

National Cancer Prevention Policy

2007–09



Screening to detect cancer early

Principles of screening

Principles of screening

Screening refers to the application of a test to a population which has no overt signs or symptoms of the disease in question, to detect disease at a stage when treatment is more effective. The screening test is used to identify people who require further investigation to determine the presence or absence of disease and is not primarily a diagnostic test.

The purpose of screening an asymptomatic individual is to detect early evidence of an abnormality or abnormalities such as pre-malignant changes (e.g. by Pap test) or early invasive malignancy (e.g. by mammography) in order to recommend preventive strategies or treatment that will provide a better health outcome than if the disease were diagnosed at a later stage.

It is a commonly held belief among health professionals and the community that 'early diagnosis' of cancer is beneficial and therefore screening is bound to be effective. However, it cannot be assumed that each person who has a screen-detected abnormality or cancer within a screening program will benefit from that diagnosis. For example, it is now understood that a substantial proportion of early abnormalities on Pap tests (i.e. dysplastic changes) will regress without treatment. The potential benefits of organised population screening program for cancer must thus outweigh any potential harms that may result in the use of a screening test in people who are otherwise well (Miller 1996) and there must be strong evidence, preferably from randomised trials, that a screening program is effective in reducing mortality from cancer.

Principles for the introduction of population screening

The accepted criteria for the assessment of evidence on benefits, risks and costs of cancer screening are the principles adopted by the World Health Organization (Wilson & Jungner 1968):

- the condition should be an important health problem
- there should be a recognisable latent or early symptomatic stage
- the natural history of the condition, including development from latent to declared disease, should be adequately understood
- there should be an accepted treatment for patients with recognised disease
- there should be a suitable test or examination that has a high level of accuracy
- the test should be acceptable to the population
- there should be an agreed policy on whom to treat as patients
- facilities for diagnosis and treatment should be available
- the cost of screening (including diagnosis and treatment of patients diagnosed) should be economically balanced in relation to possible expenditure on medical care as a whole, and
- screening should be a continuing process and not a 'once and for all' project.

Recommendations for or against population screening interventions are influenced by the relative strength of the available scientific evidence in relation to these criteria. Most importantly, there should be sufficient direct evidence from well-conducted studies that

early detection improves health outcomes, and that the benefits of screening outweigh any potential harms.

Australia currently has three population screening programs for cancer which meet the World Health Organization criteria. Screening programs for breast, cervical and bowel cancer are discussed in the following chapters. Two further chapters examine the evidence for screening for prostate cancer and melanoma and conclude that, at this stage, there is insufficient evidence to recommend population screening.

The condition

For the disease to be amenable to screening, there must be a latent stage or 'window' during which it would be possible to detect the disease before it reaches an advanced stage. Most cancers are slow growing and many have a pre-invasive or precursor stage during which early treatment is successful in halting progression to invasive cancer. For example, pre-malignant lesions of the cervix can be detected by regular Pap tests. However, the sites of many cancers are not easily visualised and potential screening tests are insufficiently accurate, so that screening asymptomatic people is ineffective in detecting early disease.

If detection of cancer at an early stage is possible, it is crucial that appropriate intervention at that time has the potential to alter the course of the disease. Ideally there should be strong evidence from well-conducted clinical trials that early treatment or intervention improves outcome.

Estimation of benefit from early detection on health outcome may be influenced by lead-time bias and length-time bias.

Lead-time bias refers to the apparent improvement in survival that is seen when screening advances the time of diagnosis without any change in the actual time of death. In this case, increased survival merely reflects a greater period of time that the individual is aware of the presence of cancer.

Length-time bias refers to the tendency of screening to detect a disproportionate number of cases of slowly progressing cancer compared with more aggressive cases. Rapidly growing cancers may progress from being undetectable at the time of screening to symptomatic during the interval between screens and thus are less likely to be detected at screening or at an early stage.

The screening test (from Miller 1996 p. xiii)

The screening test must be sufficiently accurate to detect the condition earlier than in the absence of screening. Accuracy is measured by considering sensitivity and specificity of the screening test.

'Sensitivity' refers to the ability of a test to correctly identify people who have disease i.e. the proportion of people with the disease at the time of screening who have a positive screening test. A test with poor sensitivity will miss cases (persons with disease) and will produce a large number of false negative results (true cases will be told incorrectly that they are free of disease).

'Specificity' describes the ability of the test to correctly identify people who do not have the disease. A test with poor specificity will result in a high rate of false positives (healthy persons will incorrectly test positive and may be subject to more invasive diagnostic testing).

Another useful characteristic of a screening test is the positive predictive value (PPV), which is the likelihood of having disease if the screening test is positive (i.e. true positive). The PPV depends on the sensitivity and specificity of the test, and whether the condition is common or rare in the population being screened. In the context of breast cancer screening, for example, the PPV represents the total number of cancers diagnosed as a proportion of women who have been recalled for further investigations after mammography screening.

Finally, the screening test must be acceptable to the population and cause minimal discomfort, or participation in the screening program will be low. For example, many women find having a Pap test uncomfortable or embarrassing and are subsequently under-screened. Substantial resources are consequently required for educational campaigns to encourage women to undergo Pap tests. Pain on compression is reported by a small number of women undergoing mammographic screening. Resources are devoted to radiographer training to address this issue.

Ethical issues in population screening: balance of benefits and harms

'The ethical imperative with all medical interventions is to endeavour to ensure that potential benefits will outweigh harm. This is particularly so of screening. If a patient asks a doctor for help the doctor is obliged to do his or her best to help but ... (if) ... the doctor initiates a screening program there is a presumption that this must benefit the patient' (Fowler & Austoker 1997 p. 1585).

It is very difficult to determine the benefit of screening for an individual. The distinction between benefits to the community and to individuals needs to be borne in mind when considering recommendations to participate in organised population screening programs.

Participants in screening programs are ostensibly healthy people, so a program should, at the very least, be able to demonstrate evidence of an overall benefit to the community and a minimum of risk that certain individuals may be disadvantaged by the program (Miller 1996). Not only is it important that information on the effectiveness of screening programs be available, it should also be disseminated widely. Regular monitoring and evaluation of screening programs is also vital to ensure that effectiveness is maintained and improved where possible.

Potential harms from screening

It is essential to recognise that an organised population approach to screening, which ultimately achieves a net health benefit to a community, can result in adverse outcomes for some individuals.

There is a risk that people who receive false negative results may experience delays in diagnosis and treatment. Some may develop a false sense of security and ignore warning symptoms. Increasingly, false negative results can give rise to legal action by people whose cancers appear to have been missed.

A false positive result can mean that people without the disease undergo follow-up testing that may be uncomfortable, expensive, and, in some cases, potentially harmful. Rarely, this can lead to unnecessary treatment. There may be psychological consequences such as anxiety for both the patient and their family.

For example, a woman with a false positive mammogram undergoing surgical investigation (e.g. a fine needle biopsy) incurs costs such as anxiety, time lost to the procedure, and possible adverse effects of the surgery. A person undergoing a colonoscopy as a result of a

false positive faecal occult blood test faces the possibility of a bowel perforation during the procedure. This risk might be as high as 1 in 1000 (Winawer et al. 1997).

Informed consent

As screening is initiated by 'the health system', individuals invited to participate must be informed, prior to any testing, of potential adverse effects as well as the potential benefits.

There are concerns that false negative results can give rise to legal action by people whose cancers appear to have been missed. It is important that it is understood that screening for any disease is never 100% effective and a negative result does not ever constitute a *guarantee* that an individual is free of disease. This must be communicated effectively to the potential participants in a screening program to allow informed consideration of their involvement before any test is done. Communications must address differences in literacy and language competency to ensure that individuals are properly informed.

Economic issues in screening

Implementation of possible screening programs will be influenced by consideration of the equal distribution of limited resources across the whole community for maximum benefit. Resources allocated to a screening program will lower resources available for other health needs.

Determining the costs of screening involves the costs of the test and subsequent diagnostic tests and the costs associated with any hazard of the test as well as the costs of over-treatment

balanced against

reduced costs of therapy for the primary condition, reduced costs associated with less expenditure on the treatment of the advanced disease, and the economic value of the additional years of life gained (Miller 1996 p. 1444).

References

- Fowler G & Austoker J 1997. Screening. In *Oxford textbook of public health*, eds R Detels, WW Holland, J McEwan & GS Omenn. Third edition. New York: Oxford University Press.
- Miller AB 1996. Fundamental issues in screening for cancer. In *Cancer epidemiology and prevention*, eds D Schottenfeld & J Fraumeni. Second edition. New York: Oxford University Press.
- Wilson JMG & Jungner G 1968. *Principles and practices of screening for disease*. Public health paper. Geneva: World Health Organization.
- Winawer S, Fletcher R, Miller L et al. 1997. Colorectal cancer screening: clinical guidelines and rationale. *Gastroenterol* 112: 594–642.