Levels of Prevention

Primordial prevention

- Prevention of the emergence or development of risk factors.
- Particularly useful for chronic diseases. Eg :Many adult health problems (e.g., obesity, hypertension) have their early origins in childhood, because this is the time when lifestyles are formed (smoking, eating patterns, physical exercise).
- Efforts are directed towards discouraging children from adopting harmful lifestyles .
- The main intervention – is through individual and mass education.

Primary prevention

- Measures of prevention undertaken during the phase of prepathogenesis (phase of susceptibility)
- Involves two sub-steps: Health promotion and specific protection
- **Health Promotion :** Steps undertaken to improve the level of general health and well being so that conditions for initiation of disease process are prevented.
- These steps are not specific for any disease or a group of disease

Primary prevention cont’d …..

- It includes
  - ✓ improvement in the overall socio-economic status of the population,
  - ✓ health education,
  - ✓ feeding programmes for mothers and children,
  - ✓ promotion of breast feeding,
  - ✓ promotion of small family norms,
  - ✓ Education
  - ✓ motivation for healthy lifestyle.

Primary prevention cont'd …..

- **Specific Protection** : include measures to prevent the initiation of specific diseases or a group of diseases.
- Examples
  - ✓ Immunization to protect against specific diseases
  - ✓ Fortification of foods with specific nutrients (as salt with iodine)
  - ✓ Use of condoms to protect against sexually transmitted diseases (STDs)
  - ✓ Use of helmets to protect against head injuries

Primary prevention cont'd …..

- Both health promotion and specific protection are type of "primary preventive" strategy.
- However, health promotional approach improves the general health so that a number of diseases are aimed at.
- For example, by promoting breast feeding among children, we try to prevent general malnutrition, vitamin A deficiency, providing antibodies against various diseases, preventing diarrhoeal diseases.
- On the other hand when condom is used, it is for a very specific group of diseases i.e. STDs; when measles vaccine is given it is for a specific disease i.e. measles.

Primary prevention cont’d …..

- Two types of strategy:
  - ✓ Population strategy
  - ✓ High risk strategy

Primary prevention

Population strategy

Advantages:
Radical
Large potential for population
Behaviourally appropriate

Disadvantages:
Small benefits to individual
Poor motivation of subject
Poor motivation of physician
Benefit to risk ratio may be low

High risk strategy

Advantages :
Appropriate to individuals
Subject motivation
Physician motivation
Benefit to risk ratio is favourable

Disadvantages:
High screening costs.
Temporary effects
Limited effect
Behaviourally inappropriate

Prevention Paradox

- A preventive measure which brings much benefit to the population often offers little to each participating individual.
- Classical example is the Framingham study:
  - Data from the study suggests that if all men up to age 55 reduced their cholesterol level by 10%, 1 in 50 could expect to avoid a heart attack on average, yet 49 out of 50 would follow the same measures and perhaps get nothing out of it.

Secondary Prevention

- These include all actions undertaken at the stage of early pathogenesis (asymptomatic disease) with a view to halt the progress of disease at it's earliest, incipient stage, by "early diagnosis and prompt treatment".
  - ✓ classical example is "screening for disease" for breast cancer (using mammography) and cervical cancer (using pap smear).
  - ✓ medical examinations of school children, of industrial workers and various disease screening camps.

Tertiary prevention

- These include all measures undertaken when the disease has become clinically manifest or advanced, with a view to prevent or delay death, reduce or limit the impairments and disabilities, minimize suffering and to promote the subject's adjustment to irremediable conditions.
- Tertiary prevention has two types of approaches :
  - ✓ disability limitation
  - ✓ rehabilitation

Tertiary prevention cont'd ….

- **Disability Limitation** : These include all measures to prevent the occurrence of further complications, impairments, disabilities and handicaps or even death. example :
  - ✓ Application of plaster cast to a patient who has suffered Colle's fracture, is done to prevent complications and further disability like mal-union or non-union.
  - ✓ Complete rest, morphine, oxygen and streptokinase is give to a patient of Acute MI, to prevent death or complications like arrhythmias / CHF.

Tertiary prevention cont'd ….

The sequence with which a disease turns into a handicap is as follows :

- ✓**Disease :** This is a pathological process and it's manifestations which indicate a departure from the state of perfect health.
- ✓**Impairment :** This is the actual loss or damage of a part of body anatomy or an aberration of the physiological functions that occurs consequent to a disease.
- ✓**Disability :** This is defined as the inability to carry out certain functions or activities which are otherwise expected for that age / sex, as a result of the impairment.
- ✓**Handicap :** This is the final disadvantage in life which occurs consequent to an impairment or disability, which limits the fulfillment of the role a person is required to play in life.

Tertiary prevention cont’d ….

- **Rehabilitation** : This is the second component of tertiary prevention.

- Rehabilitation stands for the combined and coordinated usage of all the available medical, social, educational and vocational measures, for training the person to the highest level of functional ability.

Tertiary prevention cont'd ….

- **Medical rehabilitation :**
  - ✓This is done through medical / surgical procedures to restore the anatomy, anatomical functions and physiological functions to as near normal as possible.
- **Vocational rehabilitation :**
  - ✓It includes steps involving training and education so as to enable the person to earn a livelihood.
- **Social rehabilitation :**
  - ✓This involves steps for restoration of the family and social relationships.
- **Emotional and Psychological rehabilitation :**
  - ✓This involves steps to restore the confidence, personal dignity and confidence.

Levels of Prevention

Level of prevention	Phase of disease	Target
Primordial	Underlying condition leading to causation	Total population and selected groups
Primary	Specific causal factors	Total population, selected groups and healthy individuals
Secondary	Early stage of disease	Patients
Tertiary	Late stage of disease	Patients

Screening

Definition

- Screening is a public health intervention intended to improve the health of a precisely defined target population.

- Screening is the presumptive identification of unrecognized disease or defect by applying tests, examinations or other procedures which can be applied rapidly. Screening tests sort out apparently well persons who probably have a disease from those who probably do not. A screening test is not intended to be diagnostic. (Last 2001)

Screening cont’d ….

- The purpose of health interventions is to reduce severe morbidity and mortality by shifting the natural history of the disease to the right and making disease less severe.

- One way of achievement detection of diseases at early stage of its natural course is by applying a screening test

Screening cont’d ….

The aim of screening program includes:

- ✓To reverse, halt, or slow the progression of disease more effectively than would probably normally happen
- ✓To alter the natural course of disease for a better outcome for individuals affected
- ✓Protect society from contagious disease
- ✓Rational allocation of resources
- ✓Selection of healthy individuals: employment, military…
- ✓Research; study on natural history of diseases

Types of screening

There are different types of screening, each with specific aims:

- ***Mass screening*** aims to screen the whole population (or subset)
- ***Multiple or multiphasic screening*** uses several screening tests at the same time
- ***Targeted screening*** of groups with specific exposures, e.g. workers in lead battery factories, is often used in environmental and occupational health
- ***Case-finding or opportunistic screening*** is aimed at patients who consult a health practitioner for some other purpose.

Criteria for a successful screening program (WHO 1968)

- ✓The problem to be detected should be important enough to be worth detecting
- ✓There should be an acceptable intervention which is effective.
- ✓The intervention should be feasible and available
- ✓There should be a recognizable latent or early "asymptomatic“ stage.
- ✓There should be a suitable test
- ✓The test should be acceptable to the population to be tested
- ✓The natural history of the condition should be adequate understood
- ✓There should be an agreed policy regarding when the intervention is appropriate
- ✓The cost of detecting the problem and its remedy should be reasonable
- ✓The screening program should be ongoing, and not a "one-time“ effort

Criteria cont’d…

In addition, several issues need to be addressed before establishing a screening programme

- ***Costs:***
  - The costs of a screening programme must be balanced against the number of cases detected and the consequences of not screening.
  - Generally, the prevalence of the preclinical stage of the disease should be high in the population screened, but occasionally it may be worthwhile to screen even for diseases of low prevalence which have serious consequences
- ***Lead time***
  - The disease must have a reasonably long lead time; that is, the interval between the time when the disease can be first diagnosed by screening and when it is usually diagnosed in patients presenting with symptoms.

Criteria cont'd…..

- ***Length bias***
  - Early treatment should be more effective in reducing mortality or morbidity than treatment begun after the development of overt disease, as, for example, in the treatment of cervical cancer in situ.
  - A treatment must be effective and acceptable to people who are asymptomatic.
  - If treatment is ineffective, earlier diagnosis only increases the time period during which the participant is aware of the disease; this effect is known as length bias or length/time bias.

Screening test

- The screening test itself must be cheap, easy to apply, acceptable to the public, reliable and valid.

- A test is reliable if it provides consistent results, and valid if it correctly categorizes people into groups with and without disease, as measured by its sensitivity and specificity

Screening test cont'd….

- **Sensitivity** is the proportion of people with the disease in the screened population who are identified as ill by the screening test. (When the disease is present, how often does the test detect it?)
- **Specificity** is the proportion of disease-free people who are so identified by the screening test. (When the disease is absent, how often does the test provide a negative result?)

Results of Screening Testing

Test Result	**Result for a Gold Standard**		**Total**
	Disease Present	Disease Absent	
Positive	*A*	*b*	*a* + *b*
Negative	*C*	*d*	*c* + *d*
Total	*a* + *c*	*b* + *d*	*a* + c + *b* + *d*

Results of Screening Testing

- *a* = No. of true positives, *b* = No. of false positives,
  c = No. of false negatives, *d* = No. of true negatives

- **Sensitivity** = probability of a positive test in people with the disease = *a/(a+c)*
- **Specificity** = probability of a negative test in people without the disease = *d/(b+d)*

- **Positive predictive value** = probability of the person having the disease when the test is positive = *a/(a+b)*
- **Negative predictive value** = probability of the person not having the disease when the test is negative = *d/(c+d)*

Results of Screening Testing cont'd…

- ✓ The ability of the screening test to differentiate between those who are disease free from those who are affected is called the test validity.
- ✓ The screening test validity is measured by sensitivity and specificity
- ✓ A highly sensitive test is preferable when there is an important penalty for failing to detect a disease (e.g., when trying to detect a dangerous but treatable condition)
- ✓ Sensitive tests are also used when the probability of disease is relatively low and the purpose of the test is to discover possible cases
- ✓ A sensitive test is, therefore, most helpful when the test result is negative

Results of Screening Testing cont'd…

- ✓ Specific tests, on the other hand, are most useful when the test result is positive, and are often used to confirm a diagnosis which has been suggested by other data.
- ✓ A highly specific test is preferable when false positive results might have negative (physical, emotional, or financial) consequences
- ➢ In theory, the sensitivity and specificity of a test are independent of the prevalence of the condition being detected.
- ➢ In practice, however, several characteristics of cases (such as the stage and severity of the disease) may be related to both the sensitivity and specificity of a test and to the prevalence of the disease, since different kinds of cases are found in high and low-prevalence situations

Results of Screening Testing cont'd…

- The predictive value of a test is not a property of the test alone. It is determined by the sensitivity and specificity of the test and the prevalence of the disease in the population being tested
- Positive results, even for a very specific test, when applied to a population with a low likelihood of disease, will be largely false positives
- Similarly, negative results, even for a very sensitive test, will be largely false negatives when the test is performed in a population with a high chance of having the disease

Results of Screening Testing cont'd…

Effect of Prevalence on the Positive Predictive Value, with 90% Sensitivity and 95% Specificity

Prevalence (%)	Positive predictive value (%)
0.1	1.80
1.0	15.4
5.0	48.6
50.0	94.7