# Section Summary: Diagnosis and Detection

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### Detection and Testing

- Detecting cancers early is an important step in preventing significant health problems.
- When a test is performed to detect a disease, there are four possible outcomes:
  - True positive - test indicates that a patient has a disease that the patient does indeed have
  - False positive - test indicates that a patient has a disease when they do not
  - True negative - test indicates the patient is disease-free, and this is indeed the case
  - False negative - test indicates the patient is healthy when in fact the patient has the disease

### Sensitivity and Specificity

- Medical tests are characterized by two features, sensitivity and specificity.
- Sensitivity refers to how accurately a test identifies people who have the disease.
- Specificity refers to how accurately a test identifies people who do not have the disease.
- The best medical tests have high sensitivity and high specificity.

### General Techniques

A wide variety of techniques are used for cancer detection, including:

- Non-invasive Techniques
  - Ultrasound uses reflection of sound waves to create an image of a part of the body
  - MRI uses magnetic fields and radio waves to produce images of the body.
  - PET scans use radioactive molecules to create a dynamic image of internal tissues and organs. PET scans are able to measure the metabolic activity of cells, not just their structure.
  - CT scans use x-rays to take multiple image slices in order to create a 3D image.
  - X-rays utilized high energy beams to create an image.
- Invasive Techniques
  - Fine needle aspiration (FNA) uses a small needle to collect small samples of a lesion.
  - Core needle biopsy (BPA) uses a larger needle to collect samples of a lesion.
- Analysis of Biopsy Samples
  - Immunohistochemistry (IHC) measures protein expression using specially labeled antibodies.
  - Fluorescence in situ hybridization (FISH) measures genetic changes (i.e. amplification) using fluorescently labeled DNA probes.

### Cancer Specific Techniques

Some detection techniques are used to detect specific cancer types. Examples include:

- Mammography uses low dose x-ray to create an image of a breast.
- Sigmoidoscopy uses a small tube containing viewing equipment to view the colon.
- Virtual Colonoscopy uses an MRI or CT scan to create an image of the inside of the colon.
- Pap smears use a sample of cells from the cervix to detect cervical cancer. Pap smears may also detect ovarian and uterine cancers that have migrated to the cervix.
- Prostate specific antigen (PSA) test measures levels of a glycoprotein in the blood. Elevated levels of PSA **may be** associated with prostate cancer.