

Appendix 2 (as supplied by the authors): Canadian Oncology Goals and Objectives for Medical Students

BASIC SCIENCE OF ONCOLOGY

Goal: By graduation, medical students should understand the basic concepts of the science of oncology relevant to molecular biology, pathology and anatomy.

Molecular Biology

1. Describe in general terms how cancers develop and be able to describe the hallmarks of cancer.
2. Describe the step-wise progression from normal to pre-malignant to malignant histology and how this relates to the principles of screening and early detection.
3. Demonstrate an understanding of how hormones influence development of certain cancers and how this may help direct management.
4. Describe the important genetic/familial syndromes related to cancer development, identify their mode of inheritance and impact on cancer development.

5. Describe how common carcinogens can cause cancer (e.g. cigarette smoke, asbestos, UV radiation, radiation exposure).
6. Describe how common infections can cause cancer (e.g. viral hepatitis, H. pylori, EBV, HPV, HIV).

Pathology

1. Define the terms metaplasia, dysplasia, carcinoma, sarcoma, lymphoma, leukemia and germ cell tumour.
2. Describe the histologic differences between benign and malignant tumours.
3. Demonstrate an understanding of common pathological terminology used in cancer diagnosis (e.g. stage, grade).
4. Describe the importance of tissue sampling for diagnosis of malignancy and for identification of molecular predictive factors.
5. Demonstrate an understanding of the differences between fine needle aspiration biopsy, core biopsy, and surgical excision.
6. Demonstrate an understanding of the role of different specialists in obtaining a tissue diagnosis of cancer (e.g. family physician, haematologist, radiologist, surgeon, oncologist).

Anatomy

1. Describe the most common patterns by which cancer spreads (i.e. direct extension, lymphatic, haematogenous, transcelomic).
2. Demonstrate an understanding of relevant anatomy for common cancers (i.e. prostate, breast, lung and colorectal cancers) in terms of how they invade and metastasize, with an emphasis on invading adjacent structures, spread through the lymphatic and vascular systems.

PUBLIC HEALTH

Goal: By graduation, medical students should understand that cancer is a significant health issue. Medical students should also understand the risk factors for cancer and be able to identify opportunities for prevention and screening.

Epidemiology

1. Demonstrate an understanding of basic cancer statistics in terms of incidence, prevalence, mortality and survival.
2. Describe the incidence rate and mortality rates of the most common cancers diagnosed in Canada.
3. List the most common childhood cancers.

Risk Factors

1. Identify common environmental hazards that can cause cancer (i.e. chemical, biological, physical, radiation).
2. Identify common diseases and biological characteristics that can predispose a person to developing cancer (e.g. infectious and inflammatory diseases, genetics/family history, obesity).
3. Identify occupational and social risk factors for cancer (e.g. asbestos, smoking, alcohol).

Prevention

1. Distinguish between primary, secondary and tertiary prevention.
2. Describe important lifestyle and behavioural modifications that can prevent cancer (e.g. dietary habits, ideal body weight, regular physical activity, sun exposure/sunscreen, alcohol abuse, sexual behaviour, smoking cessation).

Screening

1. List the criteria for an effective population-level screening program.

2. List cancers which are screened for in the periodic health exam and the specific investigations that are utilized (i.e. cervical, breast, colon, prostate).
3. Demonstrate an understanding of the impact of cancer screening investigations on the patient, with particular emphasis on the implications of false negative and false positive results.

Evidence-Based Medicine (* May be learned in other parts of the UME curriculum)

1. Define evidence-based medicine and be able to demonstrate an understanding of its role in cancer care.
2. Demonstrate an understanding of case-control and cohort studies with respect to how they are used to study the impact of risk factors on the development of cancer.

DIAGNOSIS

Goal: By graduation medical students should know common presentations of cancer and how to make a diagnosis of cancer

Clinical Presentations of Cancer

1. Describe non-specific physical symptoms and signs associated with common cancers (e.g. unexplained weight loss, pain, lymphadenopathy, palpable mass, bleeding, thrombosis, change in bowel habit and biliary tract obstruction).
2. Describe common and characteristic cancer presentations/syndromes (e.g. iron deficiency anemia, cough, breast lump, hypercalcemia, painless jaundice, paraneoplastic syndromes, superior vena cava obstruction).
3. Demonstrate the ability to perform a focused medical history when cancer is suspected (i.e. symptoms based on primary cancer location and symptoms related to spread to common metastatic sites, risk factors, family history).
4. Demonstrate the ability to perform a focused physical examination for a patient with suspected cancer with emphasis on the primary cancer and possible sites of metastases.
5. Demonstrate the ability to generate a differential diagnosis based on symptoms and signs associated with cancer.
6. Demonstrate an understanding of presentations of cancer that represent emergencies (e.g. superior vena cava obstruction, cardiac tamponade, spinal cord compression,

pulmonary embolism, symptomatic brain metastases, cancer-related bleeding).

Diagnostic Tests

1. Describe and interpret appropriate lab tests, including hematology, chemistry and tumour markers, in a patient with a suspected diagnosis of cancer.
2. Demonstrate an understanding of how serum tumour markers are used in the diagnosis and management of cancer.
3. Describe diagnostic imaging studies used in the work-up of patients with suspected cancer and characteristic radiologic findings associated with cancer (e.g. pulmonary nodules, masses, pleural effusions on chest x-rays; lytic lesions, fractures on bone x-rays; nodules and masses on CT scans; masses on mammograms; PET-avid lesions on PET scan).
4. Demonstrate an understanding that a diagnosis of cancer commonly involves a biopsy and/or surgical resection, and understand that there are exceptions where other tests can be used.
5. Identify appropriate diagnostic and treatment referrals for patients with various common cancers.

Cancer Staging

1. Demonstrate an understanding of the general principles and purpose of cancer staging.
2. Identify basic principles of the TNM staging system with respect to common cancers (e.g. prostate, breast, lung, colorectal) and recognize that there are alternative staging systems for different tumour types.

Performance Status Assessment

1. Describe the components of commonly used performance status assessment tools such as the ECOG and Karnofsky performance status scales.

TREATMENT

Goal: By graduation, medical students should know how cancer is managed from a multidisciplinary perspective. This will facilitate appropriate referral and care patterns for cancer treatment.

General Principles of Cancer Treatment

1. Demonstrate an understanding of the concepts of curative, neoadjuvant, adjuvant and palliative treatments.

2. Demonstrate an understanding of the concepts of localized treatments versus systemic treatments.
3. Describe the role of various medical and allied health professionals in multidisciplinary cancer treatment teams and know the services offered by a typical outpatient cancer centre.
4. Demonstrate an understanding of the role of a primary care physician in the treatment and follow-up of cancer patients.
5. Identify unique issues experienced by pediatric/young patients with cancer (e.g. impact on growth and development, psychosocial issues, fertility, risk of secondary cancers, long-term follow-up, finances, insurance).
6. Identify factors that would affect the formulation of a treatment plan for a cancer patient (i.e. tumour, treatment and patient-related factors).
7. Understand that Canadian treatment guidelines for common cancers are available through provincial organizations (e.g. Cancer Care Ontario, British Columbia Cancer Agency, Alberta Health Services, etc).

Principles of Surgical Treatments for Cancer

1. Demonstrate an understanding of the role of surgery in the treatment of cancer (i.e. surgery is usually reserved for patients with potentially curable localized cancer, but there are palliative indications for surgery as well).
2. Demonstrate an understanding of common complications of cancer surgeries, such as bleeding, infection, and also impact on body image.
3. Demonstrate an understanding of the rationale for using radiation and systemic therapy pre- and post-operatively.

Principles of Radiation Treatments for Cancer

1. Demonstrate an understanding of the general principles of how radiation is used to treat cancer and different types of radiation (e.g. external beam, brachytherapy, stereotactic radiation).
2. Demonstrate an understanding of the difference between, and the clinical indications for, radiotherapy with curative and palliative intent.
3. List the common acute, subacute, and late adverse effects of radiation.

Principles of Systemic Treatments for Cancer

1. Demonstrate an understanding of the general principles of chemotherapy in the treatment of cancer.

2. List factors that would make a cancer patient a good candidate for chemotherapy.
3. Know the general differences between traditional chemotherapy and targeted biological therapy
4. List common acute and chronic toxicities of chemotherapy (e.g. alopecia, nausea, vomiting, neutropenia, mucositis, weight loss, neuropathy, secondary cancers), as well as potential life threatening toxicities (e.g. febrile neutropenia).

Management of Cancer Complications and Treatment Complications

1. Demonstrate an understanding of how to diagnose and manage common complications of cancer (e.g. bone metastasis pain, hypercalcemia, pulmonary embolism, deep vein thrombosis).
2. Demonstrate an understanding of how to diagnose and manage common complications of cancer treatment (e.g. febrile neutropenia, nausea, vomiting, diarrhea, hypertension, acute renal failure).
3. Demonstrate an understanding of the emergency management of severe complications of cancer and its treatment (e.g. superior vena-cava syndrome, spinal cord compression, tumour-lysis syndrome, symptomatic brain metastases, cancer-related bleeding).

Survivorship Care and Follow-up

1. Define survivorship in relation to cancer patients.
2. Describe the appropriate investigations and follow-up plans for surveillance of patients who have had curative treatments for common cancers (i.e. prostate, breast, lung, colorectal).
3. Demonstrate an understanding of the differences between locally recurrent and metastatic disease.
4. List the symptoms and signs of local recurrence and distant metastatic disease of common cancers (i.e. prostate, breast, lung, colorectal).

Principles of Palliative Care

1. Demonstrate an understanding of the role of the palliative care physician/team in the care of cancer patients.

Also see the Undergraduate Curriculum for Medical Education in Palliative and End-of-Life Care

(http://70.38.66.73/efppecc/docs/pdf_2006_ug_curriculum_fact_sheet.pdf)

PROGNOSIS

Goal: By graduation, medical students should know the prognosis of common cancers.

1. Demonstrate an understanding of the definition of prognosis and describe general factors that affect prognosis in cancer patients.
2. Demonstrate an understanding that some metastatic cancers are curable.

KNOWLEDGE OF COMMON CANCERS

Goal: By graduation, medical students should have detailed knowledge of the most common cancers and basic knowledge regarding other common cancers.

1. Demonstrate an understanding of the epidemiology, risk factors, prevention, screening, presentation, diagnosis, staging, basics of treatment, prognosis and follow-up/survivorship care for common cancers including: prostate cancer, lung cancer, breast cancer, colorectal cancer and skin cancers (non-melanoma & melanoma).

The amount of time dedicated to covering other cancers will depend on each medical school's individual curriculum. See

below for suggestions regarding other cancer-specific objectives that can be covered if time permits.

PSYCHOSOCIAL ISSUES (*May be learned in other parts of the UME curriculum)

Goal: By graduation, medical students should understand the unique psychosocial issues that cancer patients encounter and the resources available to meet their needs.

1. Identify the psychological, social and spiritual issues associated with cancer diagnosis and treatment.
2. Demonstrate an understanding that cancer can disrupt a patient and their family's lives and can impact their ability to cope.
3. Demonstrate an understanding of the role of coping styles in dealing with life-threatening illness.
4. Demonstrate an understanding of the concept of competency and capacity to consent.
5. Demonstrate an understanding of when to refer a cancer patient to a psychologist or psychiatrist.

6. Demonstrate an understanding of the psychosocial issues around life-threatening illnesses, such as cancer, relevant to different cultures, faiths and traditions.
7. Describe the role of an oncology psychosocial care provider in the hospital and in the community.
8. Demonstrate an understanding of the financial impact of cancer on patients and their families and know that patients with these issues should be referred to a social worker.

ETHICS AND PROFESSIONALISM (*May be learned in other parts of the UME curriculum)

Goal: By graduation, medical students should know the appropriate ethical and professional conduct when dealing with cancer patients.

1. Recognize the inherent tension between society's need for the just allocation of finite resources and an individual physician's responsibility to advocate for a patient's access to effective therapies.

2. Describe the components of informed decision making, including discussion of complications of cancer therapy in the curative and palliative setting, recognizing that potentially life-prolonging cancer therapies can induce potentially life-threatening adverse reactions.
3. Have an approach to discussing withholding or ending cancer treatment considered inappropriate by the physician/oncology team, but requested by the patient.
4. Outline the key ethical principles (e.g. honesty) which guide the disclosure of diagnostic and prognostic information to a cancer patient.
5. Demonstrate an understanding of the fact that every physician has limitations and the need to refer to other specialists or health care professionals appropriately.
6. Realize that caring for cancer patients can lead to compassion fatigue and physician burnout which can negatively impact patient care.

COMMUNICATION (* May be learned in other parts of the UME curriculum)

Goal: By graduation, medical students should be able to communicate appropriately with cancer patients to establish trust and rapport, gather important information, give bad news and other information about the illness (including prognosis), address patient emotions, and elicit concerns.

1. Demonstrate the ability to communicate information in a sensitive manner, addressing concerns, fear and expectations, while making sure a realistic prognosis is explained.
2. Identify specific issues that may interfere with communication of bad news to patients and their families.
3. Describe the SPIKES strategy for breaking bad news.
4. Demonstrate an understanding that receiving bad news may interfere with a patient's ability to comprehend fully what is being presented.
5. Demonstrate the ability to discuss resuscitation status and goals of care, particularly with respect to a "Do Not Attempt Resuscitation" ("Allow natural death") order.
6. Demonstrate the ability to keep adequate medical records and provide medical information to other healthcare team members caring for cancer patients.

ESSENTIAL ONCOLOGY EXPERIENCES FOR MEDICAL STUDENTS

Goal: By graduation, medical students should have had the following clinical experiences with cancer patients.

1. Observe a physician disclose to a patient they have cancer.
2. Observe a physician discussing resuscitation status with a cancer patient.
3. Observe a physician discussing the prognosis of a terminal cancer with a patient.
4. Discuss the risks and benefits of screening for breast, colon and cervical cancer with patients.
5. Perform a breast examination and if possible examine a patient with a breast mass due to breast cancer under supervision.
6. Perform a prostate examination and if possible examine a patient with a prostate nodule who has prostate cancer under supervision.
7. Speak with a patient who has had a potentially curative surgery for cancer regarding their treatment experience.
8. Speak with a cancer patient who has had radiation treatment for cancer regarding their treatment experience.

9. Speak with cancer patients who have had adjuvant chemotherapy for breast, colorectal and/or lung cancer regarding their experience.
10. Speak with cancer patients who have had palliative chemotherapy for breast, colorectal and/or lung cancer regarding their experience.
11. Review cancer-related diagnostic imaging with a radiologist (e.g. mammograms, chest X-rays with a solitary pulmonary nodule, CT scans showing primary and metastatic cancers)

Other Optional Cancer-specific Objectives

Depending on the curriculum at each medical school, the following objectives can be considered if time permits.

1. Demonstrate a basic understanding of the epidemiology, risk factors, prevention, screening, presentation, diagnosis and prognosis for the following cancers including: lymphoma, bladder cancer, head/neck (oral and larynx), thyroid cancer, leukemia, kidney cancer, uterine (endometrial) cancer, pancreatic cancer, gastric cancer, ovarian cancer, multiple myeloma, liver (hepatocellular) cancer, esophageal cancer, cervical cancer and testicular cancer.

In addition to the above objectives, the following are important cancer-specific objectives which we suggest should be emphasized:

Prostate Cancer

1. Demonstrate an understanding of the role of digital rectal examination (DRE) and prostate-specific antigen (PSA) in the diagnosis and follow-up of prostate cancer patients.
2. Demonstrate an understanding that prostate cancer is common and know the prognosis.
3. Demonstrate a basic understanding of the treatment options available for localized and metastatic (castrate-sensitive, castrate-resistant) prostate cancer.

Lung Cancer

1. Have an approach to solitary pulmonary nodules with a specific focus on chest x-ray and CT findings that distinguish a benign from a malignant nodule.

Breast Cancer

1. Demonstrate an understanding of breast cancer screening (i.e. it is a component of the periodic health exam, know appropriate screening and diagnostic tests, such as

- mammography, and be able to describe current screening recommendations based on published guidelines).
2. Be able to evaluate a patient who presents with a breast lump, or abnormal breast screening result (mammography), and know the how to diagnose the cause with particular emphasis on ruling out breast cancer.
 3. Demonstrate an understanding of the fact that an abnormal breast discharge can be the presenting symptom of breast cancer.

Colorectal Cancer

1. Demonstrate an understanding of colon cancer screening (i.e. it is a component of the periodic health exam, know appropriate screening tests and be able to describe current screening recommendations based on published guidelines).
2. Demonstrate an understanding of how to manage a patient with lower gastrointestinal bleeding from colon cancer including assessment of patient's hemodynamic status, whether emergent care is required and appropriate referral pattern.

Lymphoma

1. Demonstrate an approach to lymphadenopathy and know which characteristics make the diagnosis of lymphoma or metastatic cancer more likely.
2. Demonstrate an approach to a patient who presents with an anterior mediastinal mass and/or neck mass with emphasis that lymphoma is part of the differential diagnosis.

Melanoma & Non-Melanoma Skin Cancers

1. Demonstrate an understanding of skin cancer screening and the importance of diagnosing melanoma at an early stage.
2. List the physical characteristics of malignant melanoma and other skin cancers.

Thyroid Cancer

1. Demonstrate an approach to thyroid nodules with emphasis on knowing that thyroid cancer is in the differential diagnosis, but most thyroid nodules are benign.

Leukemia

1. List emergency complications of leukemia that are life threatening and require immediate medical attention.

Kidney Cancer

1. Demonstrate an approach to a patient who presents with a mass in the kidney.

Pancreatic Cancer

1. Demonstrate an approach to a patient presenting with painless jaundice with emphasis on characteristics that would make the diagnosis of pancreatic cancer more likely.

Ovarian Cancer

1. Provide an appropriate differential diagnosis for a woman who presents with an adnexal mass based on age, menopausal status, family history, personal risk factors, physical exam, biochemical and diagnostic imaging findings.

Esophageal Cancer

1. Demonstrate an approach to a patient presenting with dysphagia and weight loss with emphasis that esophageal cancer is in the differential diagnosis.

Cervical Cancer

1. Demonstrate a basic understanding of the causal effect between HPV, pre-invasive cervical disease and cervical cancer.

2. Demonstrate an understanding of cervical cancer screening (i.e. it is a component of the periodic health exam, know process/benefits/limitations of cervical cancer screening and prevention, describe current screening recommendations based on published guidelines).
3. Demonstrate the ability to perform a speculum examination and PAP smear under supervision.

Testicular Cancer

1. Demonstrate an approach to a patient who presents with a testicular mass with special emphasis on a diagnostic pathway and appropriate use of imaging and tumour markers.
2. Demonstrate an understanding of the prognosis of testicular cancer with an emphasis on the fact that metastatic disease is still potentially curable.