Cancer Basics

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CENTRAL CONNECTICUT CHAPTER

Objectives

- Participants will be able to understand the basics of cancer, including prevention, detection, risk factors, the science of cancer, and diagnosis
- Explain the major theories of cancer development and carcinogenesis
- Identify the most commonly used cancer staging systems
- Follow a case study throughout prevention, detection, risk factors, and diagnosis

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Health promotion and disease prevention

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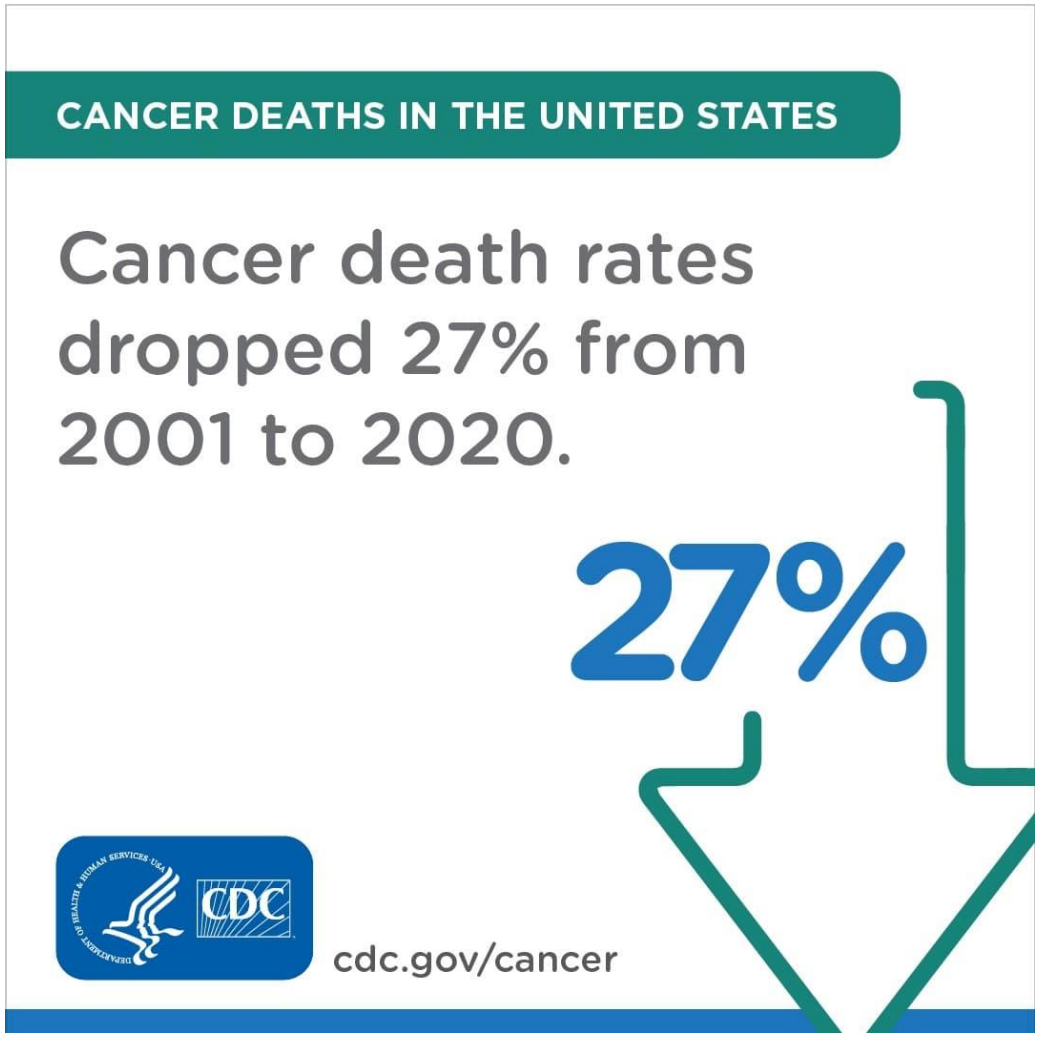
Epidemiology

- In 2022, about 1.9 million new cases of cancer were projected to be diagnosed in the U.S.
- Most common types of cancer are breast cancer, lung and bronchus cancer, prostate cancer, colon and rectum cancer, melanoma of the skin



Health promotion & disease prevention

- High-risk behaviors
  - Tobacco use
  - Obesity
  - Diet (high calorie foods, process and red meats, low vegetable/fruit consumption)
  - Alcohol consumption
  - UV radiation
  - Viral exposures (Hep B, HIV, Epstein-Barr virus, HPV)
  - Occupational exposure (Asbestos, job-specific)
  - Hormonal agents, antineoplastic drugs

Health promotion & disease prevention

- Preventative health practices
  - Nutrition
  - Physical activity
  - Vaccination (HPV, Hep B)
  - Limit sun exposure
  - Screening and early detection of cancer

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Cancer health disparities

- Adverse difference in cancer outcomes among specific groups based on age, disability, education, race/ethnicity, gender, income, poverty, lack of health insurance, geographic location, and medically underserved
- *Example:* White women have highest incidence of breast cancer, but African American women have highest mortality
- *Example:* Men have a higher lifetime risk of developing cancer compared to women

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Cancer risk factors

Modifiable risk factors

- Smoking
- Diet
- Exercise
- Occupation

Non-modifiable risk factors

- Age
- Gender
- Genetics

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Case study: Hank

- Male, white, 65 years old
- 1-2 PPD smoker for 20 years
- Drinks 3-4 beers daily
- Walks 1 mile daily
- Recently retired from steel worker factory

- High-risk behaviors?
- Preventative health practices?
- Modifiable risk factors?
- Non-modifiable risk factors?

Screening & early detection

- Primary prevention = prevention of cancer
- Secondary prevention = early detection of cancer through screening
- Effective screening = valid, easy to administer, acceptable to public, available
- Risk vs benefit
- Examples of screening modalities:
  - Imaging
  - Cytologic specimens
  - Chemical assays
  - Biomarkers or tumor markers

Breast cancer screening

Age	Recommendation
40-44	Women can start mammograms if they wish to do so
45-54	Mammogram yearly
55+	Mammogram every 2 years, or can continue yearly. Screening should continue as long as a woman is in good health and is expected to live at least 10 more years

American Cancer Society guidelines, 2023

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Colon and rectal cancer screening

Age	Recommendation (for those of average risk)
45	Stool or visual exam-based testing can start
46-75	Continue regular screening (ex: colonoscopy q 10 yrs)
76-85	Shared-decision making with patient and provider re: screening
86+	Insufficient evidence to support screening

Any abnormal test is followed up by a colonoscopy

Greater than average risk:

- A personal history of colorectal cancer or certain types of polyps
- A family history of colorectal cancer
- A personal history of inflammatory bowel disease (ulcerative colitis or Crohn's disease)
- A confirmed or suspected hereditary colorectal cancer syndrome, such as familial adenomatous polyposis (FAP) or Lynch syndrome (hereditary non-polyposis colon cancer or HNPCC)
- A personal history of getting radiation to the abdomen (belly) or pelvic area to treat a prior cancer

American Cancer Society guidelines, 2023

Cervical cancer screening

Age	Recommendation
25	Start screening for cervical cancer
25-65	Primary HPV test q 5 years OR Pap test plus HPV test q 5 years OR Pap test q 3 years
65+	Stop testing if have had normal results for past 10 years

- Women with cervical pre-cancer should continue to be tested for at least 20 years after that diagnosis
- No testing needed for women who have had a total hysterectomy and have no hx of cervical cancer or pre-cancer
- Women who have been vaccinated against HPV should still follow screening recommendations

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American Cancer Society guidelines, 2023

Lung cancer screening

Yearly low-dose CT scan (LDCT) for people who meet ALL the following conditions:

Conditions:
Age 50 to 80 and in fairly good health
Currently smoke or have quit smoking in the past 15 years
Have at least a 20-pack year smoking history

* Pack-year = 1 pack of cigarettes per day per year. 1 PPD for 20 years OR 2 PPD for 10 years both = 20 pack-years

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American Cancer Society guidelines, 2023

Prostate cancer screening

Talk with provider about PSA blood test with or without a rectal exam if you meet any of the following conditions:

Conditions:
Age 50 for men who are at average risk of prostate cancer and are expected to live at least 10 more years.
Age 45 for men at high risk of developing prostate cancer. This includes African Americans and men who have a first-degree relative (father or brother) diagnosed with prostate cancer at an early age (younger than age 65).
Age 40 for men at even higher risk (those with more than one first-degree relative who had prostate cancer at an early age).

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American Cancer Society guidelines, 2023

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- Cancer screening recommendations?

Scientific basis for cancer

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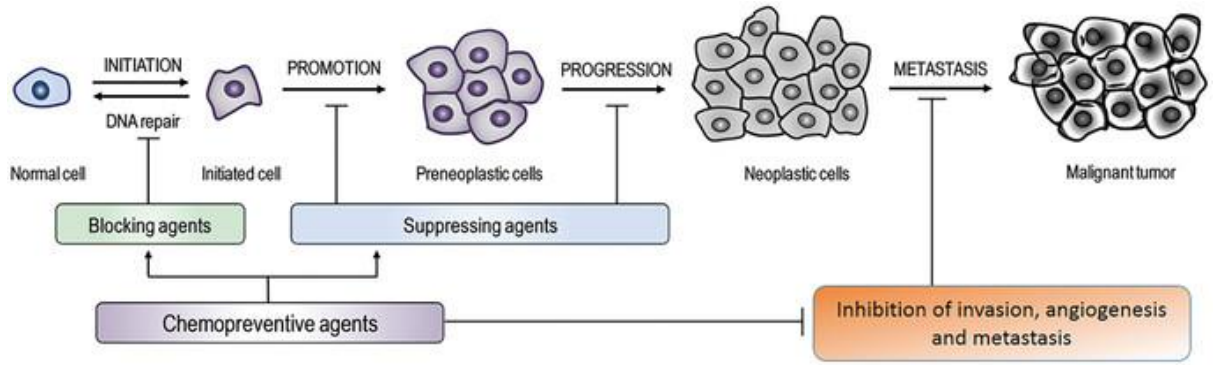
Carcinogenesis

- Process that transforms a normal cell into a cancer cell
- Begins with a mutated cell
- May take up to six mutations in a gene to cause cancer
- Population of mutated cells form a tumor
- Under right conditions, may invade other tissues



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Process of carcinogenesis

- Initiation
  - Exposure to carcinogen
  - Irreversible damage to DNA
- Promotion
  - Exposure to promoter agents results in abnormal growth
  - Reversible if carcinogens are removed
- Progression
  - Results in detectable and symptomatic disease

Malignant tumors

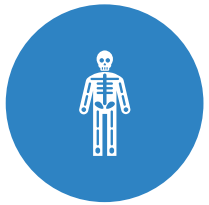
ABNORMAL MORPHOLOGY

POORLY DIFFERENTIATED

NO CONTACT INHIBITION

UNREGULATED GROWTH PATTERNS

NO PROGRAMMED APOPTOSIS



LOSS OF SPECIFIC FUNCTION

MIGRATION TO OTHER AREAS OF THE BODY

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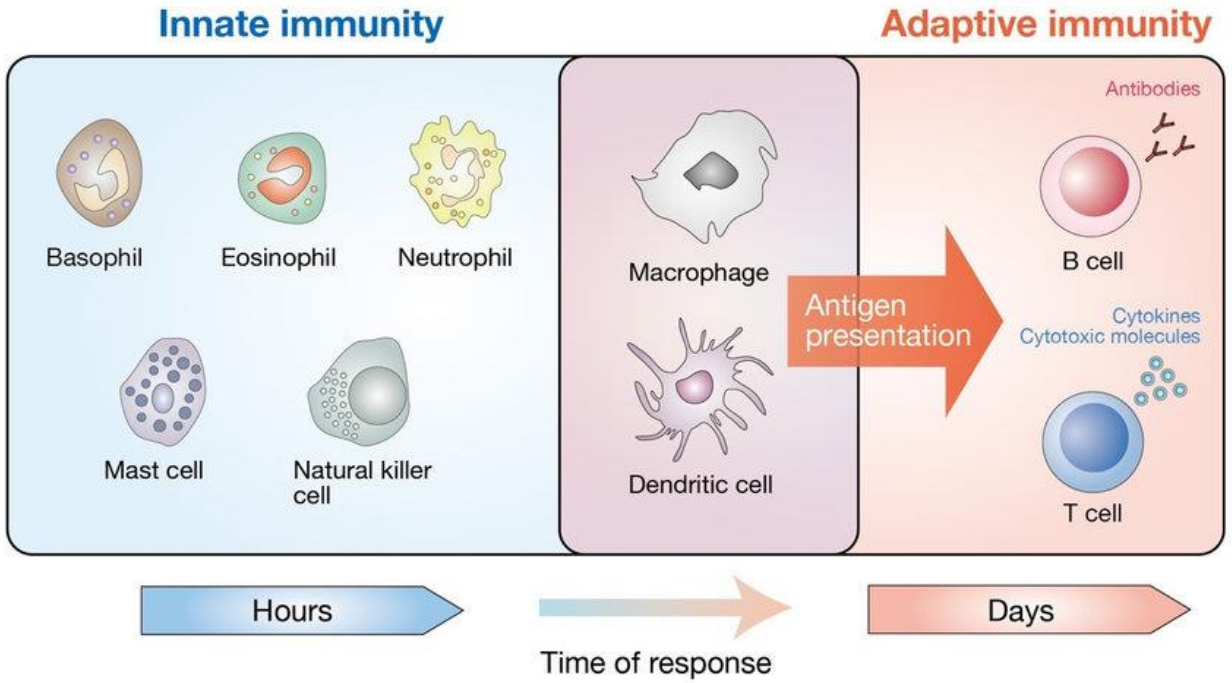

Immunology

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Clinical trials

Phase	Purpose
0	Exploratory studies of low doses of a new drug
I	Find the highest dose of a new treatment that is safe
II	Find out if the treatment works (benefit/response)
III	Compare new drug to current standard treatment
IV	Long-term study of any new effects of treatment

Classification and staging

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Classification

- Classified according to the tissues or cells from which it originates:
  - Epithelial cells – Carcinomas
  - Glandular tissues – Adenocarcinomas
  - Bone, muscle, connective tissue – Sarcomas
  - Brain and spinal cord – Gliomas
  - Lymphatic tissue or cells – Lymphomas
  - Blood-forming cells – Leukemias

Staging

- Process by which the location(s) and extent of disease are determined
  - Crucial to plan appropriate treatment
  - Helpful prognostic value
  - Provides a common terminology for healthcare providers and/or researchers
  - Uses physical examination, imaging and lab results, pathology/cytology results, and tumor and molecular markers to assign appropriate stage

Elements of a staging system

- Elements of a system:
  - Size and number of the primary tumor(s)
  - Site of the primary tumor
  - Lymph node involvement
  - Cell type/tumor grade
  - Metastatic status

Types of tumor staging

Three types of staging exist:

- Clinical (by tests, physical examination, biopsies)
- Pathologic (histologic examination of surgical/biopsy tissue)
- Restaging (to determine extent of disease after recurrence)

TNM system

Used for most solid tumors

- T = extent of the primary tumor
- N = degree of lymph node involvement
- M = metastatic status
- An additional number or letter is added to differentiate degree of involvement in each category

Overall stages I–IV

Both TNM and numbered stages are used for many cancers to describe progression.

- Stage 0 Carcinoma in situ
- Stage I, II, III Increase in number = more advanced disease
- Stage IV Advanced disease that has spread to another organ(s)

Summary staging system

Used by cancer registries:

- In situ — Abnormal cells only in the layer of cells where they developed
- Localized — Limited to the organ of origin
- Regional — Spread to nearby lymph nodes, organs, or tissues
- Distant — Spread to distant organs/nodes
- Unknown — Not enough information to stage

Histological grading

- GX: Grade cannot be assessed (undetermined grade)
- G1: Well differentiated (low grade)
- G2: Moderately differentiated (intermediate grade)
- G3: Poorly differentiated (high grade)
- G4: Undifferentiated (high grade)

Site-specific cancer considerations

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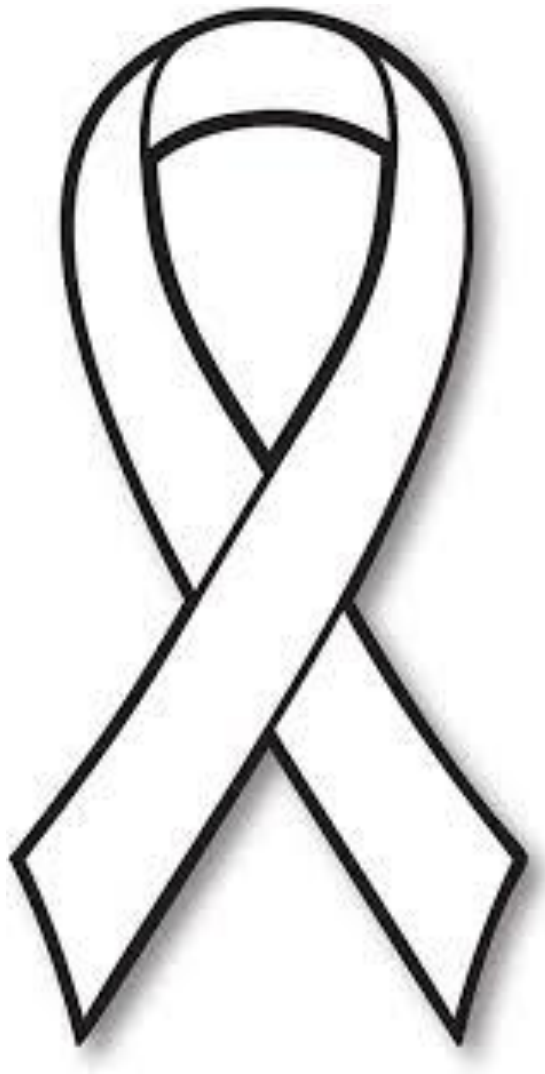
Breast cancer

- **Diagnostic measure**: biopsy
- **Histopathologic classifications**: ductal adenocarcinoma, lobular carcinoma
- **Molecular classifications**: ER/PR/HER-2
- **Common metastatic locations**: regional lymph nodes, contralateral breast
- **Distant metastatic locations**: bone, skin, lungs, liver, abdomen, brain
- **Prognosis**: 90% overall 5-yr survival
  - localized (99%), regional (86%), distant (27%)

Lung cancer

- **Pathophysiology:** DNA damage, exposure to toxins
- **Types:**
  - Non-small cell (80-85%)
  - Small cell (10-15%)
- **Diagnostic measures:** PFTs, X-ray, CT, PET
  - Incidental diagnosis
- **Common metastatic locations:** lymph nodes, brain, liver, adrenal glands, bone
- **Prognosis:** 24% overall 5-year survival
  - Localized (61%), regional (35%), distant (6%)

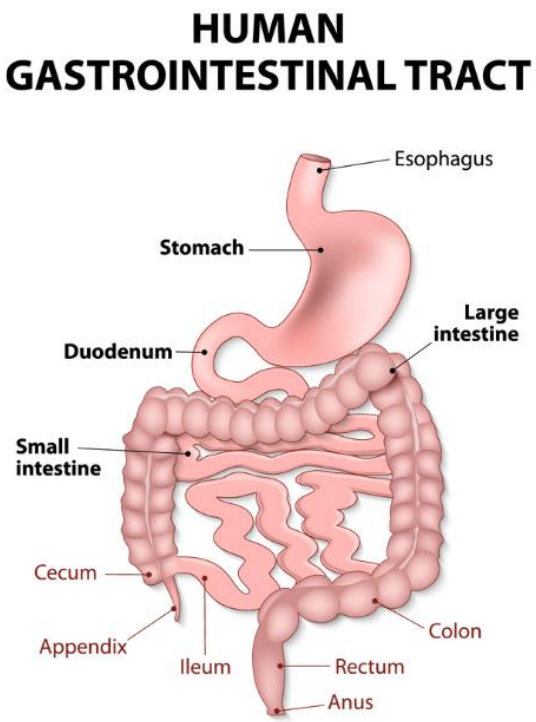


Case study: Hank

- Abnormal finding on low-dose CT scan from screening
- **Plan:**
  - Lung aspirate biopsy
  - PET scan for full-staging

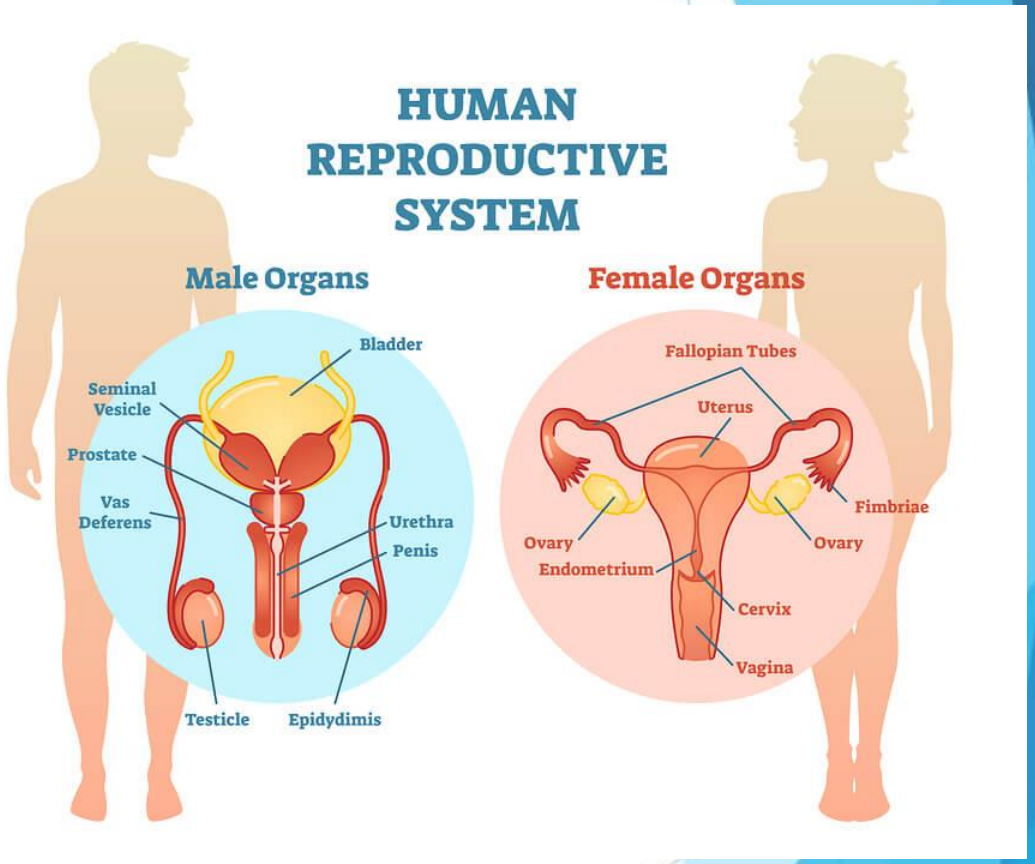
GI tract cancers

- **Types of cancers:** esophageal, gastric, colorectal, anal, hepatocellular, pancreatic
- Many adenocarcinomas
- **Common metastatic locations**:
  - lymph nodes
  - adjacent organs (liver and lung)
- **Diagnostic measures**: scope with biopsy, CT, sometimes PET
- **Prognosis**: varies
  - 63% overall 5-yr for colorectal
  - 9% overall 5-yr for pancreatic



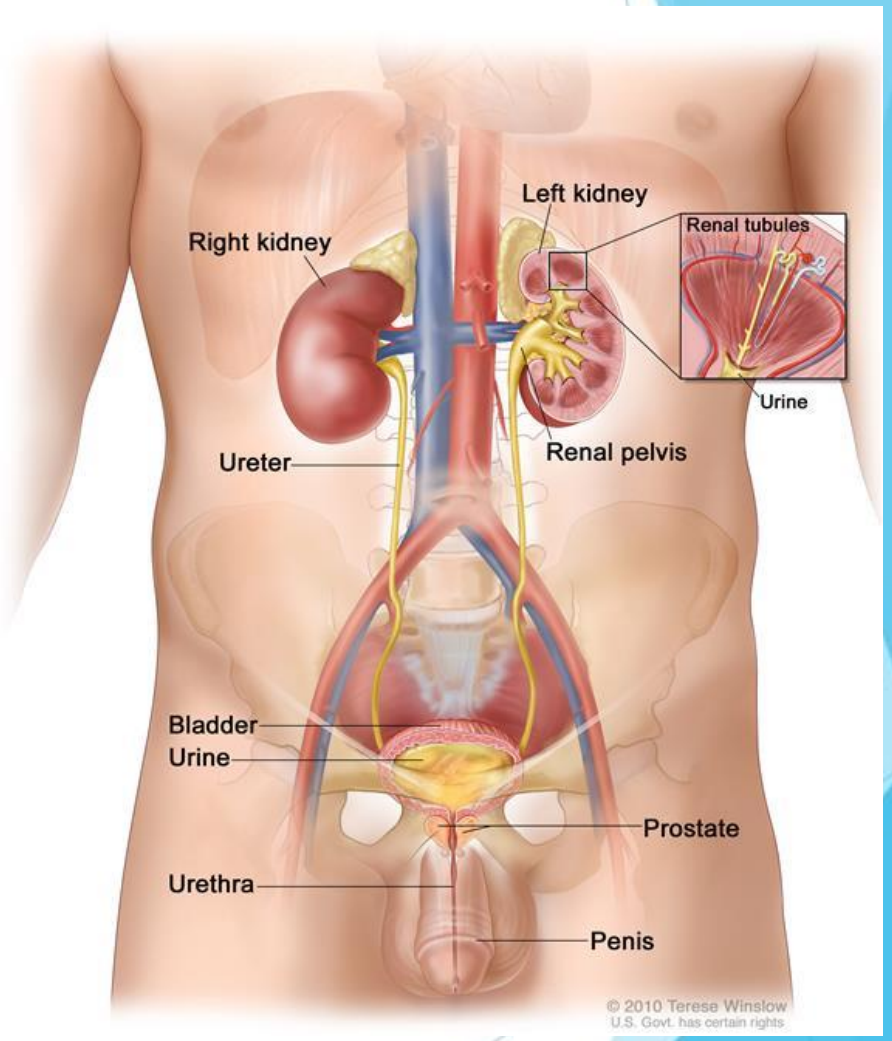
Reproductive system cancers

- **Types**: cervical, endometrial, ovarian, gestational trophoblastic neoplasia (GTN), vulvar, vaginal, testicular, penile
- **Common metastatic locations**: lymph nodes, nearby organs
- **Diagnostic measures**
  - Colposcopy (cervical), biopsy (endometrial, vulvar, vaginal, testicular, penile), laparoscopy (ovarian), beta-HCG/ultrasound (GTN)
- **Prognosis**: varies
  - Most curative: testicular (95%), endometrial (81%)
  - Lower 5-yr survival: ovarian, vaginal (47% overall), cervical (66%)



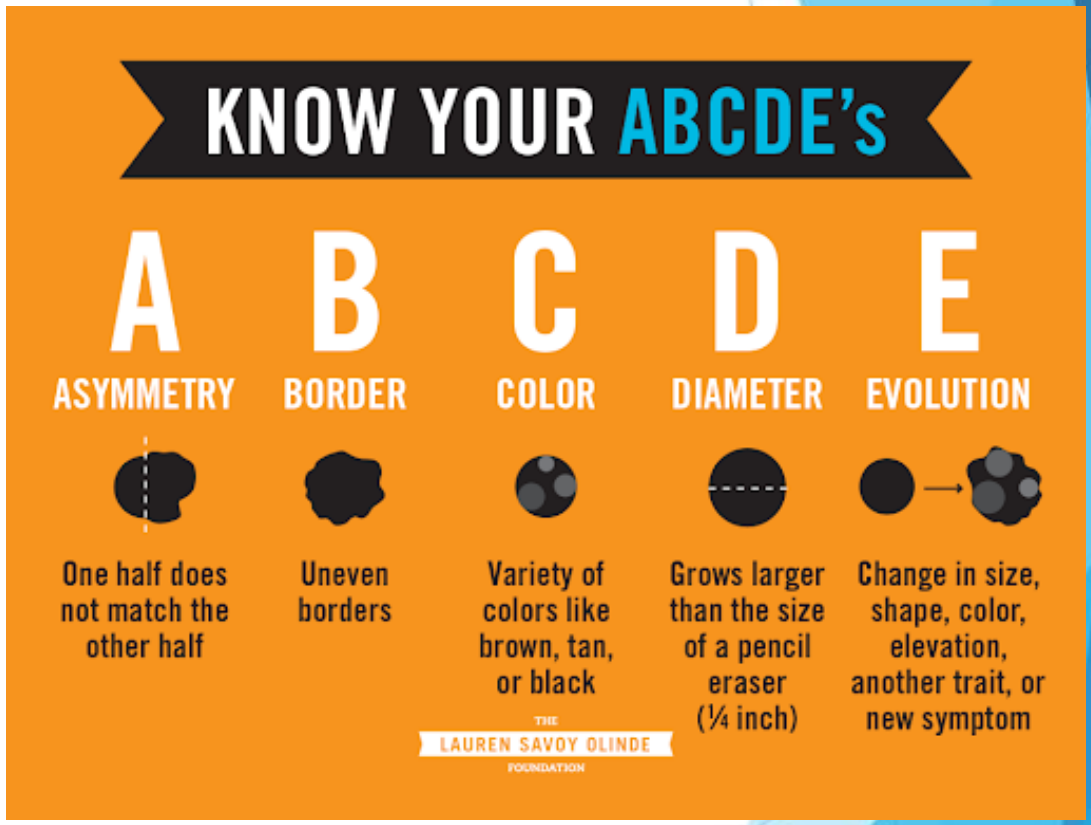
Urinary system cancers

- **Types**: kidney, bladder, prostate
- **Classifications**: clear cell carcinoma (kidney); urothelial carcinoma (bladder), adenocarcinoma (prostate)
- **Common metastatic locations**:
  - Kidney/Bladder: lungs, lymph nodes, liver, bone
  - Prostate: bladder, peritoneum, lymph node, bone
- **Diagnostic measures**:
  - Kidney/Bladder: KUB, CT
  - Prostate: digital rectal exam (DRE), transrectal u/s (TRUS)
- **Prognosis**: varies
  - Kidney (75% 5-yr survival); Bladder (77%); Prostate (98%)



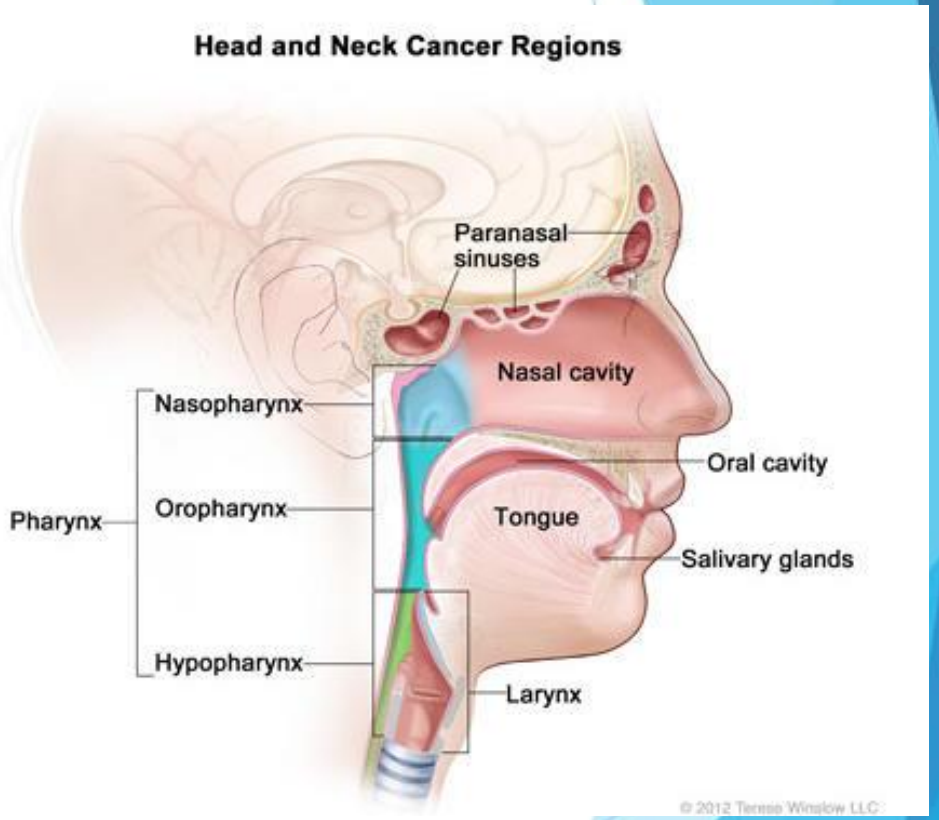
Skin cancer

- **Pathophysiology**: DNA damage from UVR
- **Types**: basal cell carcinoma, squamous cell carcinoma, melanoma
- **Common metastatic locations**: lymph nodes, brain (melanoma)
- **Diagnostic measures**: biopsy
- **Prognosis**: nearly 100% 5-yr survival with no distant involvement
  - Melanoma with distant mets: 25% 5-yr survival



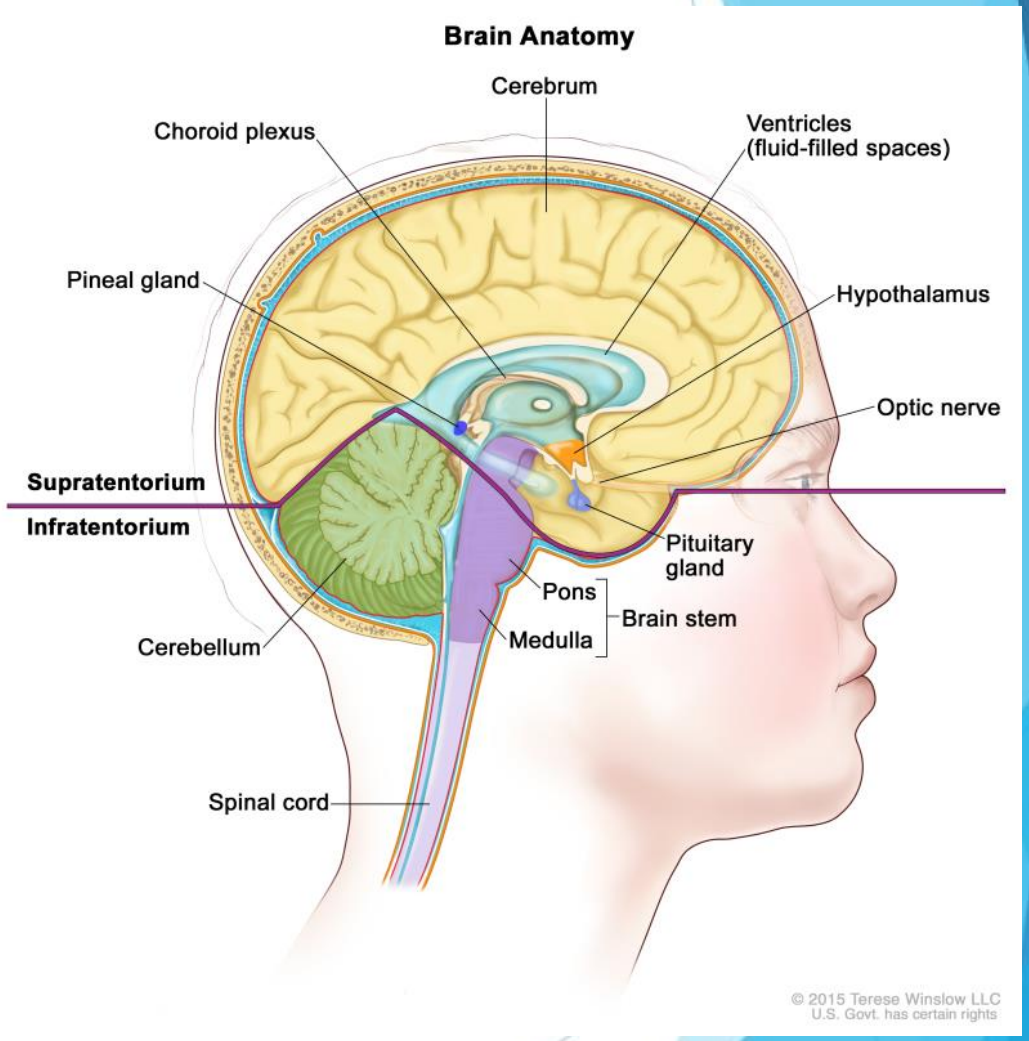
Head and neck cancer

- 90% are squamous cell carcinoma
- **Common metastatic locations**: lymph node (at diagnosis); lung, liver, bone
- **Diagnostic measures**: oral examination, CT, biopsy
- Prognosis: varies
  - Oropharyngeal (52-66%)
  - Laryngeal (46-76%)
  - Thyroid (~100%)



Neurologic system cancers

- **Sites**: brain, spine
- **Diagnostic measures**: CT, MRI, surgical resection
- **Prognosis**: varies depending on volume of disease at diagnosis; could be weeks to years
- **Nursing considerations**: seizure management (dexamethasone), oncologic emergencies (stay tuned!)



Leukemia

- **Types**: acute myeloid leukemia (AML), acute lymphoblastic leukemia (ALL), chronic myeloid leukemia (CML), chronic lymphocytic leukemia
- **Pathophysiology**: excessive proliferation of leukemic cells (myeloid or lymphoid)
- **Diagnostic measures**: CBC, PT/PTT/D-dimer; CT/MRI; LP (lumbar puncture), human leukocyte antigen (HLA) typing
- **Prognosis**: overall 5-yr survival rates
  - AML (adults) - 26%
  - CML – 63%
  - ALL – 68%
  - CLL – 81%

Lymphoma and multiple myeloma

	Lymphoma	Multiple myeloma
Pathophysiology	Abnormal lymphoid cells	Abnormal plasma cells
Types	Hodgkin (Reed-Sternberg cells) (HL) Non-Hodgkin (NHL)	-
Staging	Ann Arbor system: Extent of lymph node involvement and symptoms	Revised International Staging System: Levels of beta-2-macroglobulin and albumin in blood
Diagnostic measures	LN biopsy, CT	Bone marrow biopsy, M proteins
Prognosis	NHL: diffuse large B-cell lymphoma: 63% overall 5-yr survival rate HL: 87% overall 5-yr survival rate	Stage 1: median survival has not been reached Stage 2: 83 months Stage 3: 43 months

CRAB criteria for multiple myeloma

- C = calcium elevation in blood (>11 mg/L)
- R = renal insufficiency – serum creatinine > 2mg/dL
- A = anemia – hemoglobin < 10g/dL
- B = bone lytic lesions

- Additional criteria:
  - Bone marrow plasma cells ≥60%
  - Involved/uninvolved serum free light chain ratio ≥100
  - Abnormal MRI with more than one focal lesion, with each lesion >5 mm

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Bone and soft tissue cancers

	Bone	Soft tissue
Types	Osteosarcoma* (ages 10-25) Chondrosarcoma (ages 50-60) Ewing sarcoma (ages 10-20)	Fibrosarcoma (fibrous tissue) Liposarcoma (fat) Rhabdomyosarcoma (muscle) Leiomyosarcoma (striated/smooth muscle)
Diagnostic measures	Radiographs, CT	Tissue biopsies, MRI, CT
Prognosis (Vary depending on staging)	Chondrosarcoma – overall 5-yr survival rate 78% Osteosarcoma – overall 5-yr survival rate 60%	Soft tissue sarcoma - overall 5-yr survival rate 65%

* = most common

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HIV-related cancers

- AIDS-defining malignancies – related specifically to HIV infection and subsequently altered immune system
  - NHL
  - Burkitt lymphoma
  - Kaposi sarcoma
  - Cervical cancer
- Important to continue combined antiretroviral therapy (cART) during chemo
  - But cART's can interact with CVP pathway of some antineoplastics
- Important to monitor CD-4 counts throughout treatment

Case study: Hank

University Health Network

LABORATORY MEDICINE PROGRAM

DEPARTMENT OF PATHOLOGY
200 Elizabeth Street
Toronto, Ontario, M5G 2C4
TEL: 416-340-3325
FAX: 416-586-9901

Surgical Pathology Consultation Report

* Addended *

Patient Name:	**Patient, USCAP**			Accession #:	S16-12345
MRN:	9876543	Service:	TGH Thoracic	Collected:	May-05-2016
DOB:	11/22/1947 (Age: 68)	Visit #:	23412312345	Received:	May-05-2016
Gender:	F	Location:	2C Pre Operative Care Unit	Reported:	Jun-01-2016
HCN:	123456775CH	Facility:	TGH/PMH		
Ordering MD:	Deep Cutter, MD				
Copy To:	Good P Friend, MD Stat Response, MD				

Specimen(s) Received

1. Lymph-Node: ST10R TB Angle
2. Right middle lobe
3. Station 11R
4. Station 4R
5. Station 7
6. Interlobar ST11
7. Right middle and upper bilobectomy

Consolidated Theranostic Report

Interpretation

Invasive moderately differentiated adenocarcinoma, acinar-predominant, pT2aN1
- POSITIVE for EGFR L858R mutation (see Molecular Diagnostics report)
- NEGATIVE for ALK by immunohistochemistry (performed using the 5A4 antibody with a protocol optimized for detection of ALK gene rearrangement)
- See Diagnosis, Comment, and Synoptic Report below for further details

Signed out by: Lung Path, MD
Date Reported: Jun-01-2016

Diagnosis

1,3-6. Lymph nodes (ST10R right tracheobronchial, ST11R right interlobar, ST4R right lower paratracheal, ST7 subcarinal, ST11 interlobar):
- At least one lymph node per station, negative for malignancy (x5) (0/5)

2. Lung, resection (right middle lobectomy):
   a. Invasive moderately differentiated adenocarcinoma, acinar-predominant, pT2aN1, with:
      i. Greatest tumor dimension: 1.2 cm (see Comment)
      ii. Visceral pleural and lympho-vascular invasion present
      iii. Stapled parenchymal resection margin positive for carcinoma (see Comment)
   b. One of five lymph nodes focally positive for adenocarcinoma by direct invasion (1/5) (see Comment)

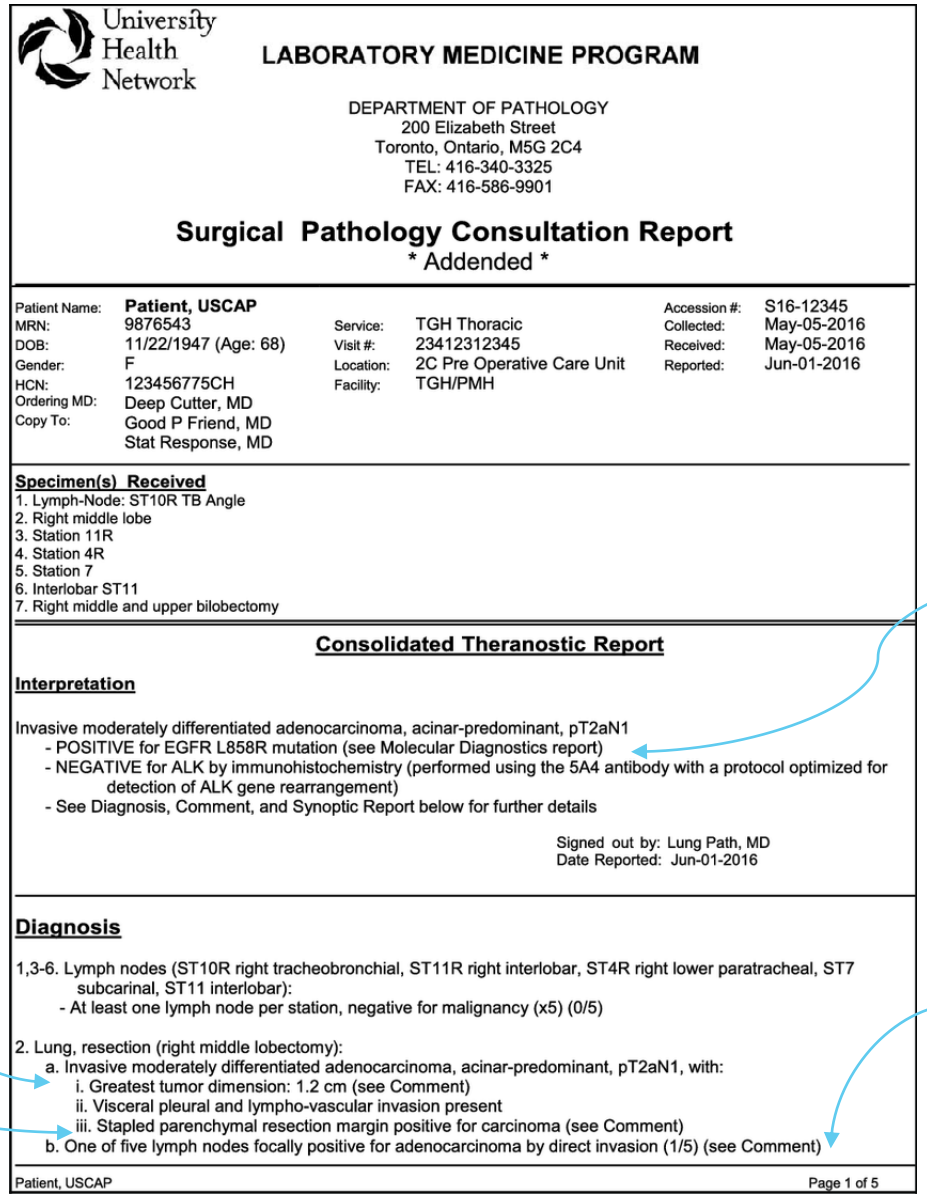
Diagnosis: invasive moderately differentiated adenocarcinoma T2aN1

Tumor location & size: R middle lobe, 1.2 cm

+ margin noted

Molecular studies: EGFR+, ALK(-)

Lymph node involvement: 1 + LN



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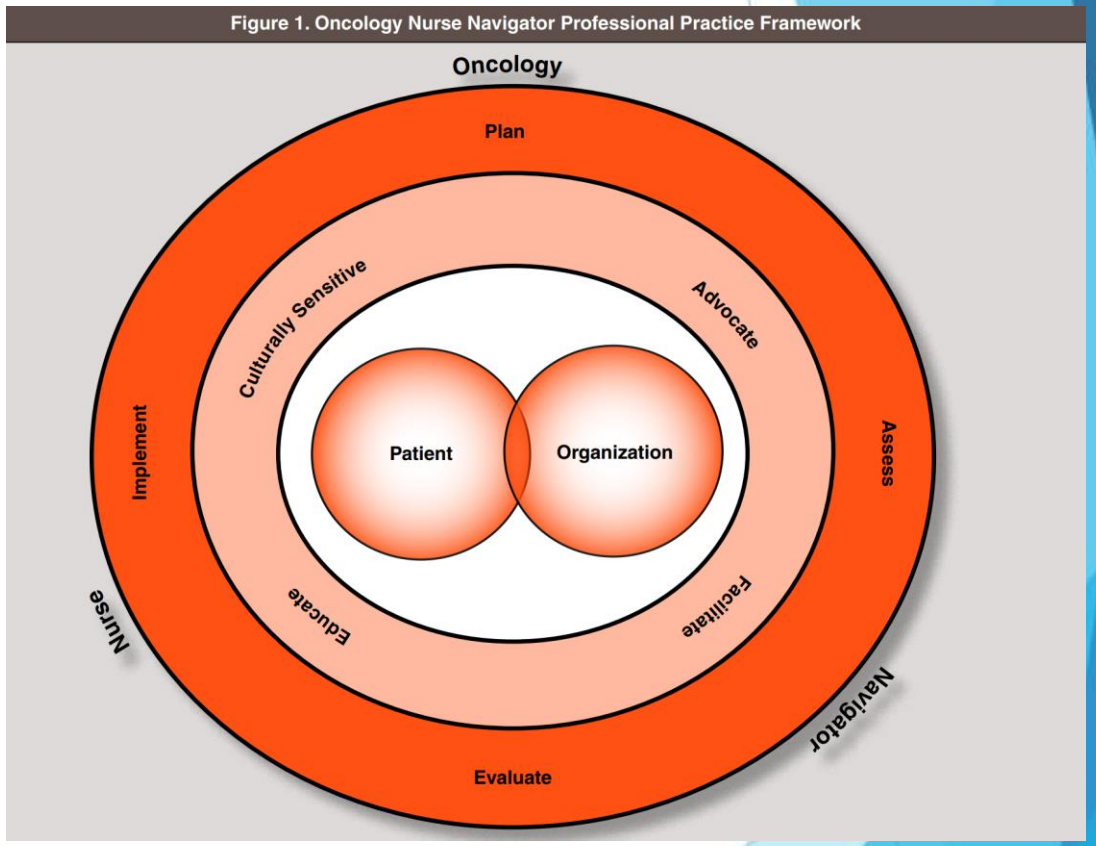
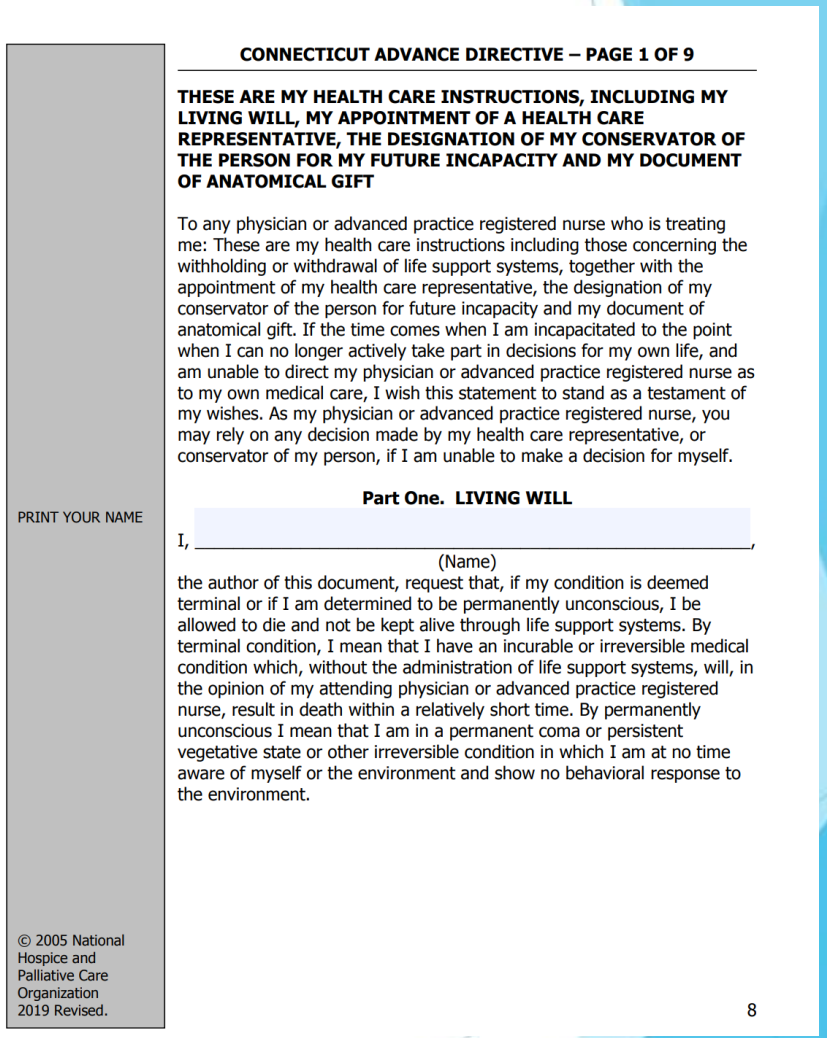
Navigation

- “An oncology nurse navigator (ONN) is a professional registered nurse with oncology-specific clinical knowledge who offers individualized assistance to patients, families, and caregivers to help overcome healthcare system barriers. Using the nursing process, an ONN provides education and resources to facilitate informed decision making and timely access to quality health and psychosocial care throughout all phases of the cancer continuum.”
- (ONS, 2013, p. 6)



Advance care planning

- “Getting information on the types of life-sustaining treatments that are available.
- Deciding what types of treatment you would or would not want should you be diagnosed with a life-limiting illness.
- Sharing your personal values with your loved ones.
- Completing advance directives to put into writing what types of treatment you would or would not want – and who you chose to speak for you – should you be unable to speak for yourself.”
- (National Hospice and Palliative Care Organization, 2020)



PRINT YOUR NAME

THESE ARE MY HEALTH CARE INSTRUCTIONS, INCLUDING MY LIVING WILL, MY APPOINTMENT OF A HEALTH CARE REPRESENTATIVE, THE DESIGNATION OF MY CONSERVATOR OF THE PERSON FOR MY FUTURE INCAPACITY AND MY DOCUMENT OF ANATOMICAL GIFT

To any physician or advanced practice registered nurse who is treating me: These are my health care instructions including those concerning the withholding or withdrawal of life support systems, together with the appointment of my health care representative, the designation of my conservator of the person for future incapacity and my document of anatomical gift. If the time comes when I am incapacitated to the point when I can no longer actively take part in decisions for my own life, and am unable to direct my physician or advanced practice registered nurse as to my own medical care, I wish this statement to stand as a testament of my wishes. As my physician or advanced practice registered nurse, you may rely on any decision made by my health care representative, or conservator of my person, if I am unable to make a decision for myself.

Part One. LIVING WILL

I, _____,
(Name)
the author of this document, request that, if my condition is deemed terminal or if I am determined to be permanently unconscious, I be allowed to die and not be kept alive through life support systems. By terminal condition, I mean that I have an incurable or irreversible medical condition which, without the administration of life support systems, will, in the opinion of my attending physician or advanced practice registered nurse, result in death within a relatively short time. By permanently unconscious I mean that I am in a permanent coma or persistent vegetative state or other irreversible condition in which I am at no time aware of myself or the environment and show no behavioral response to the environment.

Sample Questions!

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Q: Which of the following is not routinely included as part of a diagnostic work-up for colorectal cancer?

- A. Barium enema
- B. Bone marrow biopsy
- C. Colonoscopy
- D. Carcinoembryonic antigen (CEA)

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Q: Which of the following is not routinely included as part of a diagnostic work-up for colorectal cancer?

- A. Barium enema
- B. Bone marrow biopsy
- C. Colonoscopy
- D. Carcinoembryonic antigen (CEA)

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Q: Which primary cancer has a high incidence of brain metastasis?

- A. Melanoma
- B. Non-Hodgkin lymphoma
- C. Thyroid cancer
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Q: A patient presents with a new diagnosis of non-small cell lung cancer. The tumor is 4cm x 6cm and has invaded the visceral pleura. There is evidence of metastasis in the mediastinal nodes and distant metastasis in the liver. Based on TNM staging, what stage of lung cancer does the patient have?

- A. Stage 2
- B. Stage 3a
- C. Stage 3b
- D. Stage 4

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