Προσυμπτωματικός έλεγχος: Κριτήρια Wilson–Jungner, σφάλματα και υπερδιάγνωση, προγράμματα για τον καρκίνο

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ΠΑΝΕΠΙΣΤΗΜΙΟ ΠΑΤΡΩΝ

Screening: Wilson–Jungner Criteria, Screening Errors and Overdiagnosis, Cancer Screening Programs

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Screening in Modern Preventive Medicine

Evidence • Benefits • Harms • Overdiagnosis

The Screening Question

Can we detect disease earlier?

Does earlier detection improve outcomes?

Do benefits outweigh harms at population level?

Learning Outcomes

- Distinguish screening from diagnosis
- Apply screening criteria
- Interpret test performance
- Explain bias and overdiagnosis
- Evaluate benefit–harm balance

Opening Case • Earlier Must Be Better?

A new blood test detects cancer years before symptoms

It is highly sensitive

Would you recommend population screening tomorrow?

Screening ≠ Diagnosis

SCREENING: apparently healthy target population

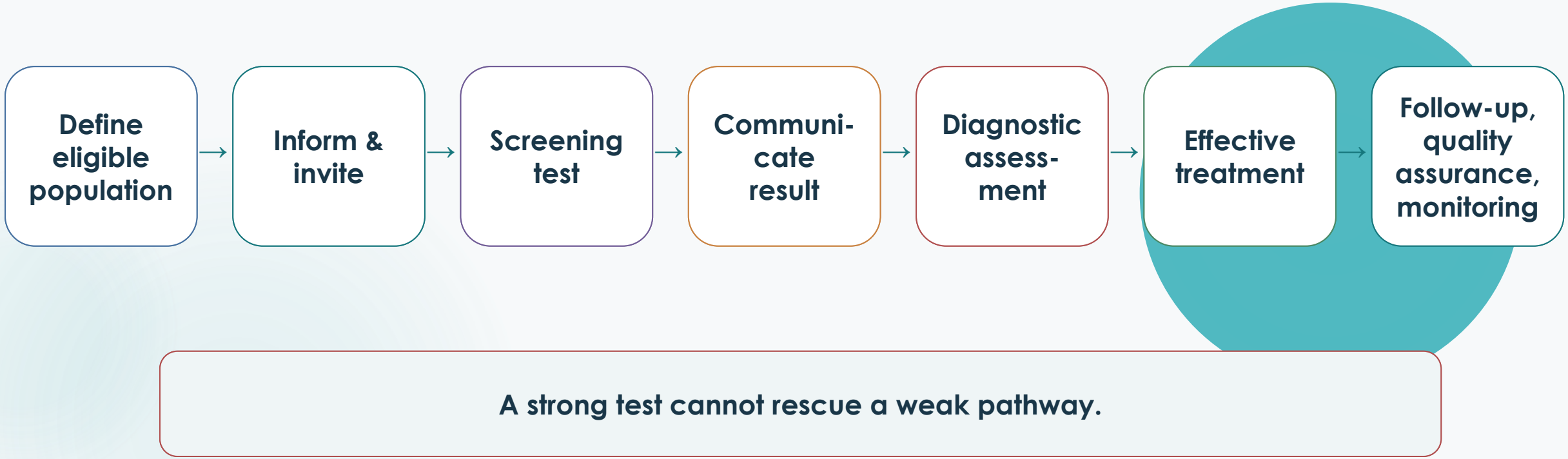
DIAGNOSIS: symptoms/signs or abnormal screening result

Positive screen ≠ diagnosis

Source: WHO Europe 2020

Screening Is a Programme, Not a Test

WHO concept: screening is an end-to-end programme, not an isolated test



A strong test cannot rescue a weak pathway.

Adapted from WHO Europe, Screening programmes: a short guide (2020), section 'Constructing a pathway'.

Source: WHO Europe 2020 / IARC ECAC5

The Screening Pathway

The pathway is the cornerstone of programme design

IDENTIFY → **INVITE** → **SCREEN** → **REFER** → **DIAGNOSE** → **TREAT**

Information system
Call / recall
Tracking

Capacity planning
Personnel
Diagnostics

Quality assurance
Standards
Outcomes

Adapted from WHO Europe 2020: pathway mapping, information systems, capacity planning and quality assurance.

Source: IARC ECAC5 2025

What Makes a Condition Suitable for Screening?

Before launching a programme, six domains must align

CONDITION

Important problem understood natural history

PHASE

Detectable preclinical stage

TEST

Accurate, safe, acceptable

TREATMENT

Earlier treatment improves outcomes

SYSTEM

Diagnostic & treatment capacity

EVIDENCE

Net benefit & affordability

Teaching synthesis based on WHO Europe cancer-screening criteria (2022).

Source: WHO Europe 2022

Wilson–Jungner: The Classic Starting Point

WILSON–JUNGNER FOUNDATION

Condition
Natural history
Suitable test
Acceptable test
Treatment available
Agreed policy
Continuing process

→

MODERN PROGRAMME LAYER

High-quality evidence
Benefit–harm balance
Equity & acceptability
System capacity
Quality assurance
Monitoring & evaluation

Wilson–Jungner principles remain foundational; modern programme appraisal adds explicit evidence, harms, equity and QA.

Source: WHO Europe 2020

From 1968 Principles to Modern Programme Criteria

A screening programme should pass every gate

- Evidence of benefit
- Harms acceptable
- Capacity ready
- Equity & accept-ability
- Quality assurance possible
- Monitoring in place

If one critical gate fails → do not scale population screening yet

Adapted teaching framework from WHO Europe screening-programme guidance (2020/2022).

Source: WHO Europe 2020

Can We Detect It? Should We Screen for It?

WHO stepwise logic: do not expand before core programmes are strong

1	Prioritise cancers with established evidence
2	Organise, assure quality and achieve broad coverage
3	Monitor evidence for other cancers
4	If criteria are met, pilot feasibility & affordability

Adapted from WHO Europe, A short guide to cancer screening (2022), Fig. 7.

Source: WHO Europe 2020

Test Performance: Four Possible Outcomes

Disease + / Test +
TRUE +

Disease - / Test +
FALSE +

Disease + / Test -
FALSE -

Disease - / Test -
TRUE -

Disease Prevention • Lecture 2

Sensitivity and Specificity

Sensitivity: disease → positive?

Specificity: no disease → negative?

Predictive Value Depends on Prevalence

PPV: disease after positive result

NPV: no disease after negative result

Predictive values change with prevalence

False Positives • False Negatives

False positive → anxiety, tests, procedures

False negative → false reassurance, delayed diagnosis

Source: WHO Europe 2024

Why Survival After Diagnosis Can Mislead

Screening moves diagnosis earlier

Survival can look longer even if death is unchanged

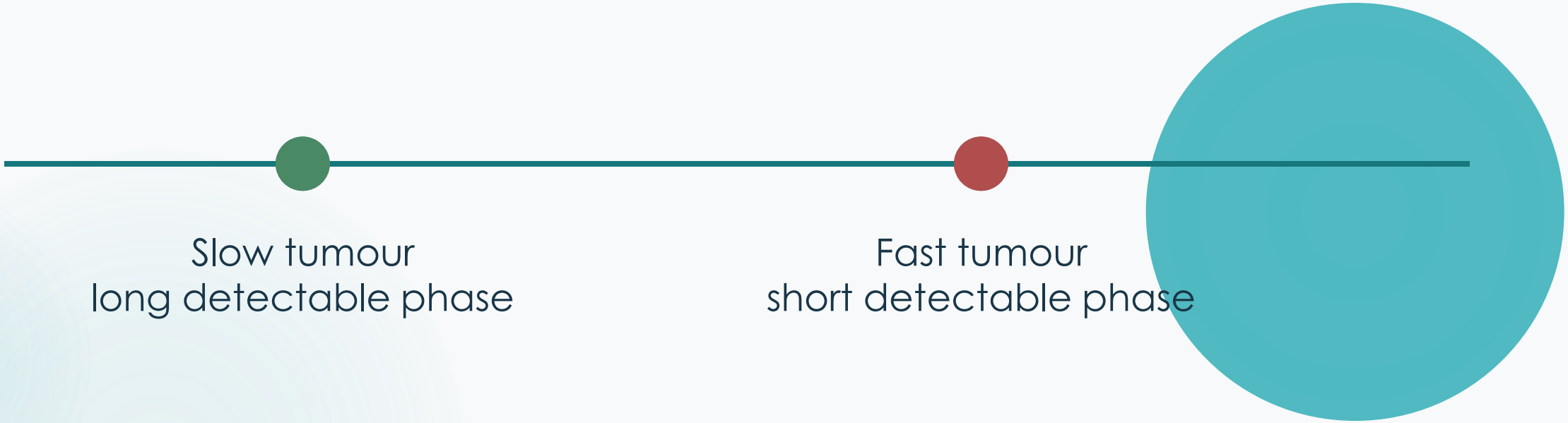
Source: IARC Handbooks

Lead-Time Bias



Source: IARC Handbooks

Length-Time Bias



Source: IARC Handbooks

Selection Effects

Participants may differ from non-participants

Observed outcomes can reflect selection

Source: IARC Handbooks

Why Mortality Matters More Than Survival

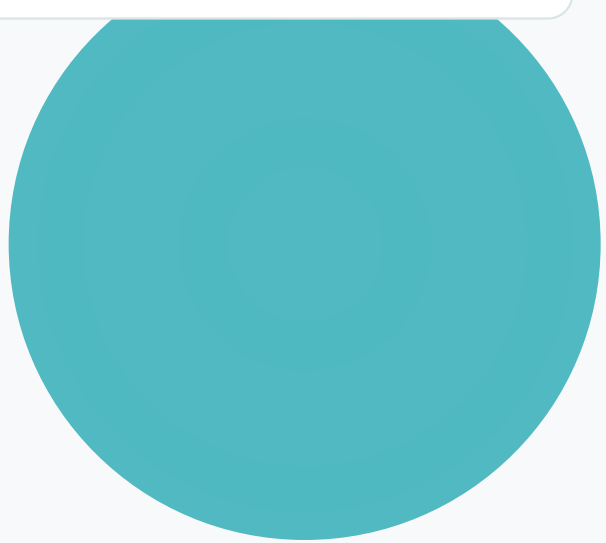
Cancer-specific mortality is less vulnerable to lead-time bias than survival after diagnosis

Programme-level outcomes matter

Source: IARC Handbooks

Overdiagnosis

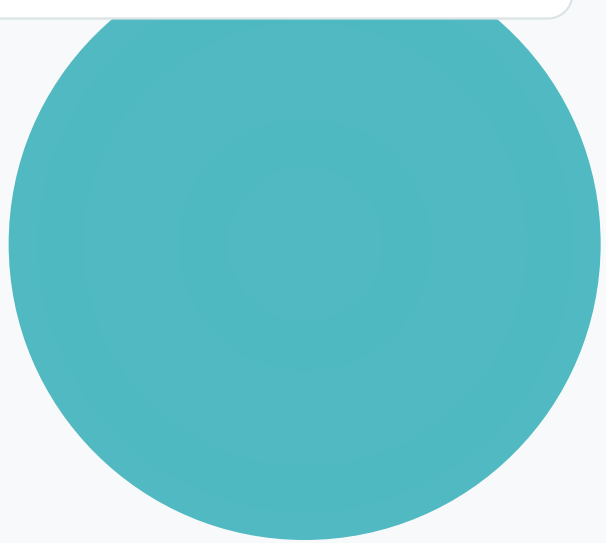
Disease detected by screening that would never have caused symptoms or death during that person's lifetime



Source: IARC / WHO Europe

Overdiagnosis → Overtreatment

Overdiagnosis can trigger treatment or surveillance that cannot benefit that person



Source: WHO Europe 2024

Benefits and Harms Must Be Weighed Together

WHO Europe: benefits of cancer screening must outweigh harms

BENEFITS

Reduced deaths
Reduced incidence
Reduced severity and morbidity
Less invasive treatment

HARMS

Overdiagnosis
Overtreatment
False positives
False negatives
Harmful physical and psychological effects

Faithful teaching adaptation of WHO Europe 2024 Fig. 8; wording follows the institutional figure.

Source: WHO Europe 2024 Fig. 8 (adapted)

Informed Choice and Shared Decision-Making

People need understandable information about benefit and harm

Participation should be informed, not simply maximised

Source: IARC ECAC5 2025

Organised vs Opportunistic Screening

Why organised screening is different

DIMENSION	ORGANISED PROGRAMME	OPPORTUNISTIC / ISOLATED
Eligible population	Evidence-defined	Anyone requesting testing
Offer	Systematic call / recall	Ad hoc
Pathway	Linked to diagnosis & treatment	May be isolated
Protocols	Evidence-based	Case-by-case drift
Quality	Common standards + monitoring	Variable / local

Adapted from WHO Europe 2020, Table 1: Dimensions of screening.

Source: IARC ECAC5 2025

Cancer Screening in the EU: 2022 Framework

EU Council Recommendation 2022/C 473/01

EVIDENCE-BASED

PERSON-CENTRED

SYSTEMATIC POPULATION-BASED

QUALITY ASSURED

EQUITY & SAFETY

The policy message is not "screen more" — it is "screen appropriately, systematically and with quality"

Council Recommendation 2022/C 473/01.

Source: EU Council 2022/C 473/01

Established Programmes and New Directions

European screening landscape: distinguish maturity from policy exploration

ESTABLISHED ORGANISED FOUNDATIONS

Breast
Cervical
Colorectal

2022 EU BROADENED FOCUS

Lung
Prostate
Gastric

→ conditions, risk targeting, feasibility & evaluation differ

Council Recommendation 2022/C 473/01; maturity and implementation conditions differ by cancer type.

Source: EU Council 2022/C 473/01

A Contemporary European Update

ECAC5 (2025–2026): current organised screening recommendations

CANCER	ECAC5 POLICY RECOMMENDATION	TARGET
Bowel	FIT every 2 years	50–74
Breast	Digital mammography every 2 years	50–69*
Cervical	HPV screening ≥5-year intervals	30–65
Lung	LDCT yearly preferred / every 2 years alternative	Increased-risk groups

*ECAC5 also considers implementation for ages 45–49 and 70–74; lung screening should integrate smoking-cessation interventions.

Source: IARC/WHO, European Code Against Cancer 5th ed.; Toes-Zoutendijk et al., Mol Oncol. 2026.

Source: ECAC5 2025–2026

Case Challenge • Would You Recommend Screening?

50-year-old asymptomatic person requests 'every available cancer test'

What criteria must be met?

What harms must be discussed?

Take-Home Messages • Key References

Screening is a programme, not a test

Earlier detection is not automatically beneficial

Bias can exaggerate apparent benefit

Overdiagnosis is a real harm

Evidence + quality + benefit–harm balance determine implementation