Cancer Control and Medical Screening

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Objectives of this presentation

- Overview of preventive medicine and cancer control
- Cancer incidence in Jordan
- Principles of medical screening
- Components of cancer control program
- Steps for successful cancer control program Pilot screening programs
- Differentiation between regular screening and scattered campaings

Preventive Medicine

- Prevention was defined by Last as:

"Actions aimed at eradicating, eliminating, or minimizing the impact of disease or disability, or if none of these is feasible, retarding the progress of disease and disability".

Last J. A Dictionary of Epidemiology. 3rd ed. Oxford: Oxford University Press; 2002

Spectrum of health and disease with the main strategies for prevention at each level

		Stages		Outcomes		
Intervention strategies	**Health**	**Asymptomatic**	**Symptomatic**	**Disability**	**Recovery**	**Death**
		→	→			
Levels of prevention	**Primary**	→	**Secondary and Quaternary**	→	**Tertiary**	

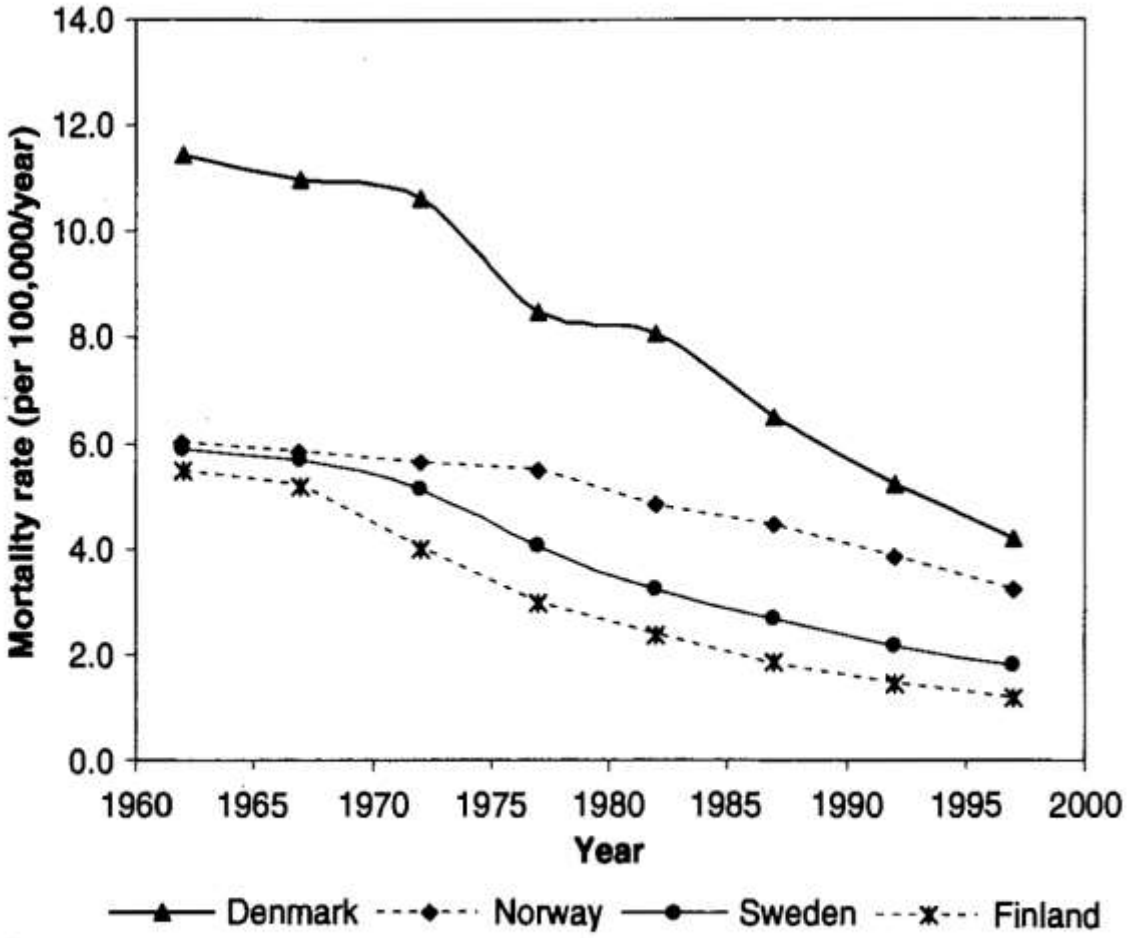


Fig. 14.5 Cervical cancer mortality rates (standardised relative to the world population) from 1950–1998 in the Nordic countries. (Data source: WHO Statistical Information System, accessed via http://www-depdb.iarc.fr/who/menu.htm, March 2004.).

Scope of preventive medicine

- High risk versus low risk
- High risk versus average risk

High risk strategy

- Targeted rescue operation for vulnerable individuals.
- Screening only those with known risk factors
- Advantages:
- The intervention is well matched to individuals “Magic bullet approach”
- Easier to conduct and cheaper

High risk strategy

Disadvantages:

- If the cause or risk factor is widely spread o the disease is common, we need to be careful to limit our programmes to the so-called high-risk groups.
- Screening women will all know risk factors for breast cancer will only detect 30% of breast cancer patients

Mass strategy

- Aims to reduce the health risks of the entire population
- It is the alternative approach in the case of a common disease or widespread causes.
- Examples: Regular systematic screening for women aged 40 to 69.
- Reduction of salt intake at national level

Ten most common cancers among Jordanians both genders, 2017

No	Site	Freq	%
1	Breast	1302	20.5
2	Colorectal	678	10.8
3	Lymphoma	485	7.6
4	Trachea, Bronchus, Lung	480	7.5
5	Thyroid	293	4.6
6	Bladder	248	3.9
7	Prostate	236	3.7
8	Leukemia	233	3.6
9	Stomach	211	3.3
10	Brain, Nervous system	185	2.9

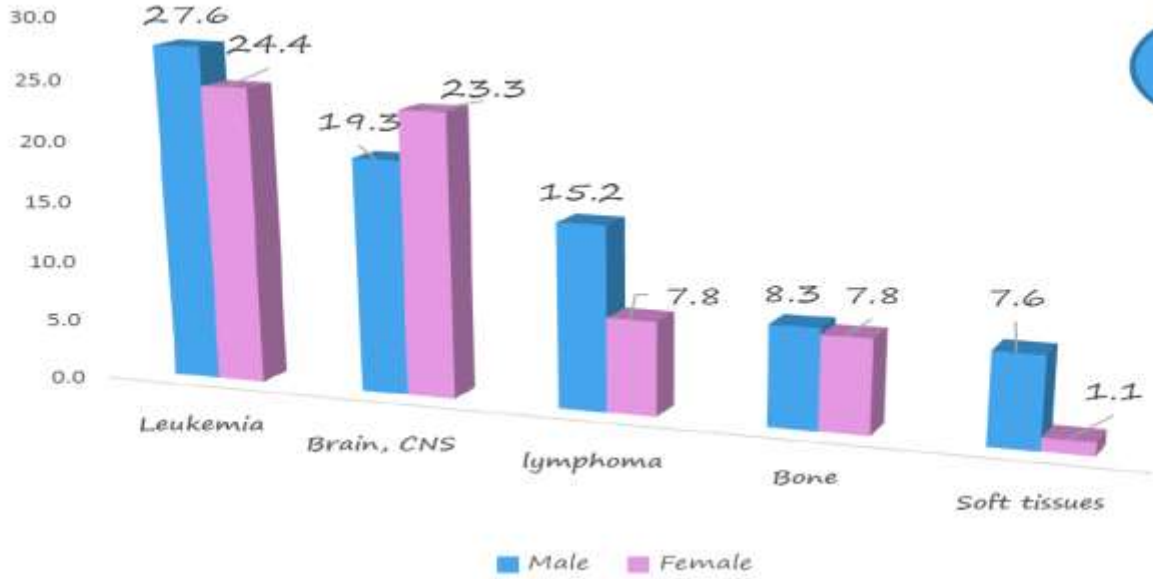
Ten most common cancers among Jordanians, Males, 2017.

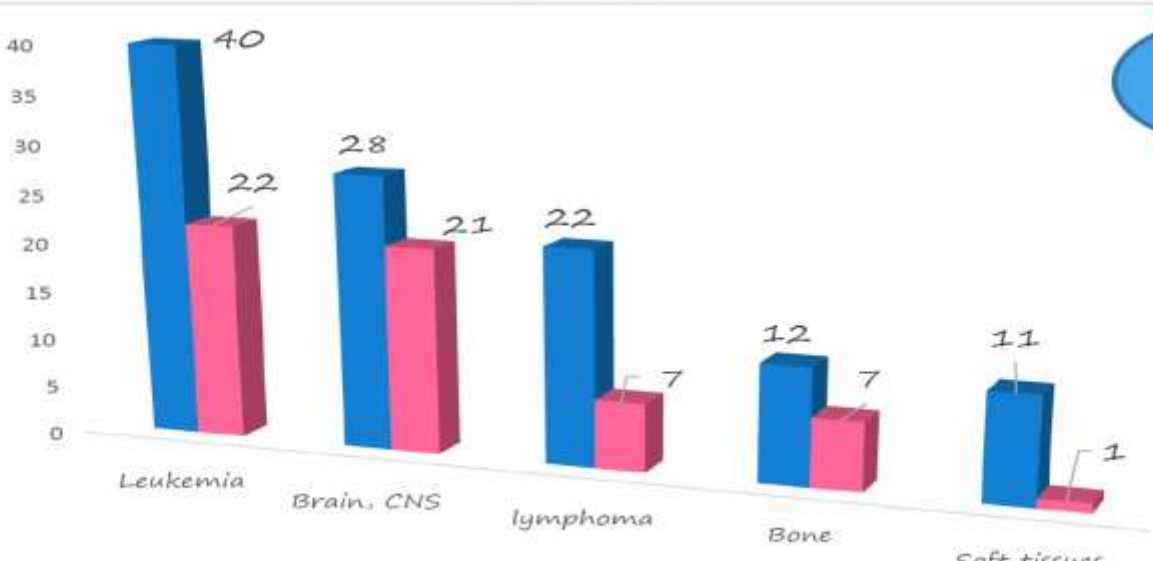
No	Site	Freq	%
1	Colorectal	371	12.4
2	Trachea, Bronchus, Lung	366	12.2
3	Prostate	236	7.9
4	Bladder	215	7.2
5	Non-Hodgkin lymphoma	159	5.3
6	Leukemia	158	5.3
7	Stomach	127	4.2
8	Kidney	117	3.9
9	Brain, Nervous system	102	3.4
10	Hodgkin disease	97	3.2

Ten most common cancers among Jordanian Females, 2017.

No	Site	Freq	%
1	Breast	1292	38.4
2	Colorectal	307	9.1
3	Thyroid	223	6.6
4	Corpus Uteri	148	4.4
5	Non-Hodgkin lymphoma	136	4.0
6	Ovary	109	3.2
7	Trachea, Bronchus, Lung	107	3.2
8	Hodgkin disease	93	2.8
9	Brain, Nervous system	84	2.5
10	Stomach	83	2.5

Top Five Pediatric Cancers percentages & Cases by gender, Jordan, 2017.





What is screening

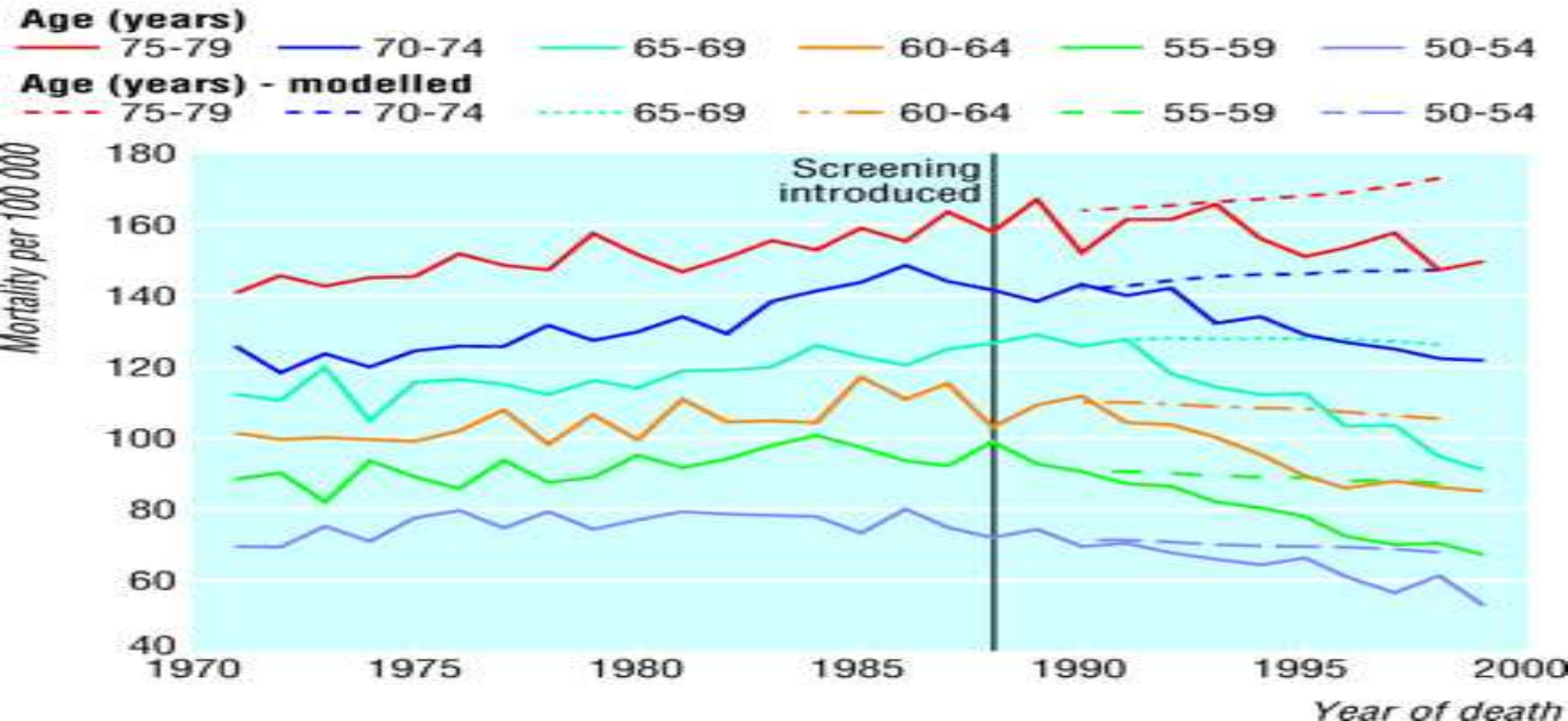
"The regular and systematic application of a test or enquiry, to identify individuals at sufficient risk of specific disorder to benefit from further investigation or direct preventive action, among persons who have not sought medical attention on account of symptoms of that disorder." Wald,2004

Aims of screening

- Better prognosis/outcomes for individuals
- Protection of public from communicable diseases
- Rational allocation of resources
- Research (understanding natural history of disease)

Example of successful medical screening

- Mortality from breast cancer by year of death for selected age groups, England and Wales, 1971-99



Opportunistic early detection (case finding):

- Do screening for someone when he/she comes into contact with the health system for another reason
- Check the lipid profile for your overweight or obese patients when they come to your clinic
- Refer women within age criteria for cervical or breast cancer screening

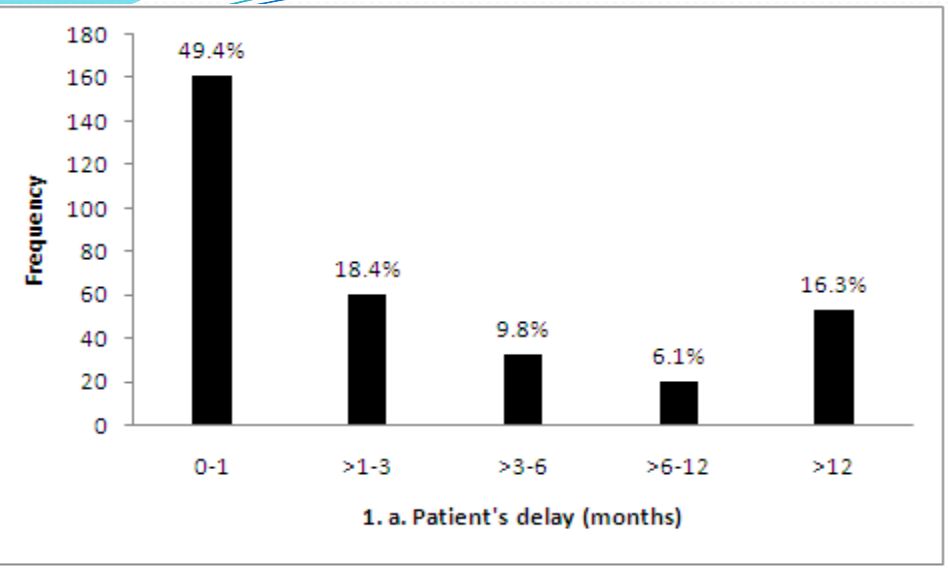
Screening versus diagnosis

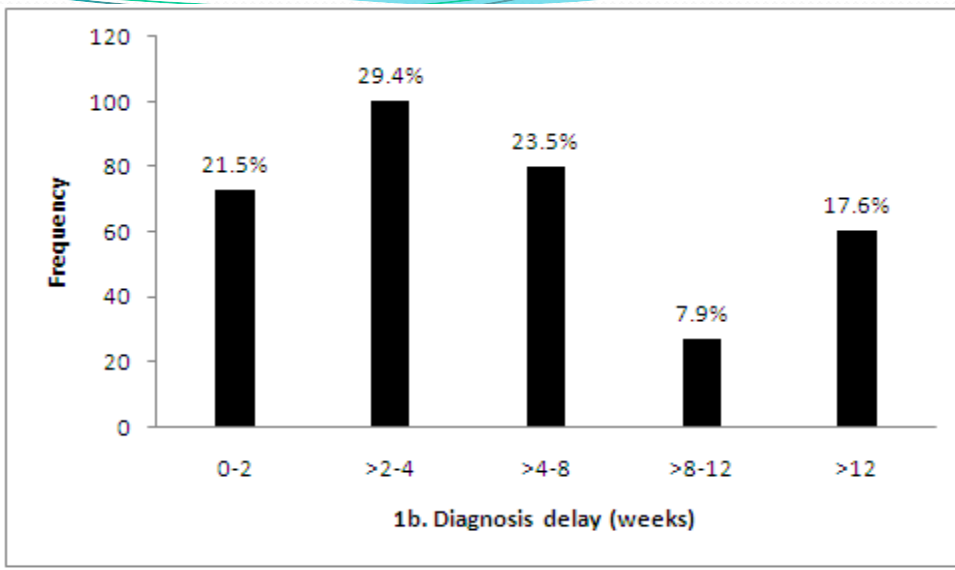
- Early detection: symptoms and signs
- Red flag system
- It is essential to work in both directions in parallel way:
- Start your screening programs

&

- Invest in early detection at GPs and general population levels.

Delay in presentation, diagnosis and treatment for Breast cancer patients in Jordan





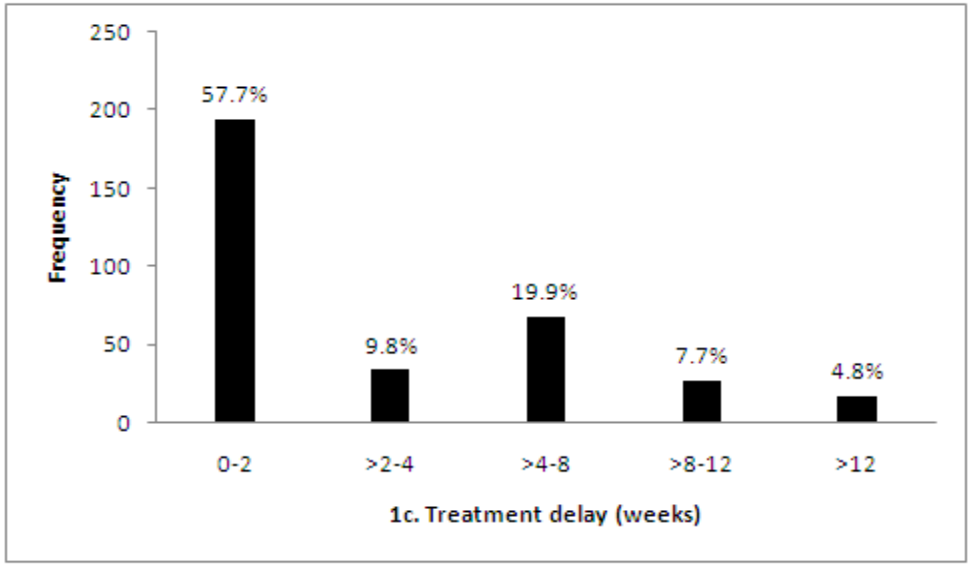
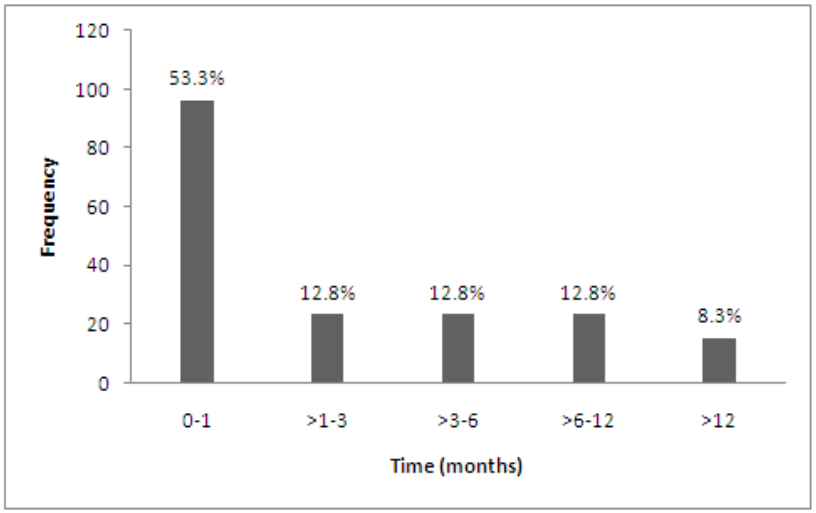


Figure 1: Proportion of participants by patient's delay, diagnosis delay, and treatment delay

Delay in presentation, diagnosis and treatment for colorecrtal cancer patients in Jordan

Fig1. Proportion of participants by patient's delay, diagnosis delay and treatment delay



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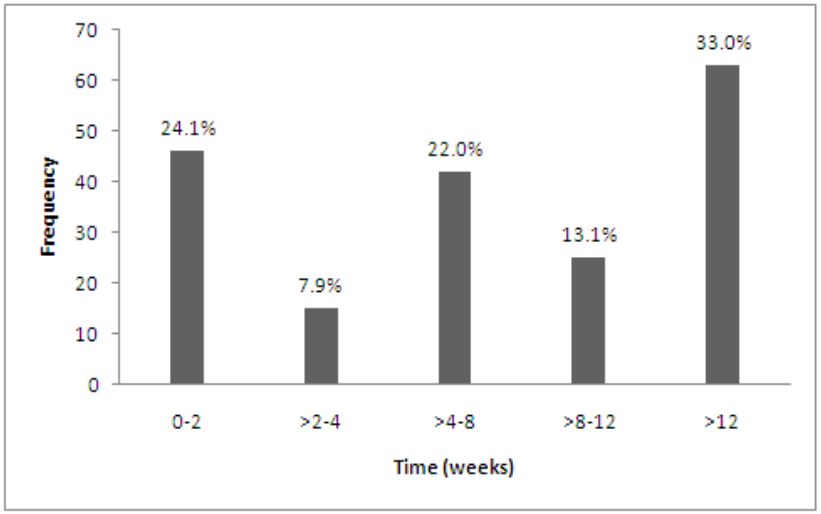

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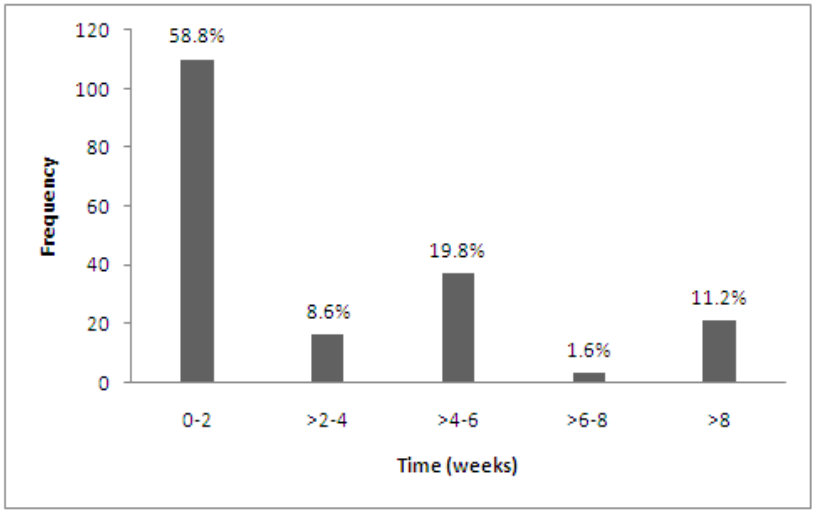

(c)

Criteria for screening

1. The disease/condition is an important health problem:

- Well-defined disorder
- Known epidemiology
- Well-understood natural history
- Prevalence of undiagnosed cases

2. Presence of presymptomatic or early stage

- Is there an evidence from a randomised controlled trial that an earlier intervention would work?
- Detecting the disorder at this stage should help in getting better outcomes when compared with the situation without screening.
- Screening for a disease or a risk factor

What do you aim to achieve from your screening programme?

- Mortality
- Morbidity
- Quality of life and psychological wellbeing

Screening test:

- Safe
- Inexpensive
- Acceptable
- Reliable
- Valid
- No or minimal adverse effects: pain or any possible adverse effects should be considered in addition to convenience and duration of the test.

Screening test validity

- **The validity of a screening test can be evaluated through its detection rate (sensitivity) and specificity.**

  A. Detection rate (sensitivity) evaluates the ability of a screening tool to detect the disorder or problem. It represents the proportion of diseased individuals who have a positive screening test.

  B. Specificity is the ability of a screening tool to label people without the targeted condition as "unaffected" (for diseases, healthy people as non-diseased).

False positive rate (1-specificity)

- More meaningful and practical than specificity because it shows the expected rate of those who would be falsely labelled as diseased or screen positive and might offered further investigations.
- It helps in estimation the magnitude of the economic and other harmful effect such as psychological distress associated such outcomes.

Screening test validity: Outcomes of screening tests

	Disease present	Disease absent	All
Positive screening test	***a*** **(true positive)**	***b*** **(false positive)**	***a + b***
Negative screening test	***c*** **(false negative)**	***d*** **(true negative)**	***c + d***
All	***a + c***	***b + d***	***a + b + c + d***

Detection rate	proportion of affected individuals with positive test results	$\frac{a}{a+c}$
Specificity	Proportion of unaffected individuals with negative test result	$\frac{d}{b+d}$
False positive rate	proportion of unaffected individuals with positive test results	$\frac{b}{b+d}$ =(1-specificity)
Positive predictive value	Probability of the disease being present given a positive test	$\frac{a}{a+b}$
Negative predictive value	probability of no disease being present given a negative test result	$\frac{d}{c+d}$

How to calculate false negative rates?

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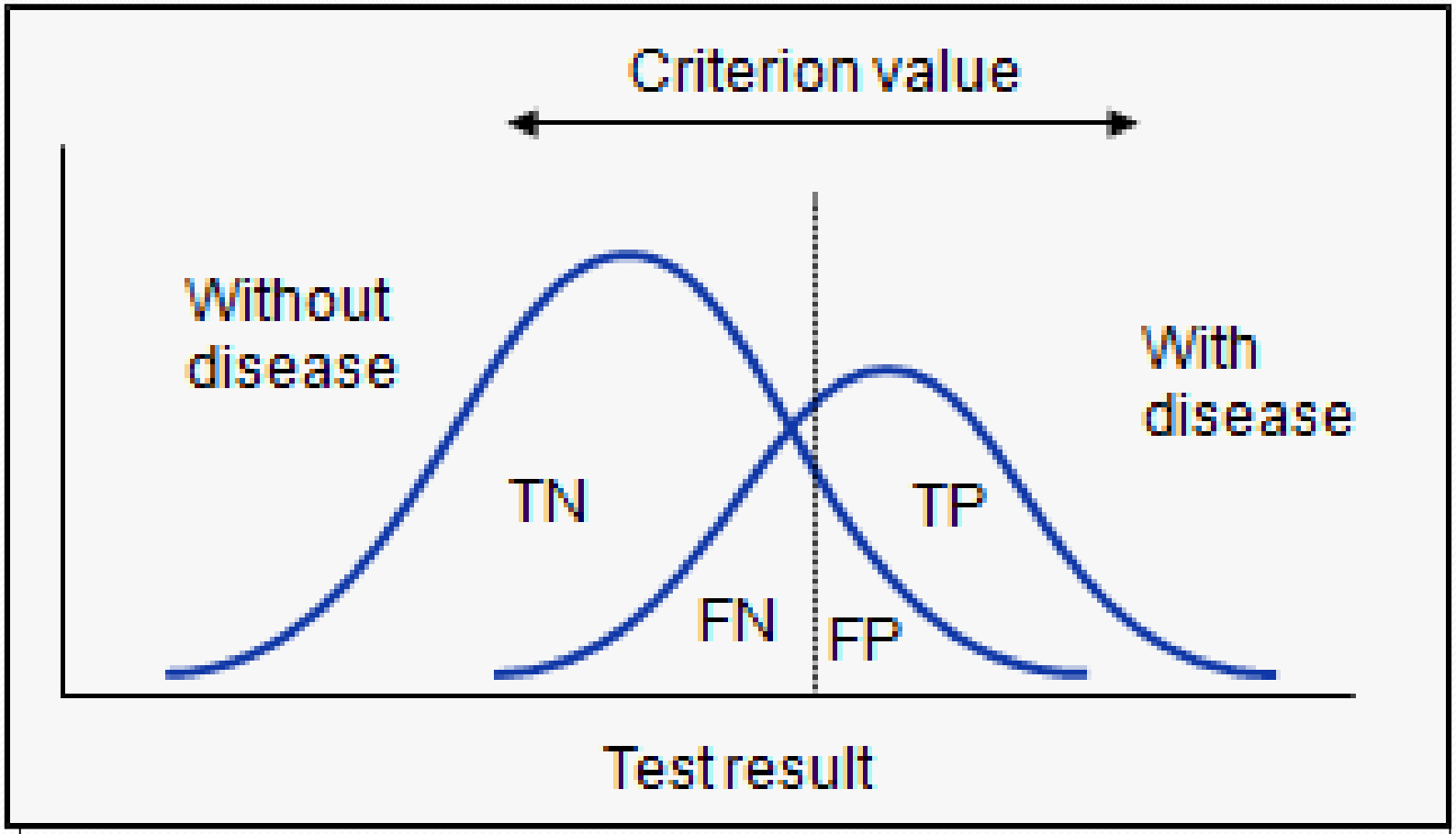
Outcomes of screening program



TP: true positives TN: true negatives
FP: False positives FN: False negatives

	G-FOBT	FIT
Sensitivity	50.00% (6.76–93.24)	75.00% (19.41–99.37)
Specificity	77.87% (72.24–82.83)	90.12% (85.76–93.50)
Positive likelihood ratio	2.26 (0.83–6.18)	7.59 (3.86–14.94)
Negative likelihood ratio	0.64 (0.24–1.71)	0.28 (0.05–1.52)
Positive predictive value	3.45% (0.42–11.91)	10.71% (2.27–28.23)
Negative predictive value	98.99% (96.42–99.88)	99.56% (97.59–99.99)

Table 2 Comparison of sensitivity and specificity between Cologuard and fecal immunochemical test

	Pathological categories	Cologuard	FIT
Sensitivity[32]	CRC	92.3%	73.8%
	Advanced precancerous lesions	42.4%	23.8%
	Polyps with high-grade dysplasia	69.2%	46.2%
	Serrated sessile polyps	42.4%	5.1%
Specificity[32]	Nonadvanced or negative findings	86.6%	94.9%
	Negative results on colonoscopy	89.8%	96.4%

- Cologuard uses advanced stool DNA technology to detect the DNA and blood cells released from altered cells, and can detect both precancer and cancer, if present
- Unlike other noninvasive colorectal cancer screening tests, Cologuard can detect both precancer and cancer

The high detection of precancerous lesions, HGD and serrated sessile polyps is extremely useful for a screening test, as these lesions may develop into CRC if they are not resected.

The only obstacle for broad application of Cologuard is the cost, as the detection of multitargets increased the cost of the test.

Its current expense of $599 per test is high for a routine screening assay.

Le-Le Song, Yue-Min Li. Current noninvasive tests for colorectal cancer screening: An overview of colorectal cancer screening tests. World

Reliability of screening test

- Reliability means that the same results should be obtained by different observer or the same observer at different occasions.
- In practice, it is hard to achieve 100% reliability
- Guidelines should be in place on decisions when two observers have different opinions.

Agreed plan on further investigation, diagnosis and treatment:

- Any interventional measures or early detection should be more worthwhile than both late diagnosis and/or intervention.
- This should be based on scientific-based evidence.
- Randomised controlled clinical trials could be needed to evaluate the impact of treatment on those detected from screening programmes as they could be different from those seeking medical attention for their conditions.

Agreed plan on further investigation, diagnosis and treatment:

- Diagnostic tools, screening intervals and treatment
- Facilities required for such steps should also be available or easily installed and equally accessed by the screened population

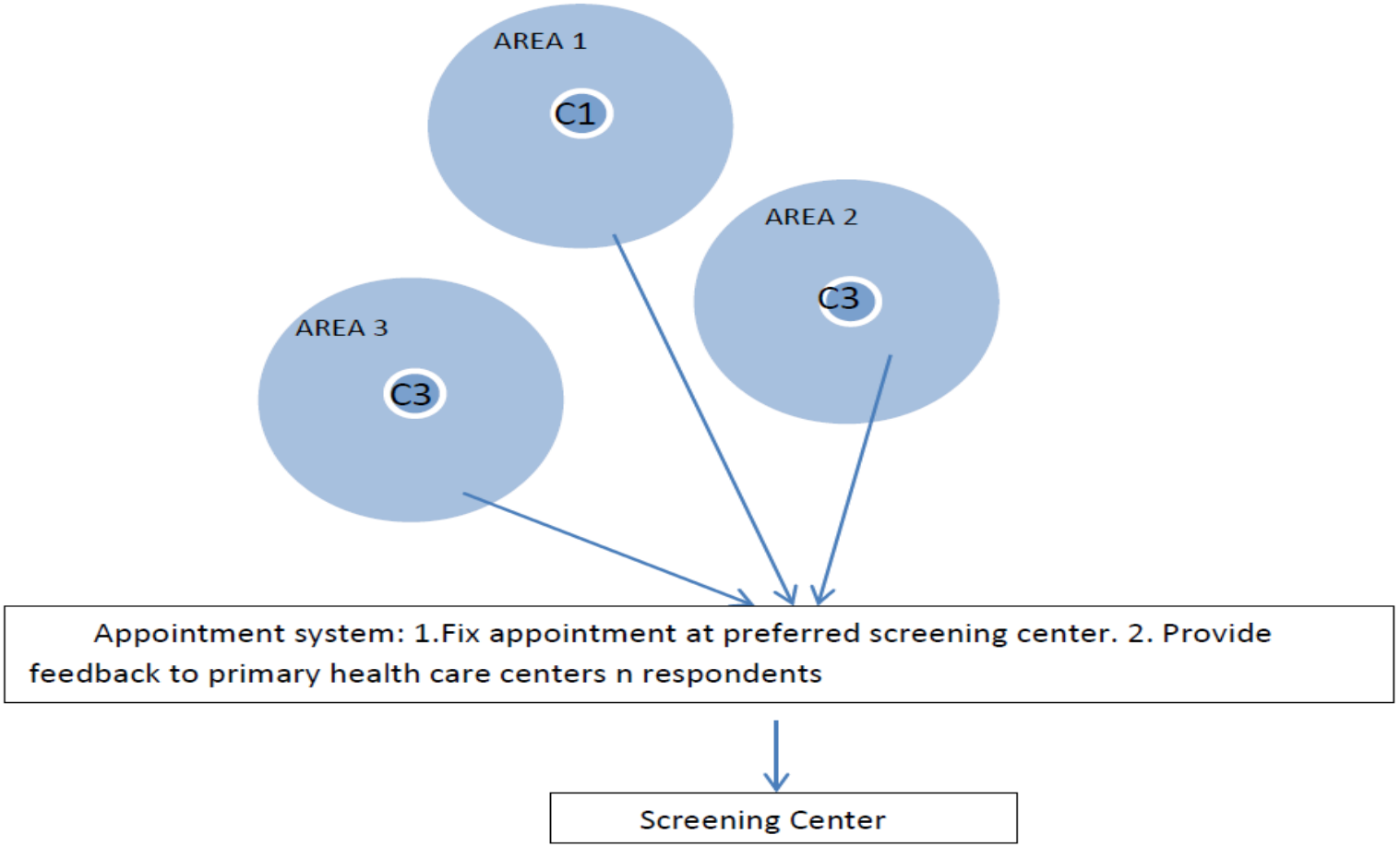
Systematic application

- This means that the test is offered routinely to the target group based on agreed criteria.

Do it in a systematic way!

- **Regular systematic national screening programs** for breast and colorectal cancers **should replace the current scattered campaigns and activities in many countries in the region.**

- Work should start with pilot systematic screening projects in representative area in the country of interest.



Obtain data from Ministry of Interior on residents in Areas 1,2,3 who fulfills screening criteria

Send letters through Health Centers C1,C2,C3

Send reminders through Health Centers C1,C2,C3 for non-respondents

Ask practice manager or health counselor to call non-respondents from the two calls and arrange for GP visit if needed.

Obtain data from the screening centers for respondents to screening calls.

Simplify your program

Is it too difficult to have a national systematic regular screening program for breast cancer in country "x" where the number of women aged 40-70 is 4,000,000?

In this country: it is recommended to screen women aged 40-69 once every two years

Notice: Screening interval depends on mean sojourn time and should not be fixed to be on annual basis unless there is clinical evidence for that

Cut it down so it will be simple

Practical example: In country X, there are 4000000 women aged 40-70 who are eligible for screening

4000000 Women aged 40-70

To be screened annually 2 Millions

75% response rate: 1500000

300 working days/ 6 days work 5000

if there are 8 main districts in your country

5000/8 625

If we have only 1 screening center per 1 Million population, then you need 41 centers in Algeria

41 centers for 625 women 15.2439024

15 women to be seen daily in each center

If we have 2 Mammograms in each center

8 patients per machine per day

What does systematic screening mean??

- **Posters, leaflets and media advertisements about the screening program are not systematic screening approaches. They are health promotion programs that could help in increasing the response rate.**

- **Every eligible person for the screening should receive personal invitation to take part in the program and should have equal opportunity to be screened**

- For example: Every woman within the target age range and meets other screening criteria should receive invitation letter and a reminder, if needed, to invite her to attend the screening.

Importance of Pilot Projects

1. Health economics evaluation
2. Setting age cut-off based on local data
3. Improve performance at national level by learning from experience at pilot phase
4. Comprehensive assessment of the screening program helpline, waiting time, film quality, guidelines such as double readers, false positive rate, false negative rate, diagnosis process, psychological counseling, treatment, prognosis, economic evaluation, how can we make it better at the national level.
5. Assessment of barriers to screening
6. Quality assessment of staff

Danger of mobile units such as mobile mammograms

- Western countries only used mobile unit after they had well-established regular systematic screening programs.
- They identified low uptake areas who failed to respond to other interventions.
- Single mobile unit costs more than 10 digital mammograms.
- They act in way against regular systematic screening
- AVOID MOBILE MAMMOGRAMS UNTIL YOU HAVE YOUR PROGRAM RUNNING AT A NATIONAL LEVEL AT LEAST FOR 2 YEARS
- Taking the easy pathway will prevent long term success

Acceptability of programme to the public and health care staff.

- Screening test, diagnostic test and therapeutic options should be ethically and socially accepted by the general public and the health care professionals.

Economic evaluation:

- Implementing screening programmes should be more economically effective than the existing system.
- Cost of all steps related to the screening programme should be assessed and compared with outcomes of the screening and with other services.

Volunteer bias:

- They tend to be of higher socioeconomic class
- More health-conscious
- Comply better with prescribed advice
- Therefore, better results for a screening programme of volunteers compared with disease outcomes for non-voluntees may be relate to factors associated with the “volunteerism” rather than benefits of treatment following diagnosis.

- Therefore it is essential to analyse data on participants and ensure that all target group have the same access and received the same message

Challenges

- Validity of the screening test
- Healthy people need further tests
- Anxiety caused
- Health care resources

Pilot basis

- What is my next step?

Quality Assurance

- Quality assurance means that the assessment of the service provided and applying modifications when necessary.
- This includes various steps such as recruitment, registration, waiting time, test procedures, results handling and follow up or referral for treatment procedures.
- Clinical audit

My programme is already in place

- Continuous monitoring and regular evaluation

Economic evaluation of the breast cancer screening programme in the Basque Country: retrospective cost-effectiveness and budget impact analysis

Arantzazu Arrospide[1,2,3*], Montserrat Rue[3,4], Nicolien T. van Ravesteyn[5], Merce Comas[3,6], Myriam Soto-Gordoa[1], Garbiñe Sarriugarte[7] and Javier Mar[1,2,3,8]

Arrospide *et al. BMC Cancer* (2016) 16:344

Global Center for Public Health and Disease Control, Global Academy for Health Sciences, OH USA

Methods: A discrete event simulation model was built to reproduce the natural history of breast cancer (BC). estimated for lifetime follow-up the total cost of BC (screening, diagnosis and treatment), as well as quality-ad ife years (QALY), for women invited to participate in the evaluated programme during the 15-year period in t actual screening scenario and in a hypothetical unscreened scenario. An incremental cost-effectiveness ratio v calculated with the use of aggregated costs. Besides, annual costs were considered for budget impact analysis population level and single-cohort analysis were performed. A probabilistic sensitivity analysis was applied to the impact of parameters uncertainty.

Results: The actual screening programme involved a cost of 1,127 million euros and provided 6.7 million QAL over the lifetime of the target population, resulting in a gain of 8,666 QALYs for an additional cost of 36.4 mil euros, compared with the unscreened scenario. Thus, the incremental cost-effectiveness ratio was 4,214€/QAL All the model runs in the probabilistic sensitivity analysis resulted in an incremental cost-effectiveness ratio lo than 10,000€/QALY. The screening programme involved an increase of the annual budget of the Basque Heal Service by 5.2 million euros from year 2000 onwards.

Conclusions: The BC screening programme in the Basque Country proved to be cost-effective during th evaluated period and determined an affordable budget impact. These results confirm the epidemiologica benefits related to the centralised screening system and support the continuation of the programme.

Keywords: Breast cancer, Screening, Cost-effectiveness, Budget impact analysis, Simulation, Modelling, Evaluation, Public health

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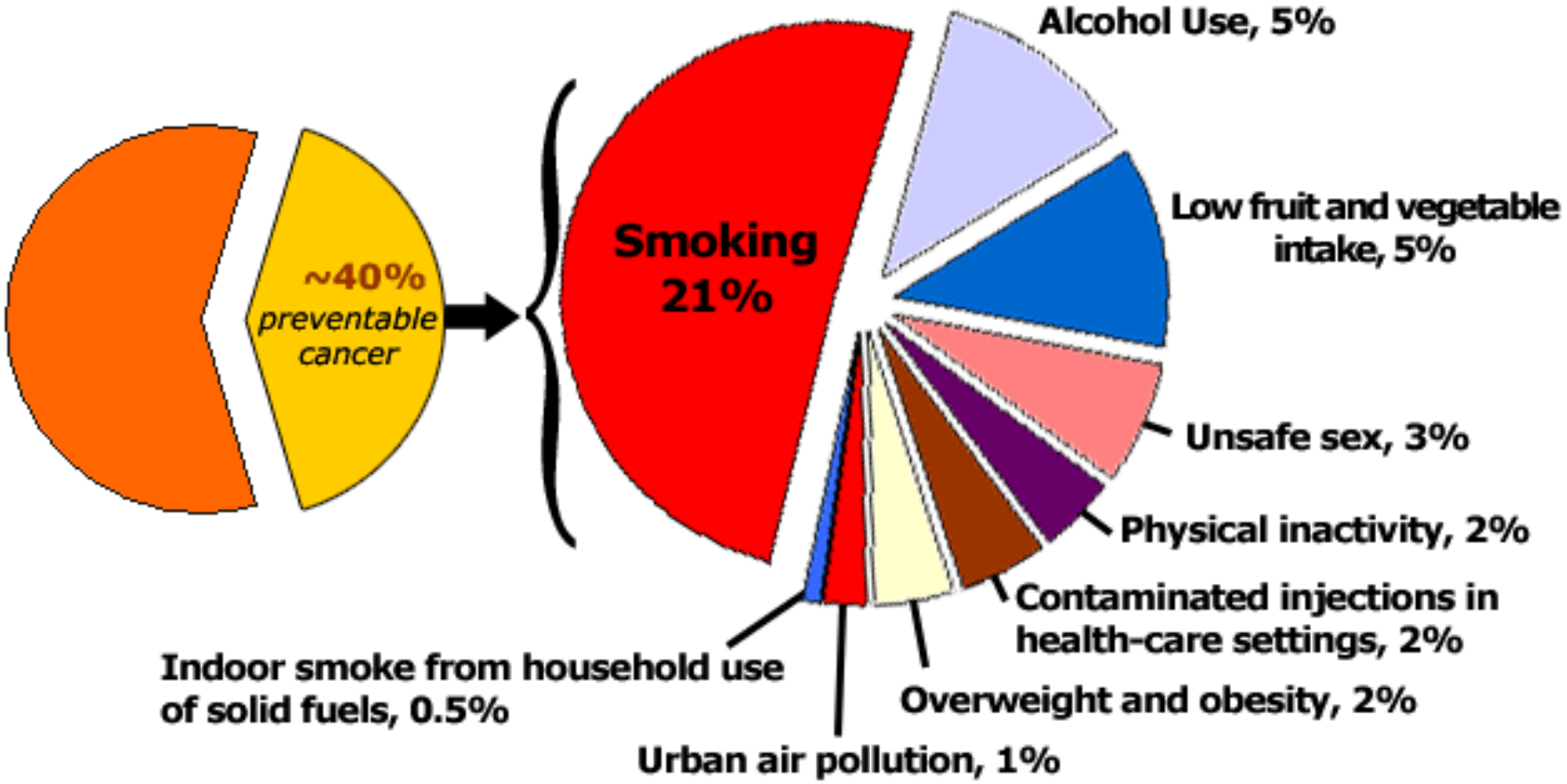
Cancer Control Program

- An evidence based program aims to reduce cancer burden through:

1. Reducing cancer incidence
2. Minimizing cancer morbidity and mortality
3. Prevention of cancer recurrence and complications
4. Improvement of quality of life

Estimated proportion of preventable cancer associated with 9 leading modifiable risk factors



Danaei G, Vander Hoorn S, Lopez AD, Murray CJ, Ezzati M. Causes of cancer in the world: comparative risk assessment of nine behavioural and environmental risk factors *The Lancet*, 2005, 366:1784-1793

Factors Influencing Survival from Cancer

Treatment:

- Availability
- Access
- Quality

Disease:

- Natural history
- Clinical extent
- Definitions

Early Detection:

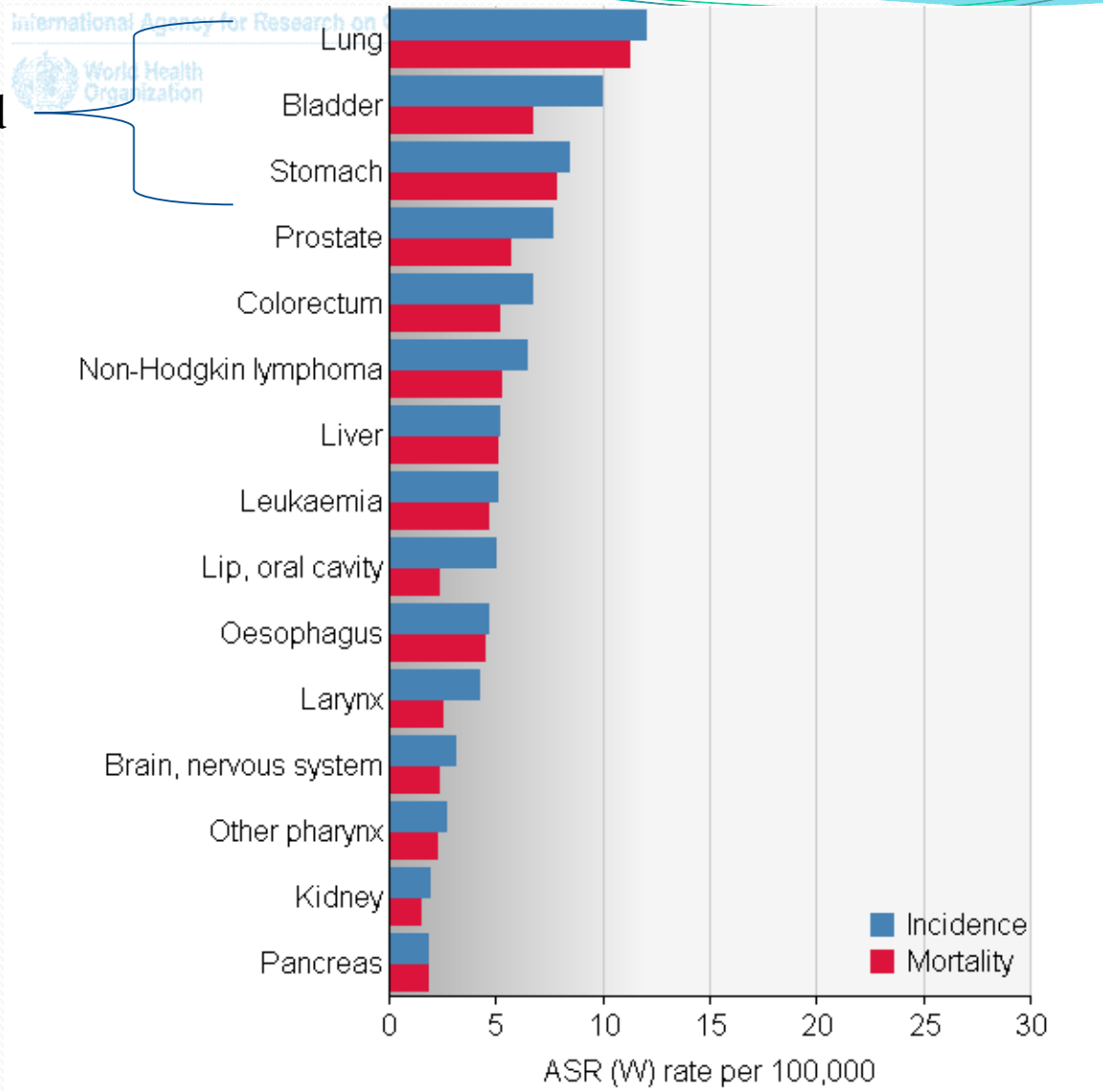
- Early clinical detection
- Screening

Host:

- Age
- Sex
- SES
- Comorbidity
- Behaviour

Estimated age-standardised incidence and mortality rates: men- Eastern Mediterranean region

Can be prevented



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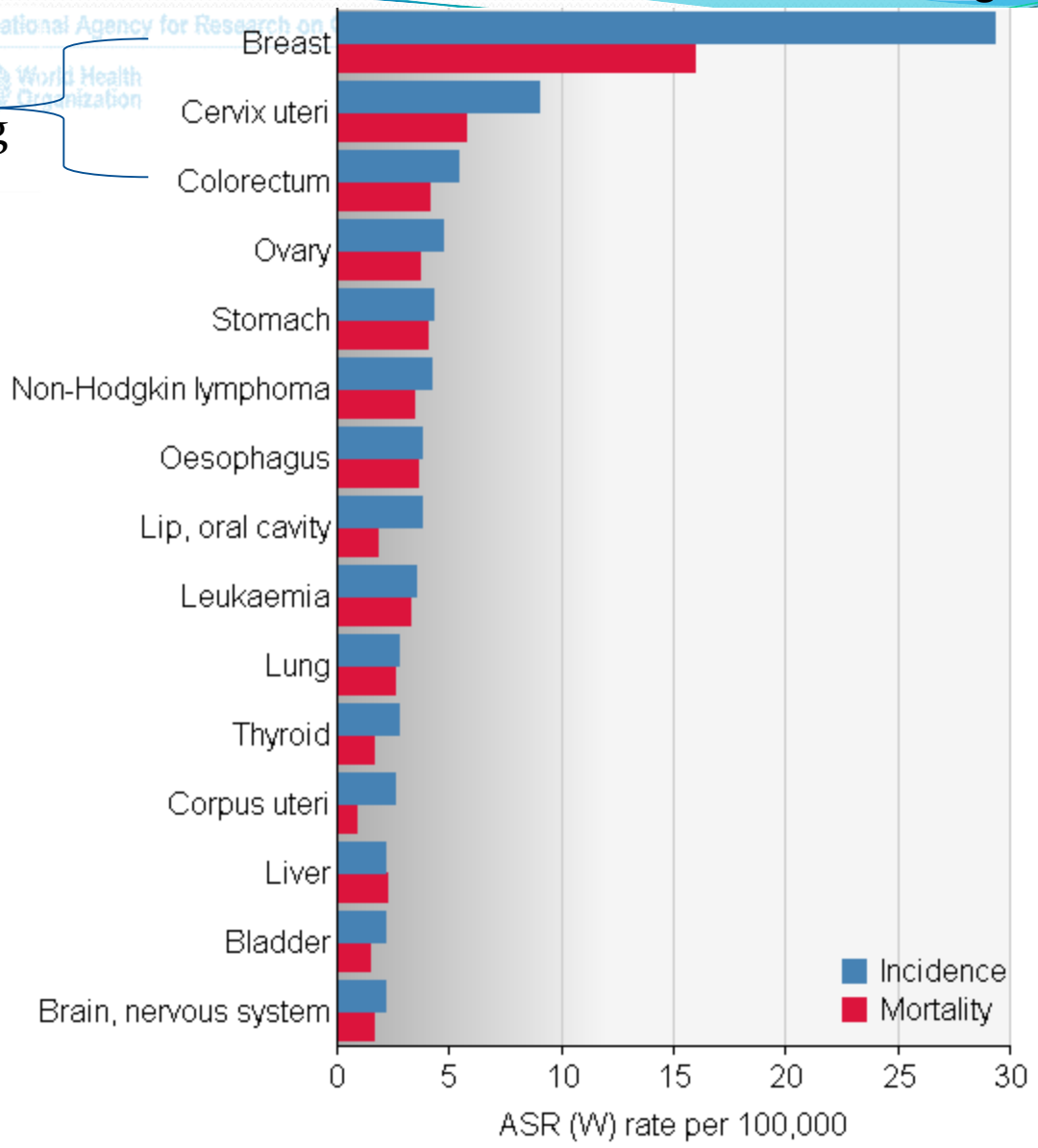
http://globocan.iarc.fr/factsheet.asp#MEN

Estimated age-standardised incidence and mortality rates: women. Eastern Mediterranean region

We can detect them through national systematic screening programmes



http://globocan.iarc.fr/factsheet.asp#MEN

Smoking cessation programs

- Include other types of smoking such as Narjeela in calculation of tobacco smoking rates

- Evaluate current and past programs
- Focus on:

1. Prevention of smoking amongst teenagers
2. Increase taxes on tobacco products and use the money for prevention programs
3. Providing free smoking cessation services : medical and behavioural interventions
4. Free helplines for smokers
5. Your team should be well-trained
6. Compare respondents with non-respondents, Success Vs failed

- Can we introduce smoking cessation medical and behavioural management into our medical education and residency training?

A smoking aware practice

GP time

Increase in quit rate

>5 mins

Intense intervention

5-7 fold

2-5 mins

Moderate intervention

4 fold

<1 mins

Brief intervention

3 fold

A 'no-smoking practice'

2 fold

Try to have incentives system

- In the UK, the incentives system has promoted GPs to have a major contribution in increasing the uptake of cervical screening system.
- In the UK, each GP surgery would send a reminder letter for non-respondents and would provide counseling, if needed.

- Therefore, have a national or regional targets and provide incentives for those who meet them.

Test it before you generalize it

- Start with pilot program
- Assess response rate
- Compare respondents with non-respondents
- Assess success rates
- Look for determinants of success and failure
- Is there a specific group who needs different intervention?