Determining Cost-effectiveness of Screening

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Screening Definition

- Screening is the presumptive identification of unrecognized disease or defect by means of tests, examinations, or other procedures that can be applied rapidly

The AIM of screening is to provide a pre-invasive diagnosis of the disease

The **OBJECTIVE** of screening is to reduce risk of death from the disease

Cost-Effectiveness of Screening

- VALUE $= \dfrac{\text{Effectiveness}}{\text{Cost}}$

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To Screen or Not to Screen

Balancing the effect on;

- **Length of Life - screening experts**

(relatively well known, easy to establish)

- **Quality of life - women**

(poorly known, difficult to measure)

- **Cost - administrative officials**

(relatively poorly known, relatively easy to measure)

Prerequisites of a successful screening programme

A CANCER is suitable for screening if:

- a cancer is a major health problem justifying screening

- natural history of disease - long enough detectable pre clinical phase

- significant proportion of preclinical lesions progress to clinical disease

- available acceptable treatment

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Prerequisites (Cont'd)

SCREENING TEST:

- is valid for identifying preclinical lesions
- acceptable (easy to apply, no pain, no side-effects)
- Screening interval
- affordable

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Prerequisites (Cont'd)

SCREENING PROGRAMME:

- opportunistic vs organized

Characteristics of an Organized Screening Program

- Identification of target Population

- Measures for high <u>coverage</u> and attendance

- Clear screening protocol: health objectives

- Adequate field facilities

- Adequate facilities for diagnosis, Rx and FU

- Information system (cancer registry)

- Evaluation and monitoring (Process and Outcome quality indicators)

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Priorities and strategies for the eight most common cancers worldwide[1]

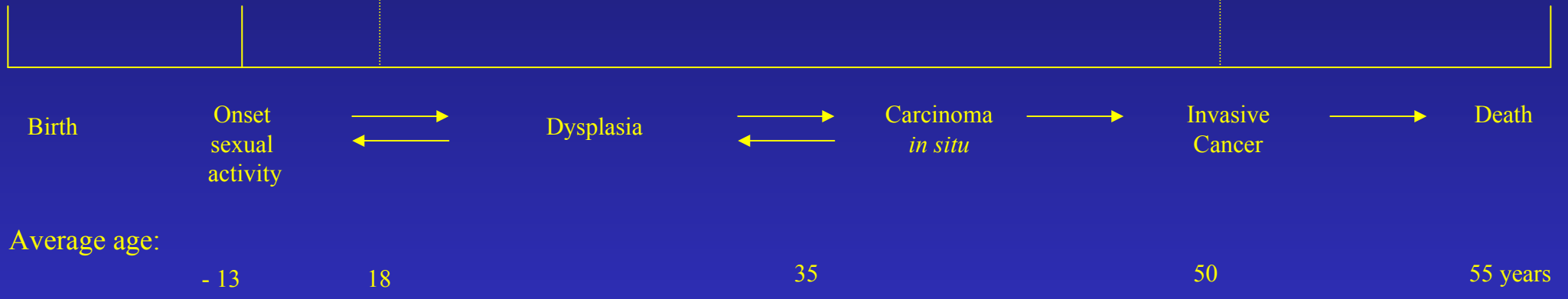| Site of Cancer[2]	Primary Prevention	Early diagnosis	Curative therapy	Pain relief and palliative care
Lung	++	-	-	++
Stomach	+	-	-	++
Breast	+	++	++	++
Colon/rectum	+	++	++	++
Cervix	++	++	++	++
Mouth/pharynx	++	+	++	++
Oesophagus	+	-	-	++
Liver	++	-	-	++

[1]Adapted from WHO 1995

Listed in order of global prevalence

For the majority of cases, provided that there is early diagnosis

++ = effective; += Partly effective - -= inactive

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ANNUAL ESTIMATES OF NEW CASES GLOBALLY

	Incidence	Mortality
• Breast Cancer	795 000	313 000
• Cervical Cancer	450 000	300 000
• Ovarian Cancer	165 000	101 000
• Endometrial Cancer	142 000	42 000

Detectable preclinical phase (DPCP)

| Birth | Onset sexual activity | → ← | Dysplasia | → ← | Carcinoma *in situ* | → | Invasive Cancer | → | Death |

Average age:

| - 13 | 18 | 35 | 50 | 55 years |

Examinations here unlikely to find cancers	Examinations here are cost-effective
- 8% of cancers	- 92 % of cancers

Pap Smears

- Sensitivity: 11 to 99%

- Specificity: 14 to 97%

- False negative: 5 to 55%

    -Errors of Commission: laboratory errors-1/3

    -Errors of Ommission: sampling errors-2/3

- Costs

Fahey et al

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Reduction in cumulative incidence of invasive cervical cancer over the age range 35-64 yrs, with different frequencies of screening
(WHO, 1992)

Frequency of screening	Percentage reduction in cumulative incidence	No. of tests
1year	93	30
2 years	93	15
3 years	91	10
5 years	84	6
10years	64	3

Reduction in cumulative incidence of invasive cervical cancer over the age range 35-64 yrs, with different population coverage and different frequencies of screening *(WHO, 1992)*

Frequency of screening	% of Population screened	Percentage reduction in cumulative incidence	No. of tests
1year	20	19	6
2 years	30	28	4.5
3 years	40	37	4
5 years	50	42	3
10years	80	51	2.4

Cost-effectiveness of two different strategies for cervical cancer screening Chile *(Eddy/WHO; 1986)*

	Programme 1	Programme 2
• Age	30-55 yrs	30-50 yrs
• Frequency	3 yrly	10 yrly
• Coverage	30%	90%
• ↓ Mortality	15%	44%
• ↓ Rx cost	USD 0.13 m	USD 0.25 m
• Cost/case	USD 2 522	USD 556

WHO Guidelines: Technical/Managerial

- IEC + Organized screening programmes
- Pap-smear: the proven method
- Screen every woman at age 45
- When resources permit screen 10yrly at age 35, 45, 55
- If resources available, screen 5yrly age 35-59
- Once coverage achieved (80%)- expand to age 25 (if resources available)

Characteristics of Failing <u>Screening Programme;</u>
in order of importance

- **Failure to reach the women at risk (opportunistic screening)**
- **Inadequate follow-up of abnormal results**
- **Long/short screening intervals**
- **Lack of quality control**

Available Control Strategies

Strategy		Cases (%)	Deaths (%)
Tobacco		20	30
Diet		25	20
Infections		15	10
Screening		3	4
	Cervix	60	60
	Breast	0	25
Treatment		0	20

Time to show Important Impact of Different Measures

Prevention	Time (in yrs)
Tobacco	30
Diet	10-50
Infections	40
Screening	5-10
Treatment	5

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Summary of cost utility analysis in 2010 due to screening by primary site. All Nordic countries combined (USD)

	Breast	Cervix	Colorectum	
Primary Site				
			Females	Males
• **Death avoided**	77 100	-11 700	42 400	42 200
• **LYG**	15 400	-1 700	5 300	6 000
• **QALYG**	15 900	-1 700	5 600	6 400
• **DFLYG**	18 100	-2 000	6 200	6 500
• **GQLYG**	18 700	-2 000	6 700	7 500

- **LYG:** Life years gained
- **QALYG:** Quality adjusted life years gained
- **DFLYG:** Dementia free life years gained
- **GQLYG:** Good quality of life years gained (adjusted for quality & dementia)

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Cost of screening for different kinds of cancer per expected year of increased survival in females (USD)

Age	Cervix	Breast	Colorectum*
30-39	2 782	2 578	
40-49	5 902	1 483	291
50-59	7 451	2 488	149
60-69	8 726	2 050	113
70-79	14 867	3 241	110

* Screening starts at age 40

Disadvantages of Screening

- Unecessary morbidity & over treatment - false positives & borderline abnormalities

- Lead time morbidity - true positives

- Psychological morbidity

Conclusion

- **The decision to establish and continue screening programmes depends not only on the factual evidence but also on whose values of benefits, harms & costs prevail**

- **A compromise has to be reached between longevity, quality of life and cost**

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