*	100.0	6.2	32.0
9. Central East	32	68.8	1.2	53.1	1.0	65.6	1.5	*	*	96.9	6.1	31.3
10. South East	17	64.7	0.9	64.7	1.1	41.2	0.6	*	*	88.2	3.4	35.3
11. Champlain	18	83.3	1.2	77.8	0.9	61.1	1.3	*	*	100.0	5.7	33.3
12. North Simcoe Muskoka	10	60.0	0.6	*	*	70.0	1.4	0.0	0.0	100.0	7.1	*
13. North East	10	*	*	*	*	*	*	*	*	100.0	4.2	*
14. North West	*	*	*	*	*	0.0	0.0	*	*	*	*	*

¹ The denominator includes all patients in the Salivary Gland Cancer/No Resection Cohort.

* In accordance with ICES policy, the exact number is suppressed when the cell size is <6, or when the cell size allows for a number of <6 to be calculated.

Discussion and Conclusions

Summary of findings and clinical implications

Our analysis of the incidence rates of salivary gland cancer in Ontario from 2003 to 2010 found that rates were much higher among men than women and higher in the elderly regardless of sex.

Although nearly 93% of Ontario adults newly diagnosed with salivary gland cancer underwent a surgical procedure for their disease within a year of diagnosis, only 82% had a definitive procedure (a parotid or submandibular gland resection).

Persons aged 75 or older who were newly diagnosed with salivary gland cancer were less likely to have any cancer-related surgery (or salivary gland resection) than younger people with this disease.

Among the 82% of patients in the cohort who underwent a parotid or submandibular gland resection for salivary gland cancer, 52% had a total or radical resection. A majority (57%) of salivary gland cancer resection procedures done in Ontario between 2003 and 2010 were performed at head and neck cancer treatment centres. A large majority of these procedures were performed by otolaryngologists (91%); the remainder were performed by general surgeons (9%) and plastic surgeons (1%).

More than a third (35%) of all surgical admissions for salivary gland cancer occurred outside the LHINs where patients were living at the time of their diagnosis, with the majority of admissions (56%) occurring in three LHINs (Toronto Central, South West, and Hamilton Niagara Haldimand Brant). Surgical care is far less regionalized for salivary gland cancer than for cancers of the oral cavity and larynx/hypopharynx. Salivary gland cancer is a relatively rare cancer that is often diagnosed after surgical resection and has rates of regionalization that are similar to gynecological malignancies.⁶

Care for patients with salivary gland cancer is resource intensive; it involves a significant number of diagnostic tests and procedures, as well as the services of a multidisciplinary team that includes different types of oncologists. In Ontario, the abdomen is not routinely imaged for staging in patients undergoing salivary gland resection. Within a year of resection, patients in this cohort had used a large number of CCAC services (11 days of care per patient on average); this is significantly less than the number of services used by those in the oral cavity and larynx/hypopharynx resection cohorts. This may be because the population with salivary gland cancer is more elderly than individuals with other head and neck cancers.

In this cohort, there was little use of head and neck MRI to diagnose or stage salivary gland cancer; patients were imaged largely with CT. Only 87% of patients undergoing a resection received any form of preoperative head and neck imaging to appropriately stage their tumour. Currently, there is no practice guideline on the use of CT or MRI; however, it is a

standard of care for patients to receive some form of axial imaging (CT or MRI) prior to surgical resection. This number (87%) should be taken into consideration when setting a benchmark in future quality improvement projects.

The use of surgery, chemotherapy and radiotherapy for salivary gland cancer varied according to the LHIN of patient residence. Significant variations existed among the province's major head and neck cancer treatment centres as to rates of consultation with radiation oncologists and medical oncologists. Similar variations were observed in the use of radiotherapy and chemotherapy.

Among the LHINs, there was also significant variation in rates of palliative care consultation. This may be indicative of a group of cancer patients presenting with very late-stage disease, or it may be due to more limited access to palliative services in certain LHINs. This should be further studied, and improvements should be targeted through regional and provincial initiatives. Patients who did not undergo a resection still used considerable surgical and other health care resources.

Supplementary data from this study were used to describe variations in incidence rates, resection rates and types of surgical ablations performed on patients with salivary gland cancer in Ontario; these have been published separately.⁷

Implications for policy and planning

The incidence of salivary gland cancer increases with age. As the Ontario population ages, there may be increasing demand for health services related to the diagnosis and treatment of salivary gland cancer, which may require planning for future healthcare resources.

We noted variations in the use of surgical procedures and referral to specialists among salivary gland cancer patients residing in one LHIN and being treated in another. More research is necessary to understand this observation and whether quality improvement initiatives are needed.

Of the head and neck cancers presented in this atlas, salivary gland cancer is the least regionalized. Benign parotid gland masses are far more common than malignant ones. A surgical resection is often used for both diagnostic and therapeutic purposes if a fine-needle aspiration biopsy does not provide a diagnosis. This is reflected in the number of surgeons and centres performing salivary gland cancer surgery. Although this is understandable, a significant proportion (75%) of patients who had a resection did not undergo a fine-needle aspiration biopsy attempt before their surgery; this is the standard of care because although a fine-needle aspiration biopsy may not provide an exact diagnosis, it can certainly differentiate between benign and malignant lesions. This in turn will change the staging workup, as well as the extent of resection. Regional quality improvement initiatives could help address the low biopsy rate and potentially improve compliance with best practice guidelines that have yet to be developed in Ontario for this cancer subsite.

Despite some regionalization to designated head and neck cancer treatment centres, there are significant variations in the diagnostic workup, treatment, use of adjunctive procedures, and consultations for patients residing in one LHIN and being treated in another, even among the three LHINs with the highest treatment volumes. Province-wide quality improvement programs and communities of practice should be designed with input from the province's nine major head and neck cancer treatment centres in an effort to standardize care, monitor and improve compliance with guidelines, and study outcomes in this cancer cohort. As there are so few cases of salivary gland cancer in the province, an accelerated and streamlined referral system to designated head and neck cancer treatment centres could be developed to further regionalize care of these cancers. This may improve the accuracy of fine-needle aspiration biopsy, cytopathology and final diagnosis. It will also improve access to reconstructive procedures, which are much more likely to be delivered at high-volume centres.

Future research

Cancer-stage data and comorbidity information are needed to more thoroughly analyze case-mix differences among the major head and neck cancer treatment centres. Work is required to validate the histology codes captured by the Ontario Cancer Registry for salivary gland cancer. Future studies should focus on delineating processes of care (i.e., preoperative imaging and metastatic workup,

multidisciplinary consultation and cancer care conferences, and appropriate follow-up care) and examining the association between adherence to guidelines and patient outcomes.

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5 Reflections and Recommendations

Inside

- Introduction
- Role of Surgery in the Management of Head and Neck Cancer
- Reflections on Research Findings
- Limitations of This Study
- Recommendations

Introduction

Head and neck cancer is a leading cause of death worldwide. It is responsible for a significant portion of health care expenditure because of its impact on the ability to breathe, speak and swallow.

It is expected that there will be an increase in the prevalence of disease and disease burden over time for the following reasons:

- Head and neck cancer predominantly affects individuals over the age of 60, and this segment of the population is growing.
- New treatments and technologies related to chemotherapy, radiotherapy and robotic surgery are constantly evolving and often cost more; therefore, we are also expecting a potential increase in the cost of managing the head and neck cancer patient.
- Patients are living longer due to changes in disease etiology, disease responsiveness to treatment and improved treatments. The growing number of survivors will lead to increased costs over time in the areas of imaging, follow up and further treatment, as well as the management of complications and side effects from treatment.

Role of Surgery in the Management of Head and Neck Cancer

This atlas is focussed on those patients diagnosed with and surgically treated for head and neck cancer in Ontario. It examines surgery-related health services because surgeons play a key role in the diagnosis, staging and treatment of nearly all head and neck cancers and are the main portal of entry to the health care system for the head and neck cancer patient. The collection of tissue by a surgeon after a surgical consultation is often the first step in the cancer journey for patients, and surgeons are often the first to disclose the diagnosis to patients.

There is evidence that surgeons and hospitals in Ontario that treat a higher volume of head and neck cancer patients are associated with better results (survival) in this population.^{1,2} Therefore, the centralization of surgical services for these patients should be encouraged. Prior to this evidence, Cancer Care Ontario's Head and Neck Cancer Standards had recommended a minimum of 80 cases per year for hospitals performing head and neck cancer surgery.³ This atlas indicates that high-volume surgeons and hospitals are performing the majority of oral cavity and larynx/hypopharynx cancer surgery in Ontario, although there is room for improvement with further regionalization of care.

Quality improvement of head and neck cancer care in Ontario is an ongoing process. This atlas provides data on key areas of variation and points to potential areas for improvement; its format was designed to inform regional, population-based planning of head and neck cancer surgery services while supporting policy-makers as they reach key decisions regarding the funding and allocation of limited resources. Last but certainly not least, our hope is that this atlas will be the basis for a health services research program in the field of head and neck oncology in Ontario. This atlas is largely descriptive and provides hypothesis-generating data that can be used to study and improve quality of care and outcomes in the province.

The ultimate goal of a highly functioning health system is to improve the patient experience by providing excellent quality of care and achieving better outcomes. Without an understanding of the current landscape, it is difficult to move forward. This atlas is the first step in that journey.

Reflections on Research Findings

In this section, using a theme-based discussion, we summarize the key points derived from this atlas while reflecting on their meaning and listing actionable items.

The changing incidence of head and neck cancer

There has been a marked decrease in the incidence of larynx/hypopharynx cancer, a moderate rise in the incidence of salivary gland cancers and a significant rise in the incidence of oropharynx cancers. The rise in incidence of salivary gland cancers is independent of pathologies such as melanoma or squamous cell carcinoma that may have been mislabelled as salivary gland cancers.

There has been a rise in the incidence of head and neck cancers with advanced age, particularly among those aged 65 years or older. Similarly, with the exception of salivary gland cancers, there has been a rise in the incidence of head and neck cancers in lower-income neighbourhoods.

Important variations exist in the incidence of head and neck cancer by Local Health Integration Network (LHIN) of residence; these warrant further investigation.

Variation in the use of surgery by patient age and LHIN of residence

Older patients are less likely to receive surgery related to their head and neck cancer or a definitive surgical resection. This difference may be the result of appropriate decision making, but further investigation is warranted to ensure there is no age-based inequity in the provision of treatment.

The LHIN of patient residence at the time of diagnosis led to significant variations in the use of

surgery. This could be explained by potential differences in referral patterns, in treatment approaches among high-volume treatment centres, in training received by head and neck oncologists, and in access to resources. This variation also warrants further investigation, including the assessment of guideline-directed care.

Variations in treatments provided by LHIN of treatment (flaps and neck dissections)

Even among those LHINs with the highest-volume treatment centres, there were important variations in the use of neck dissection for the three cancer subsites. These variations may be explained by differences in the stage of presentation of patients to each of the centres; however, this explanation is unlikely to account for all of the variation, and further study is required to assess the adequacy of neck dissection use.

Similarly, free flap use varied among the LHINs of treatment, even among the LHINs of treatment with a head and neck cancer centre. These variations were consistent between cancer subsites indicating that some centres are far more likely to use free flaps than other centres. This has implications for equitability of use of such treatments across the province. Access may be limited at some centres where the surgeons performing ablations do not have access to free flap surgeons. Alternatively, some centres may be overusing free flaps. This should be studied further to determine the adequacy of free

flap use and to assess where resources can be better distributed among the head and neck cancer treatment centres.

Regionalization of cancer care

In Ontario, head and neck cancer care is largely regionalized to nine hospitals in six cities that were designated in 2014 as head and neck cancer treatment centres.⁴ During the years covered by our study (2003 to 2010), a formal program to regionalize head and neck cancer surgery in Ontario did not fully exist. In 2009, Cancer Care Ontario published provincial standards that recommended a minimum volume of 80 surgical cases per year per centre; informal operationalization of this standard began at that time.³

Nonetheless, during our study period a small proportion of oral cavity and larynx/hypopharynx cases were being treated outside of the network of designated sites. A study conducted by Cancer Care Ontario in 2013–2014 found that not all of the designated head and neck cancer treatment centres met the minimum volume standard and only 83% of patients were being treated at one of these designated centres.⁴ There is strong evidence to suggest that higher-volume surgeons and hospitals in Ontario are associated with better outcomes (i.e., survival) for patients in the management of their head and neck cancers, and that hospital volumes appear to be more important than surgeon volumes.^{1,2} Based on the finding that there is a strong volume-outcome relationship in the management of

head and neck cancer combined with the findings from this atlas and more recent data from Cancer Care Ontario, a formal program to regionalize care of these tumours to designated head and neck cancer treatment centres was initiated in 2014.⁴ This will likely lead to a further decrease in the number of cases being performed at nondesignated sites and may lead to improved outcomes.

Salivary gland cancers are understandably and appropriately less regionalized (57% of cases are treated at designated centres). Ultrasound-guided fine-needle aspiration and advanced cytological diagnosticians are not readily available in many regions in Ontario, and this may affect surgeons' ability to preoperatively plan the extent of resection. However, the data on neck dissection and radiotherapy by region (i.e., LHIN) of treatment demonstrate much higher rates of both of these interventions in regions with a head and neck cancer centre. This finding suggests that, based on clinical and radiological grounds, advanced and/or aggressive tumours are being appropriately referred to high-volume centres for resection and subsequent management. Although the preliminary data appear to support this suggestion, further study is required to confirm whether it is indeed the case. Given the rarity of these tumours, their varied histologies and the current lack of regionalization when compared to the management of other head and neck cancer subsites, a policy to further regionalize their treatment may be warranted.

Providers of cancer care

Otolaryngology–head and neck surgeons are the main providers of care for patients with head and neck cancer. A very small group of general surgeons also provide this care within the context of a high-volume centre. We were unable to determine using administrative data which providers had a fellowship as surgical oncologists, but anecdotally, recent surgical recruitment at all head and neck cancer treatment centres have a recognized fellowship in head and neck surgical oncology. Such training from an approved and accredited fellowship program or equivalent should be maintained to ensure the highest quality of delivered care to patients with head and neck cancer, a relatively uncommon cancer site.

Despite the majority of care being provided by one specialty and at designated head and neck cancer treatment centres, variations in the use of procedures, consultations and adjuvant therapies indicate a lack of agreement on how best to manage these tumours. The development of communities of practice may be a first step toward increasing communication, collaboration and knowledge dissemination between treatment centres. To decrease variations and improve outcomes, province-wide quality improvement initiatives must engage all surgeons treating these cancers at high-volume centres.

Key processes of care (imaging and multidisciplinary care)

Among the resection cohort of patients, there were large variations in the use of head and neck and chest imaging; this finding is surprising given the clear recommendation from the provincial guidelines that patients should receive this process of care prior to surgical intervention.³ Similarly, the extent of multidisciplinary care (a patient being seen by more than one oncologist) prior to surgical resection also varied significantly, and this too had been strongly recommended in the 2009 guidelines. To decrease these variations, province-wide quality improvement initiatives, particularly in the guideline-recommended processes of care, must engage all surgeons treating head and neck cancers at high-volume centres to enhance the quality of care and potentially improve outcomes.

Central role of surgeons in the head and neck cancer patient's journey

Surgeons provide diagnostic procedures (including biopsies, scopes and panendoscopy) to patients with head and neck cancer, and as the gatekeepers of Ontario's head and neck cancer care program, they are often required to coordinate diagnosis, staging, multidisciplinary consultation, treatment and follow-up. These surgeons would have also seen patients with benign head and neck tumours or suspected head and neck tumours, two cohorts not examined in this atlas. All head and neck cancers

require a surgical specimen for diagnosis. Furthermore, many head and neck cancers are treated surgically, particularly oral cavity and salivary gland cancers and to a lesser extent laryngeal/hypopharyngeal and oropharyngeal cancers. It is, therefore, not surprising that almost all patients in our study saw a surgeon in the 24-month period surrounding their diagnosis, even those patients that did not have a cancer-related surgical procedure. Surgeons should be considered key players in the quality improvement discussion and initiatives being actively employed by the provincial government and Cancer Care Ontario.

Limitations of This Study

Exclusion of oropharynx cancers

Due to the difficulty in identifying primary treatment modality using administrative data, this atlas does not include information on surgically resected cancers of the oropharynx. This is an important cancer subsite for future study as it is rising in incidence and affecting a younger population of patients. It is also associated with a changing etiology in the form of a virus — human papillomavirus (HPV).

Treatments for cancers of the oropharynx are evolving such that patients with HPV-associated tumours are candidates for trials in which de-escalation is an option. De-escalation involves

treating patients with single-modality therapies (e.g., radiation treatment without concurrent chemotherapy) or with the same modalities but at lower doses (e.g., lower-dose radiation). While in the past, oropharyngeal tumours were treated mainly with radiotherapy or chemoradiotherapy, advances in technology (e.g., robotic surgery) have made it possible for select patients with early-stage disease to receive a surgical resection; thus, surgeons are playing an increasing role in the primary management of these tumours.

Lack of survivorship data

Because this atlas focuses on new and incident cancers of the head and neck and does not capture their prevalence, it underestimates the health resources required to manage patients with these cancers. With improved treatments and survival in Ontario, an increasing number of patients live with these cancers, often cured but dealing with the side effects of their treatment and requiring a variety of health care resources in the longer term. Also, because the Ontario Cancer Registry captures only the first diagnosis of cancer, the burden of this disease is further underestimated because patients are at a significant risk of second primaries (a second tumour in the upper aerodigestive tract) or synchronous tumours (two tumours in different locations that present at the same time).

Limitations related to missing cancer staging

Staging data for head and neck cancer are not available in the Ontario Cancer Registry. Steps should be taken to add this information to administrative databases, as this would significantly improve their power to answer important health services and clinical research questions. Furthermore, for oropharyngeal cancers, HPV status, which has important prognostic implications, should also be collected.

Some of the variations observed could potentially be explained by differences in the stage at presentation for the different cancer sites; however, it is unlikely that stage differences alone would explain some of the large variations we observed.

Lengthy study period

This atlas includes data from 2003 to 2010, which is a relatively long study period. These years were selected as they were recent, included surrogate information on the use of radiation therapy, and included enough patients such that we would not need to block too many cells for privacy reasons. Some changes in the management of head and neck cancers may have occurred in the province, although we are not aware of any that occurred during the study period. Also, some of our findings may be related to a particular event during the time period in the study. For instance, Ontario experienced a SARS outbreak in 2003, and services in the province were limited to treat only the sickest patients while

preventing the spread of infection. Referral patterns for head and neck cancer patients may have been affected during that time period.

Effects of geography and funding

Important geographic and funding considerations need to be taken into account when interpreting our findings. Patients residing in the North West LHIN are sometimes treated in the province of Manitoba, and this may not have been captured in the Ontario health data available to us. Thus, our data may have artificially demonstrated that patients in the North West LHIN receive fewer health care services than their peers elsewhere in Ontario. It is also possible that a small number of patients travelled to other provinces or the United States for treatment. Additionally, in some regions of the province, mainly the South East LHIN, some physicians are compensated through alternative payment plans for which there are no OHIP billing codes. This practice may have limited our capture of health services provided to patients treated in this LHIN.

Recommendations

Many of our conclusions match those included in the 2008 cancer surgery atlas produced by ICES,⁵ but a few of our findings are unique to head and neck cancer surgery.

Quality improvement in Ontario's cancer system

Head and neck cancer surgery is already highly regionalized to head and neck cancer treatment centres in Ontario, although there is room for further regionalization, particularly for salivary gland malignancies. More importantly, there is room to improve the quality of delivered care, and surgeons should play a critical role in the design and implementation of such programs. Communities of practice should be created for the head and neck cancer treatment centres in Ontario to assess the variations discussed in this atlas and to reduce variations in delivered care.

Cancer-related health services research program

Many of the questions regarding our province's health care system and its delivery of services to cancer patients can be addressed by consulting the Ontario Cancer Registry. Specifically, surgeons, through Cancer Care Ontario's Health Services Research Program, should be involved in answering these questions:

- Given the degree of regionalization, what can be done to improve the quality of delivered care?
- Why are there large variations in delivered care to head and neck cancer patients?

- What key differences in access to resources exist among the LHINs that may explain such variations?
- Are patients receiving guideline-recommended processes of care before undergoing surgical resection and are these processes of care associated with outcomes?

The answers to these and other health services research questions at the system level will serve as a platform from which to launch quality improvement initiatives for head and neck cancer care in Ontario.

Improved capture of cancer staging data

Some of the variations in care depicted in this atlas may be related to the stage of cancer at presentation. For Ontario Cancer Registry data to be useful in answering a broader range of questions, controlling for stage at presentation is essential. It is also feasible, given that a large proportion of patients are treated at cancer treatment centres that make every attempt to record stage at presentation. The centralization of head and neck cancer care has made it easier to collect such data.

Further study of cancer-related structures, processes and outcomes

The Donabedian model of quality improvement assesses structures of care, processes of care and outcomes of care.⁶ This atlas addresses, to a large

extent, structures and processes of care; it does not assess outcomes. Next steps might include linking some of the structures and processes of care with outcomes. This effort will naturally lead to quality improvement initiatives.

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Technical Appendix

Inside

- Data Sources
- Methods

Sections of this appendix parallel sections in the technical appendix included in *Cancer Surgery in Ontario*, an atlas published by ICES in 2008.¹ Our aim is to replicate that atlas's methodology to allow for comparisons across anatomical sites using health administrative data.

Data Sources

Ontario Cancer Registry (OCR)

Maintained by Cancer Care Ontario, the OCR is a computerized database of information on all Ontario residents who have been newly diagnosed with cancer or who have died of cancer. All cancers are included with the exception of nonmelanoma skin cancer and carcinoma in situ, a type of pre-invasive cancer.

Discharge Abstract Database (DAD)

The DAD is a database of administrative, clinical and demographic information abstracted from hospital records. Managed by the Canadian Institute for Health Information, the DAD includes patient-level data for acute and chronic care hospitals, rehabilitation hospitals and day-surgery clinics in Ontario.

Ontario Health Insurance Plan (OHIP) Database of Physician Billings

The OHIP database contains all claims made by Ontario physicians for insured services rendered to Ontario residents. Each record represents a separate service (identified by fee code) rendered to a specific person on a specific date. It includes the following information: type of service, diagnosis, service provider, service recipient, service date, physician's practice group, and referring physician (where applicable).

Registered Persons Database (RPDB)

The RPDB is a population-based registry maintained by the Ministry of Health and Long-Term Care to manage publicly funded health care services covered under OHIP. The RPDB is essentially a historical listing of the unique health numbers issued to persons eligible for Ontario health services. The listing includes corresponding demographic information such as date of birth, sex, address, date of death (where applicable) and changes in eligibility status. When new RPDB data arrive at ICES, personal information, such as name and street address, is removed, and each unique health number is converted into an anonymous identifier, ensuring the protection of each individual's privacy.

ICES Physician Database (IPDB)

The IPDB contains information about physicians practising in Ontario. It is created and maintained by ICES, using data from several sources, including the Ontario Physician Human Resource Data Centre (OPHRDC), the OHIP Corporate Provider Database and the OHIP Database of Physician Billings. For each physician, the IPDB includes age, sex, practice location, physician specialty, type of services provided, and medical school name and year of graduation.

2006 Census Area Profiles

These Statistics Canada files contain population-based information from the 2006 census for different geographic areas (including census division and census metropolitan area). The files include information on age, sex, ethnicity, educational level attained, employment, income and socioeconomic status.

Methods

Study populations and timelines

The study populations for each cancer site discussed in this atlas included all Ontario residents 18 years of age or older who were newly diagnosed with cancer between January 1, 2003, and December 31, 2010. The following look-back/look-forward windows were used:

Purpose	Time Window
To determine if individuals had surgery for their cancer	From 12 months before to 12 months after their cancer diagnosis
To estimate the number of visits persons undergoing cancer-related surgery had with their treating surgeon	From 6 months before to 6 months after their first surgery
To measure the use of nonsurgical health services by individuals who had cancer	From 12 months before to 12 months after their definitive surgery
To measure the use of nonsurgical health services by individuals who did not have surgery for their cancer	From 12 months before to 12 months after their cancer diagnosis

Age groupings of study populations

Age categories were defined as follows: 18-54, 55-64, 65-69, 70-74 and 75+ years. This choice of age groupings best represents the age distributions of the cancer cohorts studied.

Standardization method

All incidence rates were standardized to the population of Canada as of July 1, 1991, using the direct method of standardization. Subgroup proportions, such as the proportion of each particular cancer cohort who underwent surgery, were standardized to either the Overall Cancer Cohort or the Cancer Surgery Cohort.

Cancer definitions

Cancers were defined using the diagnosis code variables in the Ontario Cancer Registry. These are based on the International Classification of Disease, 9th Revision (ICD-9) developed by the World Health Organization. The cancer sites studied in this atlas were defined as follows:

Cancer Site	ICD-9 Code	Description	Exclusions
Oral Cavity	140.3, 140.4	Mucosal lining of lips	146.4 Anterior aspect of epiglottis
	141	Tongue	
	143	Gum	
	144	Floor of mouth	
	145	Other/ unspecified mouth	
	146	Oropharynx	
Larynx/ Hypopharynx	146.4	Anterior aspect of epiglottis	
	148	Hypopharynx	
	161	Larynx	
Salivary Glands	142.0	Parotid gland	
	142.1	Submandibular gland	

Definition of patient residence

For all analyses presented in this atlas, the definition of Local Health Integration Network of residence is based on where each person was living when diagnosed with cancer.

Identification and categorization of cancer surgeries

Most analyses of cancer surgery begin with a set of predefined procedures; the next step is to examine who received each procedure. Similar to the 2008 ICES cancer atlas, the current study differed from this approach in that we started with a number of cohorts (our study populations) whose members had been diagnosed with specific cancers during a given period. We then looked backward and forward in time to determine the types of procedures these patients received. The multistage process included the following steps:

Step 1. All individuals newly diagnosed with cancer during the study period were identified from the Ontario Cancer Registry.

Step 2. Data on these individuals were linked to the Discharge Abstract Database to determine the procedures they underwent in the period from 12 months before to 12 months after their diagnosis.

Step 3. The list of procedures developed for each cancer site was reviewed by a group of experts to determine which were cancer-related. The five-digit codes contained in the Canadian Classification of Health Interventions (CCI)* were used to identify procedures associated with surgical cancer treatment (excluding biopsy).

Step 4. More specific CCI codes (those containing up to 10 digits) were used to define analytic surgical subgroups (i.e., definitive procedures). For brevity, only the five-digit CCI codes are included in this appendix. However, the full CCI codes were helpful in determining the most definitive procedure when more than one CCI code was found.

(Note: In the tables on the following pages, NEC = not elsewhere classified.)

* The CCI is the current national standard for classifying health care procedures. It replaces the Canadian Classification of Diagnostic, Therapeutic and Surgical Procedures (CCP) and the intervention portion of the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) in Canada. The CCI classifies a broad range of diagnostic, therapeutic and support interventions.

Oral cavity cancer–related surgery

Surgery defining the Oral Cancer Surgery Cohort was based on the following CCI codes plus any resection codes in the next table:

CCI Code	Description
1GJ54	Management of internal device, trachea
1GJ77	Bypass with exteriorization, trachea
1MC87	Excision partial, lymph node(s), neck region NEC (cervical)
1MC89	Excision total, lymph node(s), neck region NEC (cervical)
1MC91	Excision radical, lymph node(s), neck region NEC (cervical)
1NF53	Implantation of internal device, stomach
1NF54	Management of internal device, stomach
1NF55	Removal of device, stomach
1NK53	Implantation of internal device, small intestine
1NK54	Management of internal device, small intestine
1NK55	Removal of device, small intestine
1SG58	Procurement, muscles of the back
1SN58	Procurement, scapula
1SQ58	Procurement, pelvis
1SY58	Procurement, muscles of the chest and abdomen
1SY80	Repair, muscles of the chest and abdomen
1TQ58	Procurement, muscles of the forearm (around elbow)
1TQ80	Repair, muscles of the forearm (around elbow)
1VD58	Procurement, muscles of hip and thigh
1VQ58	Procurement, tibia and fibula
1YT58	Procurement, skin of arm
1YT80	Repair, skin of arm
1YV58	Procurement, skin of leg
1YV80	Repair, skin of leg

Oral cavity cancer resection

To qualify for inclusion in the Oral Cavity Cancer Resection Cohort, patients would have been classified with one of the following CCI codes:

CCI Code*	Description
1ED87	Excision partial, maxilla
1ED91	Excision radical, maxilla
1EE87	Excision partial, mandible
1EE91	Excision radical, mandible
1EN87	Excision partial, mandibular alveolar ridge
1EN91	Excision radical, mandibular alveolar ridge
1FG87	Excision partial, oral and buccal mucosa
1FH87	Excision partial, floor of mouth
1FJ87	Excision partial, tongue
1FJ91	Excision radical, tongue
1YE87	Excision partial, lip

* In Chapter 2 (oral cavity cancer), CCI codes were used to define the type of definitive resection provided

To further characterize the Oral Cavity Cancer Resection Cohort, the following OHIP codes were used to assess physician-level data, mainly physician specialty:

OHIP Code	Description
M055	Maxillary, Caldwell-Luc (includes intranasal antrostomy)
M056	Maxillectomy (partial or complete)
R181	Excision of nasopharyngeal or oropharyngeal lesion (with palatal split)
R182	Excision of nasopharyngeal or oropharyngeal lesion (with mandibulotomy, glossectomy and/or palatal split)
S003	Excision of oral lesion (2–4 cms, inclusive)
S005	Composite resection of lesion of oral cavity and/or oropharynx with partial resection of mandible
S006	Excision of oral lesion (more than 4 cms)
S007	Extended composite resection of lesion of oral cavity and oropharynx with partial resection of mandible and resection of maxilla
S010	Wedge resection of lip (with plastic repair)
S011	Wedge resection of lip (vermillion)
S012	Lip shave vermillionectomy
S018	Partial glossectomy
S067	Partial pharyngectomy – transthyroid or lateral
Z502	Excision of oral lesion (less than 2 cms)
Z504	Excision of lip lesion

Larynx/hypopharynx cancer-related surgery

Surgery defining the Larynx/Hypopharynx Cancer Surgery Cohort was based on the following CCI codes plus any resection codes in the next table:

CCI Code	Description
1EQ87	Excision partial, soft tissue of head and neck
1FU87	Excision partial, thyroid gland
1FU89	Excision total, thyroid gland
1FV83	Transfer, parathyroid gland
1FX87	Excision partial, oropharynx
1GA59	Destruction, glottis
1GE59	Destruction, larynx NEC
1GA87	Excision partial, glottis
1GA89	Excision total, glottis
1GJ53LAPM	Implantation of internal device, trachea of tracheoesophageal button using open approach
1GJ54	Management of internal device, trachea
1GJ77	Bypass with exteriorization, trachea
1MC87	Excision partial, lymph node(s), neck region NEC (cervical)
1MC89	Excision total, lymph node(s), neck region NEC (cervical)
1MC91	Excision radical, lymph node(s), neck region NEC (cervical)
1NF53	Implantation of internal device, stomach
1NF54	Management of internal device, stomach
1NF55	Removal of device, stomach
1NK53	Implantation of internal device, small intestine
1NK54	Management of internal device, small intestine
1NK55	Removal of device, small intestine
1SY58	Procurement, muscles of the chest and abdomen
1SY80	Repair, muscles of the chest and abdomen
1TQ58	Procurement, muscles of the forearm (around elbow)
1TQ80	Repair, muscles of the forearm (around elbow)
1VD58	Procurement, muscles of hip and thigh
1YT58	Procurement, skin of arm
1YT80	Repair, skin of arm
1YV58	Procurement, skin of leg
1YV80	Repair, skin of leg
1SG58	Procurement, muscles of the back
1SN58	Procurement, scapula
1SQ58	Procurement, pelvis
1VQ58	Procurement, tibia and fibula

Larynx/hypopharynx cancer resection

To qualify for inclusion in the Larynx/Hypopharynx Cancer Resection Cohort, patients would have been classified with one of the following CCI codes:

CCI Code	Description
1GB87	Excision partial, supraglottis
1GB89	Excision total, supraglottis
1GD87	Excision partial, laryngeal cartilage
1GD89	Excision total, laryngeal cartilage
1GE87LL	Excision partial, larynx NEC (vertical technique)
1GE87NZ	Excision partial, larynx NEC (horizontal technique)
1GE89	Excision total, larynx NEC
1GE91	Excision radical, larynx NEC

To further characterize the Larynx/Hypopharynx Cancer Resection Cohort, the following OHIP codes were used to assess physician-level data, mainly physician specialty:

OHIP Code*	Description
M081	Total laryngectomy
M082	Laryngofissure
M084	Segmental laryngectomy (including reconstruction)
M085	Arytenoidectomy or arytenoidopexy or lateralization procedure
S068	Pharyngo-laryngectomy

*In Chapter 3 (larynx/hypopharynx cancer), OHIP fee codes were used to define the type of definitive resection provided.

Salivary gland cancer–related surgery

Surgery defining the Salivary Gland Cancer Surgery Cohort was based on the following CCI codes plus any resection codes in the next table:

CCI Code	Description
1BB80	Repair, other nerves of head and neck
1BB87	Excision partial, other nerves of head and neck
1BD58	Procurement, nerve(s) of the ear
1BT58	Procurement, nerve(s) of lower leg
1CV53LALF	Implantation of internal device, upper eyelid using open approach and implant (e.g., gold weight)
1CX74	Fixation, eyelid NEC using incisional approach
1EP80	Repair, muscles of head and neck
1EQ87	Excision partial, soft tissue of head and neck
1GJ54	Management of internal device, trachea
1GJ77	Bypass with exteriorization, trachea
1MC87	Excision partial, lymph node(s), neck region NEC (cervical)
1MC89	Excision total, lymph node(s), neck region NEC (cervical)
1MC91	Excision radical, lymph node(s), neck region NEC (cervical)
1NF53	Implantation of internal device, stomach
1NF54	Management of internal device, stomach
1NF55	Removal of device, stomach
1NK53	Implantation of internal device, small intestine
1NK54	Management of internal device, small intestine
1NK55	Removal of device, small intestine
1SG58	Procurement, muscles of the back
1SN58	Procurement, scapula
1SQ58	Procurement, pelvis
1SY58	Procurement, muscles of the chest and abdomen
1SY80	Repair, muscles of the chest and abdomen
1TQ58	Procurement, muscles of the forearm (around elbow)
1TQ80	Repair, muscles of the forearm (around elbow)
1VD58	Procurement, muscles of hip and thigh
1VQ58	Procurement, tibia and fibula
1WT58LAXXA	Procurement, tendons of ankle and foot of autograft using open approach
1YA87	Excision partial, scalp
1YB87	Excision partial, skin of forehead
1YC87	Excision partial, skin of ear
1YD87	Excision partial, skin of nose
1YF87	Excision partial, skin of face
1YG87	Excision partial, skin of neck
1YT58	Procurement, skin of arm
1YT80	Repair, skin of arm
1YV58	Procurement, skin of leg
1YV80	Repair, skin of leg
2FP71HA	Biopsy salivary glands and ducts using percutaneous (needle) approach

Salivary gland cancer resection

To qualify for inclusion in the Salivary Gland Cancer Resection Cohort, patients would have been classified with one of the following CCI codes:

CCI Code*	Description
1FM87	Excision partial, parotid gland
1FM89	Excision total, parotid gland
1FM91	Excision radical, parotid gland
1MC87**	Excision partial, lymph node(s), neck region NEC (cervical)
2FP71LA	Biopsy salivary glands and ducts using open approach

* In Chapter 4 (salivary gland cancer), CCI codes were used to define the type or extent of the definitive resection provided.

** Considered a definitive resection in only those patients that had an OCR diagnosis of submandibular gland cancer and did not undergo any of the other definitive procedures. We chose to do this because it is plausible that patients with submandibular gland cancers would undergo a limited neck dissection as their definite procedure as opposed to a submandibular gland excision alone.

To further characterize the Salivary Gland Cancer Resection Cohort, the following OHIP codes were used to assess physician-level data, mainly physician specialty:

OHIP Code	Description
S042	Excision of submandibular gland or sublingual gland
S043	Excision parotid gland (total with preservation of facial nerve)
S044	Excision parotid gland (total without preservation of facial nerve)
S045	Excision parotid gland (subtotal with preservation of facial nerve)

Histology codes

More than 90% of mucosal head and neck cancers are squamous cell carcinomas. For this reason, in the chapters devoted to oral cavity and larynx/hypopharynx cancers, we excluded patients with ICD-O-3 histology codes that were not in keeping with squamous cell carcinoma. The following histology codes were included:

ICD-O-3 Code*	Description
8020	Undifferentiated carcinoma
8051	Verrucous carcinoma
8052	Papillary squamous cell carcinoma
8070	Squamous cell carcinoma
8071	Squamous cell carcinoma, keratinizing
8072	Squamous cell carcinoma, non-keratinizing
8073	Squamous cell carcinoma, small cell, non-keratinizing
8074	Squamous cell carcinoma, spindle cell
8075	Squamous cell carcinoma, pseudoglandular
8076	Squamous cell carcinoma, microinvasive
8077	Squamous intraepithelial neoplasia, grade III
8078	Squamous cell carcinoma, horn formation
8082	Lymphoepithelial carcinoma
8083	Basaloid squamous cell carcinoma
8084	Squamous cell carcinoma, clear cell
8094	Basosquamous carcinoma
8123	Basaloid carcinoma
8560	Adenosquamous carcinoma

*ICD-O-3 = International Classification of Diseases for Oncology, 3rd Edition

For Chapter 4 (devoted to salivary gland cancers), we excluded melanoma and lymphoma histological types but included the remaining histological codes and these are presented in the chapter. We chose to include squamous cell carcinoma in this chapter as well as there are a very small minority of salivary gland cancers that are squamous cell carcinoma histologically. More importantly, some skin squamous cell carcinomas are metastatic to the salivary glands and require a surgical resection similar to that for a primary salivary gland cancer. We wanted to capture procedures performed on the salivary glands for cancer regardless of the histological type, and thus we were more liberal with histological codes in this chapter.

Identification of diagnostic, radiologic and other nonsurgical health services

OHIP fee codes were used to identify the following services:

- Biopsy
- Bone scan
- Chemotherapy
- CT scan
- Emergency department visits
- Endoscopy and panendoscopy
- External beam radiation
- Facial reanimation
- Fine-needle aspiration
- Gastrostomy tube
- Intensive care
- MRI scan
- Neck dissection
- Palliative care (including home care visits)
- PET scan
- Radiation therapy planning
- Reconstructive procedures
- Specialist consultations (including surgeon visits)
- Swallow study
- Tracheotomy
- Ultrasound
- X-ray

(Note: Utilization of these procedures is examined in Exhibits X.7 and X.8).

Biopsy	
Biopsy	
S063	Pharynx – Tonsillectomy
S065	Pharynx – Adenoidectomy
Z323	Larynx – Laryngoscopy – Direct, with removal of lesion(s)
Z324	Larynx – Laryngoscopy – Indirect, with biopsy or removal of foreign body
Z501	Mouth – Incision – Biopsy
Z502	Mouth – Excision – Lesion – Less than 2 cm
Z503	Lips – Incision – Biopsy
Z504	Lips – Excision of lesion
Z537	Oral cavity – Incision – Biopsy – Requiring general anaesthetic
Excision or Biopsy of Small Parotid Mass	
J149	Diagnostic ultrasonic guidance of biopsy, aspiration, amniocentesis or drainage procedures
Z522	Salivary gland – Excision small tumour
Neck Biopsy	
Z405	Lymph nodes – Biopsy – Cervical, axillary, inguinal
Z406	Lymph nodes – Biopsy – Scalene

Bone Scan	
J650	Nuclear med. – Bone scintigraphy – General survey
J651	Nuclear med. – Bone single site
J850	Nuclear med. – Bone scintigraphy – General survey
J851	Nuclear med. – Bone single site
Y650	Nuclear med. – Bone scintigraphy – General survey
Y651	Nuclear med. – Bone single site
Y850	Nuclear med. – Bone scintigraphy – General survey
Y851	Nuclear med. – Bone single site

Chemotherapy	
G339	Inj/inf. chemotherapy & patient assess. – Single agent IV
G345	Inj/inf. chemotherapy & patient assess. – Multiple agent IV
G359	Inj/inf. chemotherapy & patient assess. – Special single agent, etc.
G381	Inj/inf. chemotherapy (marrow suppression) – Single injection

CT Scan	
CT Scan – Abdomen and/or Pelvis	
X126	Abdomen – with/out IV contrast
X231	Pelvis – without IV contrast
X232	Pelvis – with IV contrast
X233	Pelvis – with/out IV contrast
X409	Abdomen – without IV contrast
X410	Abdomen – with IV contrast
Excision or Biopsy of Small Parotid Mass	
X125	Thorax – with/out IV contrast
X406	Thorax – without IV contrast
X407	Thorax – with IV contrast
CT Scan – Head and/or Neck	
X124	Neck – with/out IV contrast
X188	Head – with/out IV contrast
X400	Head – without IV contrast
X401	Head – with IV contrast
X402	Complex head – without IV contrast
X403	Neck – without IV contrast
X404	Neck – with IV contrast
X405	Complex head – with IV contrast
X408	Complex head – with/out IV contrast

Emergency Department Visits	
H055	ED Physician on Duty
H065	Emerg. Phys. Consult. (Non-Specialist in Emerg. Med.)
H101	Minor Assess. – GP – ED Phys. on Duty – M-F Days
H102	Comprehensive Assess. & Care – Daytime
H103	Multiple Systems Assess. – GP – ED Phys. on Duty
H104	GP Re-assess. – ED Phys. on Duty – M-F Days
H105	Interim Inpatient Admission Orders
H112	ED Phys. on Duty – Extra to Proc. – Nights
H113	ED Phys. on Duty – Extra to Proc. – Sat/Sun/Holidays
H121	Minor Assess. – Phys. on Duty – Nights
H122	Comprehensive Assess. & Care – Nights
H123	Mult. Syst. Assess. – Phys. on Duty – Nights
H124	Re-Assess. – ED Phys. on Duty – Nights
H131	Minor Assess. – ED Phys. on Duty – Evenings
H132	Comprehensive Assess. & Care – ED Phys. on Duty – Evenings
H133	Mult. Syst. Assess. – ED Phys. on Duty – Evenings
H134	Re-assess. – ED Phys. on Duty – M-F Evenings
H151	Minor Assess. – ED Phys. on Duty – Sat/Sun/Holiday
H152	Comprehensive Assess. & Care – Sat/Sun & Holidays
H153	Mult. Syst. Assess. – ED Phys. on Duty – Sat/Sun/Holiday
H154	Re-assess. – ED Phys. on Duty – Sat/Sun/Holiday

Endoscopy and Panendoscopy	
Other Endoscopy (with or without biopsy)	
E600	Larynx – Laryngoscopy using operating microscope
Z298	Nose – EUGA of nasopharynx, if only procedure performed
Z299	Nose – Fiberoptic endoscopy of upper airway with rigid endoscope
Z321	Larynx – Laryngoscopy – Direct, with/out biopsy
Z327	Trachea & Bronchi – Bronchoscopy, with/out biopsy
Z515	Digestive Syst. Oesophagoscopy, with/out biopsy(s)
Panendoscopy (with or without biopsy)	
Z355	Trachea & Bronchi – Quadroscope or panendoscopy, with/out biopsy

Facial Reanimation Procedures	
Tarsorrhaphy	
E190	Eyelid – Suture – Tarsorrhaphy
Nerve Suture or Graft	
N287	Peripheral Nerves – Suture – Major peripheral nerve
N288	Peripheral Nerves – Graft – Major nerve /Secondary repair
Static or Dynamic Slings	
R531	Muscles – Repair/Reconstruction – Static slings
R532	Muscles – Repair/Reconstruction – Dynamic slings
Composite Repair of Facial Paralysis	
R533	Muscles – Repair/Reconstruction – Composite repair or resection

Fine-Needle Aspiration of the Head or Neck	
Z413	Lymph Nodes – Incl. scalene node fine-needle aspiration

Gastrostomy Tube	
J055	Diag. Radiol. – Clin. procedure with percutaneous gastrostomy
S118	Stomach – Incl. gastrostomy
S119	Stomach – Percutaneous endoscopic gastrostomy
Z532	Stomach – Percutaneous endoscopic gastrostomy – revised

Intensive Care (any of the following, limit of one per day)	
G400	Critical Care Per Diem (first day)
G401	Critical Care Per Diem (2nd to 10th day)
G402	Critical Care Per Diem (11th day onward)
G405	Ventilatory Support – ICU (first day)
G406	Ventilatory Support – ICU (2nd to 10th day)
G407	Ventilatory Support – ICU (11th day onward)
G557	Comprehensive Care – ICU (first day)
G558	Comprehensive Care – ICU (2nd to 10th day)
G559	Comprehensive Care – ICU (11th day onward)

MRI Scan	
Head and/or Neck	
X421	Head – Multislice sequence
E875	Head – Multislice sequence with spectroscopy
X425	Head – Multislice sequence repeat
E876	Head – Multislice sequence repeat with spectroscopy
X431	Neck – Multislice sequence
X135	Neck – Multislice sequence repeat
Abdomen and/or Pelvis	
X451	Abdomen – Multislice sequence (1 or 2 echos)
X461	Pelvis – Multislice sequence (1 or 2 echos)

Neck Dissection	
Partial Neck Dissection	
R910	Neck Lymph Nodes – Excision – Limited
Total or Radical Neck Dissection	
R911	Neck Lymph Nodes – Excision – Radical
R915	Neck Lymph Nodes – Excision – Modified Radical – Preservation of Spinal Accessory Nerve

PET Scan	
J700	Solitary pulmonary nodule
J701	Thyroid cancer
J702	Germ cell tumour
J703	Colorectal cancer
J704	Lymphoma – Evaluation of residual mass
J705	Lymphoma – Assessment of response to treatment
J706	Non-small cell lung cancer
J709	Limited disease small cell lung cancer

Palliative Care	
A945	GP/FP Special Palliative Care Consultation
C945	Special Palliative Care Consultation, Hospital Inpatient
C882	GP/FP Terminal Care in Hospital
C982	Palliative Care
W872	Terminal Care in Nursing Home
W882	GP Terminal Care in Chronic Care Hospital
W972	Palliative Care in Nursing Home
W982	Palliative Care in Chronic Care Hospital
K023	Palliative Care Support, Individual Care, 0.5 Hr or Major Part
B998	Special Visit, Palliative Care Home, Days, Evenings
B966	Travel Premium, Palliative Care Home Visit
G511	Telephone Management of Palliative Care at Home
G512	Weekly Palliative Care Case Management

Radiation Therapy Planning (used as proxy measure for radiation therapy)	
X310	Radiation Treatment Planning Level 1 – Simple
X311	Radiation Treatment Planning Level 2 – Intermediate
X312	Radiation Treatment Planning Level 3 – Complex
X313	Radiation Treatment Planning Level 4 – Full 3D

Reconstructive Procedures	
Pedicled Flaps	
S013	Lips – Repair – Cleft Lip – Unilateral
S014	Lips – Reconstruction with Lip Switch Flap
S015	Lips – Repair – Complex Reconstruction
R070	Skin – Pedicle Flap – Direct, Intermediate
R080	Skin – Pedicle Flaps – Direct, Large
R101	Skin – Pedicle Flaps – Delay, Intermediate
R100	Skin – Pedicle Flaps – Delay, Major
Myocutaneous, Myogenous or Fasciocutaneous Flaps	
R005	Skin – Myocutan. Flap – Incl. Closure of Sterno-mastoid/Tensor Fascia Lata
R006	Skin – Myocutan. Flap – Incl. Closure of Pectoralis Major, etc.
R009	Skin – Myocutan. Flap – Incl. Closure of Osseous Flaps, etc.
Skin Grafts (Split Thickness or Full Thickness)	
R084	Skin – Split Thick. Graft – Very Minor, Small Area
R085	Skin – Split Thick. Graft – Minor, Medium Area
R086	Skin – Split Thick. Graft – Intermediate, Large Area
R087	Skin – Split Thick. Graft – Major, Complex Area
R088	Skin – Split Thick. Graft – Extensive Major, Large Area
R092	Skin – Full Thick. Graft – Minor, Less than 1 cm
R093	Skin – Full Thick. Graft – Intermediate, 1-5 cm
R083	Skin – Full Thick. Graft – Major, Over 5 cm Diameter
R091	Skin – Full Thick. Graft – Complex, Eyelid, Nose, Lip, Face
Free Flap Elevation	
R013	Skin & Subcut. Tissue – Free Island Flaps – Jejunum Artery & Vein for Transplantation
R064	Skin & Subcut. Tissue – Elevation of F.I. Skin & Subcut. Flap & Closure of Defect
R067	Skin & Subcut. Tissue – Elevation of Innervated F.I. Skin and Subcut. Flap
R125	Skin – Elevation of F.I. Skin & Muscle Flap & Closure of Defect
R128	Skin – Elevation of F.I. Muscle Flap with Tendon & Nerve & Closure of Defect
R131	Skin – Elevation of F.I. Bone Flap & Closure of Defect
R134	Skin – Elevation of F.I. Skin & Bone Flap & Closure of Defect
Free Flap Transplantation	
R015	Skin & Subcutaneous Tissue – Free Island Flaps – Transpl. of Jejunum Artery & Vein with Microvascular Anastomosis
R066	Skin & Subcut. Tissue – Transpl. of F.I. Skin & Subcut. Flap with Microvasc. Anast.
R069	Skin & Subcut. Tissue – Transpl. of Innervated F.I. Skin & Subcut. Flap with Microvasc. Anast. & Nerve Repair
R127	Skin – Transpl. of F.I. Skin & Muscle Flap with Microvasc. Anast.
R130	Skin – Transpl. of F.I. Muscle Flap with Tendon, Nerve and Microvasc. Anast.
R133	Skin – Transpl. of F.I. Bone Flap with Microvasc. Anast. & Bone Fixation
R136	Skin – Transpl. of F.I. Skin & Bone Flap with Microvasc. Anast. & Bone Fixation

Specialist Consultations	
Radiation Oncology	
A345	Consultation
A346	Repeat Consultation
A745	Limited Consultation
C345	Consultation – Hospital
C346	Repeat Consultation – Hospital
C745	Limited Consultation – Hospital
Medical Oncology	
A135	Consultation – Internal & Occupational Medicine
A136	Repeat Consultation – Int. & Occ. Med.
A435	Limited Consultation – Int. Med.
C135	Consultation – Int. Med. – Hospital
C136	Repeat Consultation – Int. Med. – Hospital
C435	Limited Consultation – Int. Med. – Hospital
Otolaryngology–Head and Neck Surgery*	
A243	Special Assessment
A244	Partial Assessment
A245	Consultation
A246	Repeat Consultation
A935	Special Surgical Consultation on I.C. Basis
C243	Specific Assessment – Hospital
C244	Specific Re-assessment – Hospital
C245	Consultation – Hospital
C246	Repeat Consultation – Hospital
C935	Special Surgical Consultation – Hospital
K013	Counselling – Individual care, first three units
K033	Counselling – One person, additional units/patient/year/unit
K040	Group Counselling – Two or more persons
K041	Group Counselling – Two or more persons, additional
*Includes a specialty code for Otolaryngology–Head and Neck Surgery.	
General Surgery or Thoracic/Cardiothoracic Surgery**	
A033	Specific Assess. – Gen. Surg.
A034	Partial Assess. – Gen. Surg.
A035	Consult. – Gen. Surg.
A036	Repeat Consult. – Gen. Surg.
A093	Specific Assess. – Cardio. & Thoracic Surg.
A094	Partial Assess. – Cardio. & Thoracic Surg.
A095	Consult. – Cardio. & Thoracic Surg.
A096	Repeat Consult. – Cardio. & Thoracic Surg.

General Surgery or Thoracic/Cardiothoracic Surgery** (continued)	
A643	Specific Assess. – Thoracic Surg.
A644	Partial Assess. – Thoracic Surg.
A645	Consult. – Thoracic Surg.
A646	Repeat Consult. – Thoracic Surg.
A935	Special Surgical Consult. on I.C. Basis
C033	Specific Assess. – Gen. Surg. – Hospital
C034	Specific Re-assess. – Gen. Surg. – Hospital
C035	Consult. – Gen. Surg. – Hospital
C036	Repeat Consult. – Gen. Surg. – Hospital
C093	Specific Assess. – Cardio. & Thoracic Surg. – Hospital
C094	Specific Re-assess. – Cardio. & Thoracic Surg. – Hospital
C095	Consult. – Cardio. & Thoracic Surg. – Hospital
C096	Repeat Consult. – Cardio. & Thoracic Surg. – Hospital
C643	Specific Assess. – Thoracic Surg. – Hospital
C644	Specific Re-assess. – Thoracic Surg. – Hospital
C645	Consult. – Thoracic Surg. – Hospital
C646	Repeat Consult. – Thoracic Surg. – Hospital
C935	Special Surgical Consult. – Cardio. & Thoracic Surg. – Hospital
K013	Counselling – Individual Care, first three units
K033	Counselling – One person, additional units/pat/year/unit
K040	Group Counselling – Two or more persons
K041	Group Counselling – Two or more persons, additional
**Includes a specialty code for Cardio & Thoracic Surgery, General Surgery, Vascular Surgery and Thoracic Surgery.	
Plastic Surgery (fee code and main specialty plastic surgery)***	
A083	Specific Assess. – Plastic Surg.
A084	Partial Assess. – Plastic Surg.
A085	Consult. – Plastic Surg.
A086	Repeat Consult. – Plastic Surg.
A935	Special Surgical Consult. on I.C. Basis
C083	Specific Assess. – Plastic Surg. – Hospital
C084	Specific Re-assess. – Plastic Surg. – Hospital
C085	Consult. – Plastic Surg. – Hospital
C086	Repeat Consult. – Plastic Surg. – Hospital
C935	Special Surgical Consult. – Plastic Surg. – Hospital
K013	Counselling – Individual care, first three units
K033	Counselling – One person, additional units/patient/year/unit
K040	Group Counselling – Two or more persons
K041	Group Counselling – Two or more persons, additional
***Includes a specialty code for Plastic Surgery.	

Swallow Study	
X105	Diag. Radiology – Palatopharyngeal Analysis – Cine/Videotape
X106	Diag. Radiology – Pharynx & Oesophagus – Cine/Videotape
X107	Diag. Radiology – Oesophagus only

Tracheotomy	
E639	With Anterior Cricoid Split – Add to Tracheotomy
M089	Creation of Tracheo-oesophageal Fistula
T310	Tracheotomy
Z325	Emergency tracheotomy
Z741	Trachea & Bronchi, including Tracheotomy

Ultrasound	
Ultrasound – Thorax, Abdomen, and Retroperitoneum	
J128	Abdomen/Retroperitoneum – Abdom. scan, limited study
J135	Abdomen/Retroperitoneum – Abdom. scan, complete
J428	Abdomen/Retroperitoneum – Abdom. scan, limited study
J435	Abdomen/Retroperitoneum – Abdom. scan, complete
Ultrasound – Head and Neck	
J105	Face and/or Neck, excluding vascular study
J149	Guidance of biopsy, aspiration or drainage procedure
J405	Face and/or Neck, excluding vascular study

X-Ray	
X090	Diag. Rad. – Chest – single film
X091	Diag. Rad. – Chest – two views
X092	Diag. Rad. – Chest – three or more views

Identification of head and neck cancer centres

We considered classifying Ontario hospitals as either academic (teaching) or community hospitals, but this approach would not have captured important information. Head and neck cancers are rarer than other cancers treated in the province. Nine hospitals in the province employ fellowship-trained head and neck surgical oncologists and radiation oncologists to manage these rare tumours; these hospitals are identified as head and neck cancer centres (represented geographically in [Exhibit 1.3](#)). We thus categorized our hospitals using this more important distinction as it demonstrates the percentage of procedures being provided at nondesignated centres and is a measure of the degree of regionalization of head and neck cancer care in Ontario.

The following institutions are designated as head and neck cancer centres in Ontario:

Institution No.	Institution
3910	University Health Network (includes Toronto General Hospital, Princess Margaret Hospital, Toronto Western Hospital and Toronto Rehabilitation Institute)
1423	Mount Sinai Hospital, Toronto
3936	Sunnybrook Health Sciences Centre, Toronto
3850	London Health Sciences Centre
2003	St. Joseph's Hospital, Hamilton
4059	Health Sciences North, Sudbury
1100	Kingston General Hospital
4048	Ottawa Hospital – Civic Campus
4046	Ottawa Hospital – General Campus

This information is pertinent to [Exhibits 2.6B, 3.6B](#) and [4.6B](#).

Identification of physician specialties and subspecialties

Identifying physician specialties and subspecialties presented several challenges.

- Because physician identifiers used in the CIHI-DAD are not standard for all Ontario hospitals, it was necessary to use OHIP data for the physician specialty analysis. The OHIP billings then had to be matched back to the procedures identified in the CIHI-DAD, a challenging process because the procedures were not defined the same way in the two data sources.
- There was variation in the fee codes that physicians used to bill OHIP for surgical procedures (i.e., they did not always bill as expected).
- Some physician subspecialties are not listed in the OHIP data, so it was necessary to link to other sources. Each additional data source used increased the potential sources of misclassification error.
- Because the OHIP fee schedule does not follow the same structure as the CIHI-DAD, it was necessary to use an iterative process to identify and match billings with surgeries.

The following process was used to identify physician specialties and subspecialties:

1. A list of OHIP billing codes used for cancer surgery was developed by the clinician-authors involved in the development of the atlas.
2. For each cancer subsite, OHIP records were extracted that matched the following criteria: the service date was between January 1, 2003 and December 31, 2010, the patient was a member of the cancer cohort, and the fee code was one of those on the list provided by the clinician-authors (see pages 132-141 of this appendix).
3. OHIP billings were matched with the CIHI-DAD procedures on patient and date. This was done twice: first, we sought an exact match between the procedure date on the DAD record and the service date on the OHIP billing; then we utilized a date window of ± 2 days.
4. In situations where there was still a high proportion of unmatched surgeries, the process was started over, using a slightly different methodology. Rather than extracting OHIP billings using a defined list of fee codes, we extracted all OHIP billings for services other than office, emergency department or long-term care visits for the patient cohort within the defined time frame.

5. After going through the matching exercise outlined in no. 3 (above), the matched OHIP billings were examined to see what other fee codes might have been missed in the original list of probable billing codes.
6. After consultation with the clinician-authors, the original list of fee codes was amended and the initial process was re-run, resulting in the final match.

Once the OHIP billings for the surgeries were identified, the specialty of the physician who submitted the billing was obtained from the ICES Physician Database.

This information is pertinent to [Exhibits 2.6A, 3.6A](#) and [4.6A](#).

Reference

1. Urbach DR, Simunovic M, Schultz SE. *Cancer Surgery in Ontario: ICES Atlas*. Toronto, ON: Institute for Clinical Evaluative Sciences; 2008.



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