Cancer screening

Screening: Screening is a way of finding out if people have a higher chance of having a health problem, so that early treatment can be offered or information given to help them make informed decisions. (NHS)
Screening refers to the use of simple tests across a healthy population to identify those individuals who have a disease, but do not yet have symptoms (WHO).

screening : is not only to detect disease at its earliest stage , but also to find individuals at risk or those with established disease who are not receiving adequate care .

Levels of Preventions :
● 1. Primary – prevent risk factor .
● 2. Secondary – prevent subclinical illness from advancing → early detection and Tx (**screening** and case finding)
● 3. Tertiary – prevent clinical illness from advancing → reduce complications

Wilson's criteria for screening tests:
● The condition should be an **important & common** health problem.
● The **natural history** of the condition should be **understood**.
● There should be a **recognizable** latent or early **symptomatic stage.**
● There should be a **test** that is **easy** to perform and interpret, safe, acceptable, accurate, reliable, sensitive and specific.
● There should be an **accepted treatment** recognized for the disease.
  - Treatment should be more effective if started early.
  - There should be a policy on whom should be treated.
● Diagnosis and treatment should be **cost-effective.**

USPSTF: United States preventive services taskforce (published in different years, covers around 14 types of cancer but we will focus mainly on screening of: breast cancer 2024, colorectal cancer 2021, lung cancer 2021, cervical cancer 2018)

Grades of USPSTF recommendations:

Grade	Definition	Suggestions for Practice
A	The USPSTF recommends the service. There is high certainty that the net benefit is substantial.	Offer or provide this service.
B	The USPSTF recommends the service. There is high certainty that the net benefit is moderate or there is moderate certainty that the net benefit is moderate to substantial.	Offer or provide this service.
C	The USPSTF recommends selectively offering or providing this service to individual patients based on professional judgment and patient preferences. There is at least moderate certainty that the net benefit is small.	Offer or provide this service for selected patients depending on individual circumstances.
D	The USPSTF recommends against the service. There is moderate or high certainty that the service has no net benefit or that the harms outweigh the benefits.	Discourage the use of this service.
I Statement	The USPSTF concludes that the current evidence is insufficient to assess the balance of benefits and harms of the service. Evidence is lacking, of poor quality, or conflicting, and the balance of benefits and harms cannot be determined.	Read the clinical considerations section of USPSTF Recommendation Statement. If the service is offered, patients should understand the uncertainty about the balance of benefits and harms.

A+B -> the USPSTF recommends the service, high certainty of high to moderate net benefit.
C -> recommends selectively offering or providing this service based on professional judgment and patient preference. (Net benefit is small)
D -> recommends against the service, high to moderate certainty that the service has no net benefit or the harms outweigh the benefits.
I -> current evidence is insufficient to assess the balance between benefits and harm.

We will start by the most recent recommendations:

1- Breast cancer **(biennial)**

USPSTF Grade: B/I, age: adults, senior

This shows the stages of breast cancer →

Grades are catigortized according to the age into three entities:

Population	Recommendation	Grade
Women aged 40 to 74 years	The USPSTF recommends biennial screening mammography for women aged 40 to 74 years.	B
Women 75 years or older	The USPSTF concludes that the current evidence is insufficient to assess the balance of benefits and harms of screening mammography in women 75 years or older.	I
Women with dense breasts	The USPSTF concludes that the current evidence is insufficient to assess the balance of benefits and harms of supplemental screening for breast cancer using breast ultrasonography or magnetic resonance imaging (MRI) in women identified to have dense breasts on an otherwise negative screening mammogram. See the "Practice Considerations" section for more information on the patient population to whom this recommendation applies and on screening mammography modalities.	I

		Tumour size (cm)	Lymph nodes involved?	Metastasised?
Non-invasive cancer	Stage 0	N/A	No	No
Early breast cancer	Stage 1	<2	No	No
	Stage 2A	<2	Yes: Category 1	No
		2–5	No	No
		No cancer found in breast	Yes: Category 1	No
	Stage 2B	2–5	Yes: Category 1	No
Advanced breast cancer		>5	No	No
	Stage 3A	<2	Yes: Category 2	No
		2–5	Yes: Category 2	No
		>5	Yes: Category 1	No
		>5	Yes: Category 2	No
		No cancer found in breast	Yes: Category 2	No
	Stage 3B	Any size but cancer has spread to nearby muscles and skin	Any	No
	Stage 3C	Any size	Yes: Category 3	No
	Stage 4	Any size	Any	Yes

To whom does this recommendation apply?
The USPSTF recognizes that clinical decisions involve more considerations than evidence alone. **Clinicians should understand the evidence but individualize decision-making to the specific patient or situation.**

These recommendations apply **to women who have factors associated with an increased risk of breast cancer**, such as a **family history** of breast cancer (ie, a first-degree relative with breast cancer) or **having dense breasts**.

These recommendations **do not apply** to persons who have a **genetic marker or syndrome** associated with a high risk of breast cancer (eg, BRCA1 or BRCA2 genetic variation), a history of **high-dose radiation** therapy to the chest at a young age, or **previous breast cancer** or a high-risk breast lesion on previous biopsies

How to implement this recommendation?

• Screen women aged 40 to 74 years with a mammogram every 2 years.
• Both digital mammography and digital breast tomosynthesis (or “3D mammography”) are effective mammographic
screening modalities.
• **To achieve the benefit of screening** and mitigate disparities in breast cancer mortality by race and ethnicity, it is important that **all persons with abnormal screening mammography findings receive equitable and appropriate follow-up evaluation and**

additional testing, inclusive of indicated biopsies, and that all persons diagnosed with breast cancer receive effective treatment.
• There is insufficient evidence to recommend for or against screening for breast cancer in women 75 years or older.
• There is insufficient evidence to recommend for or against supplemental screening using breast ultrasonography or MRI in women who have dense breasts.
• **Clinicians should use their clinical judgment** regarding whether to screen for breast cancer in women 75 years or older and regarding whether to use supplemental screening in women who have dense breasts and an otherwise normal mammogram.

Why is this recommendation and topic important?
Breast cancer is the second most common cancer and the second most common cause of cancer death among US women. In 2023, an estimated 43 170 women died of breast cancer.

2- Lung cancer (2021) **annual**
grade B, age: adults, senior

Population	Recommendation	Grade
Adults aged 50 to 80 years who have a 20 pack-year smoking history and currently smoke or have quit within the past 15 years	The USPSTF recommends annual screening for lung cancer with low-dose computed tomography (LDCT) in adults aged 50 to 80 years who have a 20 pack-year smoking history and currently smoke or have quit within the past 15 years. Screening should be discontinued once a person has not smoked for 15 years or develops a health problem that substantially limits life expectancy or the ability or willingness to have curative lung surgery.	B

What is LDCT?
○ New multi-detector CT scanners **generate high-resolution imaging with radiation exposure significantly less than for diagnostic chest CT scanning**. Low-dose CT (LDCT) refers to a **non-contrast study** obtained with a multi-detector CT scanner during a single maximal inspiratory breath-hold with a scanning time under 25 seconds.
○ The overall average effective dose of low-dose CT used in the National Lung Screening Trial was 2 mSv, compared with 7 mSv for a standard-dose diagnostic chest CT examination

What's new?
The USPSTF has revised the recommended ages and pack-years for lung cancer screening. It **expanded the age range to 50 to 80 years** (previously 55 to 80 years) and **reduced** the pack-year history to **20 pack-years** of smoking (previously 30 pack-years).

How to implement this recommendation?
1. **Assess risk based on age and pack-year smoking history**: Is the person aged 50 to 80 years and have they accumulated 20 pack-years or more of smoking?
   a. A pack-year is a way of calculating how much a person has smoked in their lifetime. One pack-year is the equivalent of smoking an average of 20 cigarettes—1 pack—per day for a year.
2. **Screen**: If the person is aged 50 to 80 years and has a 20 pack-year or more smoking history, engage in shared decision-making about screening.
   a. The decision to undertake screening should involve a discussion of its potential benefits, limitations, and harms.
   b. If a person decides to be screened, refer them for lung cancer screening with low-dose CT, ideally to a center with experience and expertise in lung cancer screening.

c. If the person currently smokes, they should receive smoking cessation interventions.

When to stop screening?
Stop screening once a person has **not smoked for 15 years** or **has a health problem that limits life expectancy** or the **ability to have lung surgery**.

Add:
The most important risk factor for lung cancer is **smoking**. Increasing age is also a risk factor for lung cancer. Lung cancer has a generally **poor prognosis**, with an overall 5-year survival rate of 20.5%. However, early-stage lung cancer has a better prognosis and is more amenable to treatment.

3- Colorectal cancer (2021)
Grade: A,B,C age: adults, senior

Population	Recommendation	Grade
Adults aged 50 to 75 years	The USPSTF recommends screening for colorectal cancer in all adults aged 50 to 75 years. See the "Practice Considerations" section and Table 1 for details about screening strategies.	A
Adults aged 45 to 49 years	The USPSTF recommends screening for colorectal cancer in adults aged 45 to 49 years. See the "Practice Considerations" section and Table 1 for details about screening strategies.	B
Adults aged 76 to 85 years	The USPSTF recommends that clinicians selectively offer screening for colorectal cancer in adults aged 76 to 85 years. Evidence indicates that the net benefit of screening all persons in this age group is small. In determining whether this service is appropriate in individual cases, patients and clinicians should consider the patient's overall health, prior screening history, and preferences.	C

Screening strategies:

Table 1. Characteristics of Recommended Colorectal Cancer Screening Strategies

Screening method[a]	Frequency[b]	Evidence of efficacy	Other considerations
Stool-based tests			
High-sensitivity gFOBT	Every year	• Evidence from RCTs that gFOBT reduces colorectal cancer mortality • High-sensitivity versions (eg, Hemoccult SENSA) have superior test performance characteristics than older tests (eg, Hemoccult II), although there is still uncertainty about the precision of test sensitivity estimates. Given this uncertainty, it is unclear whether high-sensitivity gFOBT can detect as many cases of advanced adenomas and colorectal cancer as other stool-based tests	• Harms from screening with gFOBT arise from colonoscopy to follow up abnormal gFOBT results • Requires dietary restrictions and 3 stool samples • Requires good adherence over multiple rounds of testing • Does not require bowel preparation, anesthesia or sedation, or transportation to and from the screening examination (test is performed at home)
FIT	Every year	• Evidence from 1 large cohort study that screening with FIT reduces colorectal cancer mortality • Certain types of FIT have improved accuracy compared to gFOBT and HSgFOBT (20 µg hemoglobin per gram of feces threshold was used in the CISNET modeling)	• Harms from screening with FIT arise from colonoscopy to follow up abnormal FIT results • Can be done with a single stool sample • Requires good adherence over multiple rounds of testing • Does not require bowel preparation, anesthesia or sedation, or transportation to and from the screening examination (test is performed at home)
sDNA-FIT	Every 1 to 3[c] y	• Improved sensitivity compared with FIT per 1-time application of screening test • Specificity is lower than that of FIT, resulting in more false-positive results, more follow-up colonoscopies, and more associated adverse events per sDNA-FIT screening test compared with per FIT test • Modeling suggests that screening every 3 y does not provide a favorable (ie, efficient) balance of benefits and harms compared with other stool-based screening options (ie, annual FIT or sDNA-FIT every 1 or 2 y) • Insufficient evidence about appropriate longitudinal follow-up of abnormal findings after a negative follow-up colonoscopy • No direct evidence evaluating the effect of sDNA-FIT on colorectal cancer mortality	• Harms from screening with sDNA-FIT arise from colonoscopy to follow up abnormal sDNA-FIT results • Can be done with a single stool sample but involves collecting an entire bowel movement • Requires good adherence over multiple rounds of testing • Does not require bowel preparation, anesthesia or sedation, or transportation to and from the screening examination (test is performed at home)
Direct visualization tests			
Colonoscopy	Every 10 y	• Evidence from cohort studies that colonoscopy reduces colorectal cancer mortality • Harms from colonoscopy include bleeding and perforation, which both increase with age	• Screening and follow-up of positive results can be performed during the same examination • Requires less frequent screening • Requires bowel preparation, anesthesia or sedation, and transportation to and from the screening examination
CT colonography	Every 5 y	• Evidence available that CT colonography has reasonable accuracy to detect colorectal cancer and adenomas • No direct evidence evaluating effect of CT colonography on colorectal cancer mortality • Limited evidence about the potential benefits or harms of possible evaluation and treatment of incidental extracolonic findings, which are common. Extracolonic findings detected in 1.3% to 11.4% of examinations; <3% required medical or surgical treatment	• Additional harms from screening with CT colonography arise from colonoscopy to follow up abnormal CT colonography results • Requires bowel preparation • Does not require anesthesia or sedation or transportation to and from the screening examination
Flexible sigmoidoscopy	Every 5 y	• Evidence from RCTs that flexible sigmoidoscopy reduces colorectal cancer mortality • Risk of bleeding and perforation but less than risk with colonoscopy • Modeling suggests that it provides fewer life-years gained alone than when combined with FIT or in comparison to other strategies	• Additional harms may arise from colonoscopy to follow up abnormal flexible sigmoidoscopy results • Test availability has declined in the US but may be available in some communities where colonoscopy is less available
Flexible sigmoidoscopy with FIT	Flexible sigmoidoscopy every 10 y plus FIT every year	• Evidence from RCTs that flexible sigmoidoscopy + FIT reduces colorectal cancer mortality • Modeling suggests combination testing provides benefits similar to those of colonoscopy, with fewer complications • Risk of bleeding and perforation from flexible sigmoidoscopy but less than risk with colonoscopy	• Additional potential harms from colonoscopy to follow up abnormal flexible sigmoidoscopy or FIT results • Flexible sigmoidoscopy availability has declined in the US but may be available in some communities where colonoscopy is less available • Screening with FIT requires good adherence over multiple rounds of testing

Abbreviations: CISNET, Cancer Intervention and Surveillance Modeling Network; CT, computed tomography; FIT, fecal immunochemical test; gFOBT, guaiac fecal occult blood test; RCT, randomized clinical trial; sDNA-FIT, stool DNA test with fecal immunochemical test.

[a] To achieve the benefits of screening, abnormal results from stool-based tests, CT colonography, and flexible sigmoidoscopy should be followed up with colonoscopy.

[b] Applies to persons with negative findings (including hyperplastic polyps) and is not intended for persons in surveillance programs. Evidence of efficacy is not informative of screening frequency, with the exception of gFOBT and flexible sigmoidoscopy alone.

[c] As stated by the manufacturer.

Summary of screening strategies:
Recommended screening strategies include
• High-sensitivity guaiac fecal occult blood test **(HSgFOBT)** or fecal immunochemical test (FIT) **every year**
• **Stool DNA-FIT** every **1 to 3** years
• Computed tomography colonography every **5 years**
• Flexible sigmoidoscopy every **5 years**
• Flexible sigmoidoscopy every **10 years + annual FIT**
• Colonoscopy screening every **10 years**

(customized) The tests require different frequencies of screening, location of screening (home or office), methods of screening (stool-based or direct visualization), preprocedure bowel preparation, anesthesia or sedation during the test, and follow-up procedures for abnormal findings.

To whom does this recommendation apply?
Adults 45 years or older who **do not have signs or symptoms of colorectal cancer** and who are at **average risk** for colorectal cancer (ie, no prior diagnosis of colorectal cancer, adenomatous polyps, or inflammatory bowel disease; no personal diagnosis or family history of known genetic disorders that predispose them to a high lifetime risk of colorectal cancer [such as Lynch syndrome or familial adenomatous polyposis]).

Selectively screen adults aged 76 to 85 years for colorectal cancer.
• **Discuss** together with patients the decision to screen, taking into consideration the patient's **overall health status** (life expectancy, comorbid conditions), prior screening history, and preferences.

Add:
Colorectal cancer is most frequently diagnosed among persons aged 65 to 74 years. It is estimated that 10.5% of new colorectal cancer cases occur in persons younger than 50 years.

4- Cervical cancer (2018)
Grades: A,D age: adolescent, adults, senior

Population	Recommendation	Grade
Women aged 21 to 65 years	The USPSTF recommends screening for cervical cancer every 3 years with cervical cytology alone in women aged 21 to 29 years. For women aged 30 to 65 years, the USPSTF recommends screening every 3 years with cervical cytology alone, every 5 years with high-risk human papillomavirus (hrHPV) testing alone, or every 5 years with hrHPV testing in combination with cytology (cotesting). See the Clinical Considerations section for the relative benefits and harms of alternative screening strategies for women 21 years or older.	A
Women younger than 21 years	The USPSTF recommends against screening for cervical cancer in women younger than 21 years.	D
Women who have had a hysterectomy	The USPSTF recommends against screening for cervical cancer in women who have had a hysterectomy with removal of the cervix and do not have a history of a high-grade precancerous lesion (ie, cervical intraepithelial neoplasia [CIN] grade 2 or 3) or cervical cancer.	D
Women older than 65 years	The USPSTF recommends against screening for cervical cancer in women older than 65 years who have had adequate prior screening and are not otherwise at high risk for cervical cancer. See the Clinical Considerations section for discussion of adequate prior screening and risk factors that support screening after age 65 years.	D

Summary:

- 21-65 years
  - Cytology q3 years
  - Or if 30-65 years → Cytology + HPV testing → q5 years
- If <21 → no screening
- If 65 + adequate prior screening + no high risk → no screening
- Hysterectomy + removal of cervix → no screening

Table. Characteristics of Cervical Cancer Screening Tests

Method	Frequency	Evidence of Efficacy	Other Considerations
Women Aged 21-29 y			
Cytology	Every 3 y	Observational data[23] Modeling study[27]	Screening with cytology is recommended in this age group Screening with hrHPV testing is not recommended because of the transient nature of infection and natural clearance of HPV
Women Aged 30-65 y			
Cytology	Every 3 y	Observational data[23] Modeling study[3,27]	Cytology has lower sensitivity than primary hrHPV testing or cotesting and a lower false-positive rate and rate of additional testing The modeling study suggests that, compared with no screening, screening with cytology every 3 y can reduce the number of cervical cancer deaths from 8.34 to 0.76 deaths per 1000 women[a]
Primary hrHPV testing	Every 5 y	4 RCTs of hrHPV testing vs cytology (screening intervals of 3.5 y,[28,34] 4 y,[29,56-58] and 5 y[30,31]) 2 RCTs[37,54] of cotesting, with 13-14 y of follow-up of HPV-negative component 1 US prospective cohort study[53] of cotesting, with analysis of 5-y risk of death from HPV component Modeling study[3]	Primary hrHPV testing has adequate sensitivity; see the Clinical Considerations section for triage protocols following a positive hrHPV test result The modeling study suggests that, compared with no screening, switching from cytology to primary hrHPV testing every 5 y at age 30 y can reduce the number of cervical cancer deaths from 8.34 to 0.29 deaths per 1000 women[a]
Cotesting	Every 5 y	4 RCTs of cotesting vs cytology (screening intervals of 3 y[28,32,33,36-40,42] and 5 y[41,54,59]) 3 prospective cohort studies (United States,[46-51] Spain,[52] and Germany[60,61]) Modeling study[3]	Cotesting may detect slightly more cases of CIN than screening with hrHPV testing alone but with a significant increase in the number of tests and procedures The modeling study suggests that, compared with no screening, switching from cytology to cotesting every 5 y at age 30 y can reduce the number of cervical cancer deaths from 8.34 to 0.30 deaths per 1000 women[a]

Abbreviations: CIN, cervical intraepithelial neoplasia; HPV, human papillomavirus; hrHPV, high-risk humanpapillomavirus; RCT, randomized clinical trial.

[a] Outcomes calculated from models of cohorts of women aged 20 to 100 years; screening is assumed to end at age 65 years.

Risk Assessment	All women aged 21 to 65 years are at risk for cervical cancer because of potential exposure to high-risk HPV types (hrHPV) through sexual intercourse and should be screened. Certain risk factors further increase risk for cervical cancer, including HIV infection, a compromised immune system, in utero exposure to diethylstilbestrol, and previous treatment of a high-grade precancerous lesion or cervical cancer. Women with these risk factors should receive individualized follow-up.
Screening Tests	Screening with cervical cytology alone, primary testing for hrHPV alone, or both at the same time (cotesting) can detect high-grade precancerous cervical lesions and cervical cancer. Clinicians should focus on ensuring that women receive adequate screening, appropriate evaluation of abnormal results, and indicated treatment, regardless of which screening strategy is used.
Treatments and Interventions	High-grade cervical lesions may be treated with excisional and ablative therapies. Early-stage cervical cancer may be treated with surgery (hysterectomy) or chemotherapy.

- This recommendation statement applies to women who have a cervix, **regardless of sexual history.**
- This recommendation statement does not apply to women who have received a diagnosis of a **high-grade precancerous cervical lesion or cervical cancer**, women with in utero exposure to diethylstilbestrol, or women who are immunocompromised (such as those who are HIV positive).

5- Prostate cancer (2018)

Grade: C,D age: adult, senior

Population	Recommendation	Grade
Men aged 55 to 69 years	For men aged 55 to 69 years, the decision to undergo periodic prostate-specific antigen (PSA)-based screening for prostate cancer should be an individual one. Before deciding whether to be screened, men should have an opportunity to discuss the potential benefits and harms of screening with their clinician and to incorporate their values and preferences in the decision. Screening offers a small potential benefit of reducing the chance of death from prostate cancer in some men. However, many men will experience potential harms of screening, including false-positive results that require additional testing and possible prostate biopsy; overdiagnosis and overtreatment; and treatment complications, such as incontinence and erectile dysfunction. In determining whether this service is appropriate in individual cases, patients and clinicians should consider the balance of benefits and harms on the basis of family history, race/ethnicity, comorbid medical conditions, patient values about the benefits and harms of screening and treatment-specific outcomes, and other health needs. Clinicians should not screen men who do not express a preference for screening.	C
Men 70 years and older	The USPSTF recommends against PSA-based screening for prostate cancer in men 70 years and older.	D

Summary:

Figure 2. Clinical Summary: Screening for Prostate Cancer

Population	Men aged 55 to 69 y	Men 70 y and older
Recommendation	The decision to be screened for prostate cancer should be an individual one. Grade: C	Do not screen for prostate cancer. Grade: D

Informed Decision Making	Before deciding whether to be screened, men aged 55 to 69 years should have an opportunity to discuss the potential benefits and harms of screening with their clinician and to incorporate their values and preferences in the decision. Screening offers a small potential benefit of reducing the chance of death from prostate cancer in some men. However, many men will experience potential harms of screening, including false-positive results that require additional testing and possible prostate biopsy; overdiagnosis and overtreatment; and treatment complications, such as incontinence and erectile dysfunction. Harms are greater for men 70 years and older. In determining whether this service is appropriate in individual cases, patients and clinicians should consider the balance of benefits and harms on the basis of family history, race/ethnicity, comorbid medical conditions, patient values about the benefits and harms of screening and treatment-specific outcomes, and other health needs. Clinicians should not screen men who do not express a preference for screening and should not routinely screen men 70 years and older.
Risk Assessment	Older age, African American race, and family history of prostate cancer are the most important risk factors for prostate cancer.
Screening Tests	Screening for prostate cancer begins with a test that measures the amount of prostate-specific antigen (PSA) protein in the blood. An elevated PSA level may be caused by prostate cancer but can also be caused by other conditions, including an enlarged prostate (benign prostatic hyperplasia) and inflammation of the prostate (prostatitis). Some men without prostate cancer may therefore have false-positive results. Men with a positive PSA test result may undergo a transrectal ultrasound-guided core-needle biopsy of the prostate to diagnose prostate cancer.
Treatments	The 3 most common treatment options for men with screen-detected, localized prostate cancer are surgical removal of the prostate gland (radical prostatectomy), radiation therapy (external-beam radiation therapy, proton beam therapy, or brachytherapy), and active surveillance.

What's new?
In 2012, prostate screening was **grade D** for all, without any classifications.

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