Principles and Practice of Disease Prevention

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Disease
A change away from a normal state of health to an abnormal state in which health is diminished.

Sign
A \textit{sign} is an objective change in body function (e.g., health) that may be observed and measured by an individual in addition to the patient.

Contrast with symptom.

Symptom
A \textit{symptom} is a changes in body function felt by the patient.

\textit{Symptoms are not measurable by a physician.}

Contrast with sign
Definitions

- **Infectious diseases**
  - Caused by an infectious agent

- **Communicable diseases**
  - Transmission – directly or indirectly – from an infected person

- **Transmissible diseases**
  - Transmission – through unnatural routes – from an infected person

**Non-Communicable diseases**

Physical disability

Non-communicable diseases – virus involved in pathogenesis of diabetes?

- Chronic diseases – HIV?
Disease prevention

- Disease prevention is the deferral or elimination of specific illnesses and conditions by one or more interventions of proven efficacy.

- The term is generally applied to human health, the principles apply to other plant and animal species.
Three levels of prevention

- **Primary** prevention
- **Secondary** prevention
- **Tertiary** prevention
The construct of primary, secondary, and tertiary prevention considers preventive intervention in the context of the onset and natural history of specific human diseases and their outcomes.
Primary prevention

- Primary prevention refers to the prevention of diseases before their biological onset.
  For example, pasteurizing milk essentially eliminates bacterial pathogens that could cause illnesses.

- Measles immunization prevents clinical illness before it can get started.

- Older persons with osteoporosis wear hip protectors, which absorb the shock of a fall and are capable of preventing hip fracture.

- Behavioral interventions such as smoking cessation, preventive dental care, and maintaining physical exercise.

- The provision of uncontaminated food and water.
Routine searching for genetic abnormalities is in that abnormal genes that are associated with various diseases can often be detected before any disease occurs.

An example is newborn screening for phenylketonuria, a metabolic disease that can be subverted with an appropriate diet.
Primary prevention generally involves the prevention of diseases and conditions before their biological onset. This can be done in a variety of ways, such as preventing environmental exposures, improving human resistance to disease, or education to diminish risk-taking behaviors. Thus, general environmental and sanitary measures, such as maintaining a safe water and food supply, promoting the use of condoms to prevent sexually transmitted diseases, supplemental restraint systems in automobiles ("airbags"), and application of safe and effective vaccines are examples of primary prevention, whereby diseases and injuries do not obtain a foothold in the body.
Primordial prevention

- refers to creating an environment where certain challenges to health are eliminated, and thus no other preventive interventions are necessary.
- examples of primordial prevention are the global elimination of smallpox, so that no immunization is necessary; and the potential for eliminating added salt from all foods, which would, if achieved, be quite effective in preventing hypertension.
Secondary Prevention

- Refers to the prevention of clinical illness through the early and asymptomatic detection and remediation of certain diseases and conditions that, if left undetected, would likely become clinically apparent and harmful. This is referred to as "screening."

Examples:

- Routine bacteriological culturing for sexually transmitted organisms in asymptomatic persons

- Routine serological testing for preclinical infections such as “syphilis”

- Screening for high blood pressure, which may indicate clinical hypertension
- Screening for early breast cancer using mammography

- Screening (that is actually a primary prevention) is to routinely examine the paint on walls of older homes, where lead contamination and its exposure to children may be a problem

- One variation of secondary prevention is to screen for conditions that might be clinically overt but have gone undetected, such as clinical depression or other mental illnesses
Smoking cessation and increasing exercise may prevent the emergence of heart attack or stroke, even though some atherosclerotic lesions (hardening of the arteries) are already developed
Tertiary prevention

- refers to the prevention of disease progression and additional disease complications after overt clinical diseases are manifest.

- While the distinction between disease treatment and tertiary prevention may be sometimes uncertain.

- examples exist— lowering a high blood cholesterol level after a heart attack can prevent the occurrence of further heart attacks and related conditions such as stroke and angina pectoris (chest pain with activity).
■ Treating high blood pressure after a stroke may decrease the risk of subsequent strokes.

■ For persons with diabetes mellitus, eye examinations to detect diabetic retinal disease, and steps taken to prevent its progression, are routinely undertaken.

■ Among persons who are severely disabled, provision of special mattresses and other interventions can prevent some chronic skin ulceration.

■ Providing handrails in the homes of persons at high likelihood of repeated falling can prevent fractures and other injuries.
Environmental Factors

Some of the most important disease prevention is carried out by *environmental modification*. e.g. includes all sanitary services, such as the provision of safe food and water, adequate housing; and a general environment free of disease causing physiochemical and biological pollutants.

Many work environments require substantial environmental protections, since they would otherwise be extremely hazardous.
environmental modifications that yield disease prevention, such as highway engineering to control speeds and dangerous road segments, the elimination of overhanging building cornices, and the removal of sharp edges or provision of shielding devices on consumer products.
Air Quality, Fires, and Volcanic Eruptions

Protect Yourself and Your Family from Debris Smoke

- Natural disasters, such as hurricanes and floods, can leave a lot of debris. Some of this debris may be burned during cleanup. Smoke from these outdoor fires is unhealthy for you to breathe.

- Smoke may cause you to cough. It can cause shortness of breath or tightness in the chest. It also can sting your eyes, nose, or throat.

- Infants, children, pregnant women, older adults, and people with chronic diseases such as asthma are at greater risk from smoke.
Preventive Measures

- Leave the area if you are at greater risk from breathing smoke.
- Limit your exposure to smoke outdoors and indoors.
- Stay inside and use your air conditioner. If you do not have an air conditioner or smoke is likely to get inside your house, leave the area until the smoke is completely gone.
- Avoid activities that put extra demands on your lungs and heart. These include exercising or physical chores, both outdoors and indoors.
- Make sure you take all your medications according to the doctor’s directions. Contact your doctor if your health gets worse.
- Dust masks, bandanas, or other cloths (even if wet) will not protect you from smoke.
You Can Prevent Carbon Monoxide Exposure

- **Do** have your heating system, water heater and any other gas, oil, or coal burning appliances serviced by a qualified technician every year.
- **Do** install a battery-operated CO detector in your home and check or replace the battery when you change the time on your clocks each spring and fall. If the detector sounds leave your home immediately and call 911.
- **Do** seek prompt medical attention if you suspect CO poisoning and are feeling dizzy, light-headed, or nauseous.
- **Don't** use a generator, charcoal grill, camp stove, or other gasoline or charcoal-burning device inside your home, basement, or garage or near a window.
- **Don't** run a car or truck inside a garage attached to your house, even if you leave the door open.
- **Don't** burn anything in a stove or fireplace that isn't vented.
- **Don't** heat your house with a gas oven
Asthma

- Asthma is a serious environmental health threat, but it can be controlled by taking medication and by avoiding contact with environmental "triggers" such as dust mites, furry pets, mold, tobacco smoke, and certain chemicals.

- Environmental Tobacco Smoke (Secondhand Smoke).

- **Outdoor Air Pollution**

- Pollution caused by industrial emissions and automobile exhaust can cause an asthma attack.
Cockroaches and their droppings may trigger an asthma attack

- **Pets**
- Furry pets may trigger an asthma attack.
- Strenuous physical exercise; some medicines; bad weather, such as thunderstorms, high humidity, or freezing temperatures; biomass smoke from burning wood, grass, or other vegetation; and some foods and food additives can trigger an asthma attack.
Asbestos

- Scientists have recognized asbestos as a health threat to humans because these fibers can be breathed into the lungs and can cause cancer and other lung diseases.

- **Biomonitoring**

- Biomonitoring measurements are the most health-relevant assessments of exposure because they measure the amount of the chemical that actually gets into people, not the amount that may get into people.
Climate Change

- Potential Climate Change Health Effects
  - Aero-allergens
  - Air Quality and Respiratory Disease
  - Extreme Weather Events
  - Heat Waves
  - Mental Health
  - Vector-borne and Zoonotic Disease
  - Water- and Food-borne Diseases
  - Other Indirect Health Effects
  - Interacting Trends
Radiation Emergencies

Health Effects and Treatments

- Radiation can affect the body in a number of ways, and the adverse health effects of exposure may not be apparent for many years. These can range from mild effects, such as skin reddening, to serious effects such as cancer and death, depending on the amount of radiation absorbed by the body (the dose), the type of radiation, and how and for how long the person was exposed.

- Acute Radiation Syndrome (ARS)

- Radiation sickness, known as acute radiation syndrome (ARS), is a serious illness that occurs when the entire body (or most of it) receives a high dose of radiation, usually over a short period of time.

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- **Treatments**
- **Potassium Iodide (KI)**
- **Prussian Blue**
- **DTPA**
- **Neupogen** (Filgrastim (trade name Neupogen®) is a human granulocyte colony stimulating factor (G-CSF) produced by recombinant DNA technology. It is a specific type of cytokine that stimulates the growth of white blood cells.)
Rodents

- Worldwide, rats and mice spread over 35 diseases. These diseases can be spread to humans directly, through handling of rodents, through contact with rodent feces, urine, or saliva, or through rodent bites. Diseases carried by rodents can also be spread to humans indirectly, through ticks, mites or fleas that have fed on an infected rodent.

- The primary strategy for preventing human exposure to rodent diseases is effective rodent control in and around the home. This is achieved by eliminating any food sources, sealing even the smallest entries into homes, and successfully trapping rodents in and around the home.
Health Effects

- Cancer
- Heart Disease and Stroke
- Respiratory Health
- Smoking During Pregnancy

Quit Smoking
Healthy water

- With its many uses for drinking, recreation, sanitation, hygiene, and industry, water is our most precious global resource.
- Drinking water comes from a variety of sources including public water systems, private wells, or bottled water. Ensuring safe and healthy drinking water may be as simple as turning on the tap from an EPA-regulated public water system. Other water sources may need a water filter, a check on water fluoridation, or an inspection to ensure a septic tank is not too close to a private well. It is important to know where drinking water comes from, how it’s been treated, and if it’s safe to drink.
Hygiene refers to behaviors that can improve cleanliness and lead to good health, such as frequent hand washing, face washing, and bathing with soap and water. In many areas of the world, practicing personal hygiene etiquette is difficult due to lack of clean water and soap. Many diseases can be spread if the hands, face, or body are not washed appropriately at key times.

It is estimated that washing hands with soap and water could reduce diarrheal disease-associated deaths by up to 50%
Hygiene-related Diseases

- *Acanthamoeba* keratitis (AK)
- Athlete's Foot (tinea pedis)
- Body Lice
- Dental Caries
- Diarrhea
- Head Lice
- Hot Tub Rash
- Lymphatic Filariasis
- Pinworms
- Pubic Lice ("Crabs")
- Scabies
- Swimmer's Ear (otitis externa)
- Recreational Water Illness (RWI’s)
- Ringworm (Tinea)
- Trachoma
Recreational Water Illness (RWI)

Recreational water illnesses (RWIs) are caused by germs spread by swallowing, breathing in mists or aerosols of, or having contact with contaminated water in swimming pools, hot tubs, water parks, water play areas, interactive fountains, lakes, rivers, or oceans.
Efficacy of Disinfection/Sterilization Influencing Factors

- All hospitals and health care facilities should have a decontamination policy, and should help staff to decide what decontamination process should be used for each item of medical equipment.
- Cleaning of the object.
- Organic and inorganic load present.
- Type and level of microbial contamination.
- Concentration of and exposure time to disinfectant/sterilant.
- Nature of the object.
- Temperature and relative humidity.
STERILIZATION

Physical method

Heat

Dry heat

Moist heat (autoclave)

Prevaccum

Gravity displacement

Radiation
2% GLUTARALDEHYDE

Sterilization
8-10 Hrs used for :-
Pneumatic circuits. i.e.-
ventilator tubing O2 masks
ventury devices nebulizer
chamber

Disinfection
15-30 Mts used for disinfected endoscopes
Respiratory tubing's
ETHYLENE OXIDE (EO)

Used for polythene and plastic items

E.g.: - Ambu bag, Baines circuit, Domes, Biopsy Needle, Electric items, Rubber items
Decontamination

- It includes:
  - Cleaning.
  - Disinfection.
  - Sterilization
Cleaning

Cleaning is the removal of all foreign material (dirt, organic matter and microorganisms) from an object.

Two key components of cleaning are friction to remove foreign matter and fluids to remove or
Individual and group behavior

- Part of the disease-prevention burden lies with the individual, who must practice behaviors that minimize disease risk and occurrence, and maximize health states.

- Some examples are maintaining an appropriate weight, never taking up or ceasing the use of tobacco products, avoiding exposures that may lead to unwanted pregnancy or passage of sexually transmitted diseases, avoiding carcinogenic sun exposure, maintaining active exercise habits appropriate for one's health status, appropriately using prescription drugs or other substances, and discouraging participation in social behaviors that may lead to disease or injury.
It is clearly important that individuals have sufficient and accurate information in order to assist in initiating and maintaining disease-preventing behaviors.

A related source of appropriate disease prevention is health education and behavioral training.

Include educational institutions, medical care sites, the Internet, and all other venues where health information and knowledge are offered, including the media and marketing activities.
Another important source of disease prevention lies largely with health-professional practice. In general, only health professionals and an environmentalist can conduct and interpret many screening procedures, administer immunizations, or prescribe chemo preventive interventions and provide tertiary preventive services for persons with existing medical conditions.
Political Action

- Underlying preventive-intervention delivery, no matter the source, is the need for political action.

- The citizens of every community or jurisdiction must provide the political impetus and the resources to assure that modern prevention is available, whether in regulating and policing the general or workplace environment, assuring high-quality sanitary procedures, furnishing effective educational programs and services, or providing fiscal and geographical access to clinical services.
Provision of suitable research programs and prevention professionals.

Disease prevention may not be equally applied to all persons in the community. Many clinical and environmental interventions, such as routine childhood immunizations, air pollution control, and public health sanitary measures, are appropriately intended for all persons.

Individuals may differ dramatically in their risk of various diseases for genetic, behavioral, or environmental reasons.

For example, screening for blood-lead levels in children may only be useful for those who reside in older housing, where lead paint exposure is much more likely. Persons with a clear family history of some chronic conditions, such as coronary heart disease and cancer, may benefit from more intensive screening and intervention programs.
Disease prevention has a greater moral burden to be free of adverse effects than do treatments, since they target individuals who are generally healthy. e.g. Some adverse effects are clearly and immediately identifiable, such as acute allergic reaction to a vaccine.

For example, while consuming beta-carotene-containing vegetables has been associated with lower cancer incidence rates, randomized trials of beta-carotene in smokers have been associated in some studies with higher incident lung cancer rates.
An environmental determinant of health is, in general, any external agent (biological, chemical, physical, social, or cultural) that can be causally linked to a change in health status.

Environment is defined as everything that is not genetically determined could be considered "environmental."

In the developed world, environmentalists are concerned about such things as gene-environment interactions, environment-environment interactions, particulate air pollution, nitrogen dioxide, ground-level ozone, environmental tobacco smoke, radiation, lead, video display terminals, cellular telephones, and persistent organic pollutants (POPs) that act as endocrine disruptors.
Exposures to these types of environmental vectors are known as proximate determinants of health (that is, the exposures are closely related in time and space to the ill effects they produce), and they impact both health and well-being.

In the developing world, the primary environmental determinants of health are biological agents in the air, water, and soil that account for most deaths in the world. Four million children die annually from diarrheal diseases acquired from contaminated food or water.

Over one million people die from malaria each year. Hundreds of millions of people suffer from debilitating intestinal parasitic infestations. Hundreds of millions of people suffer from respiratory diseases caused by biological and chemical agents in the air, both indoors and outdoors.

According to the World Health Organization (WHO), over one billion people are unable to meet their basic needs (i.e., adequate food, clean water, and shelter) because they lack the necessary income or land.
The workplace often serves as a laboratory for understanding the relationship between environmental exposures and health.

- It serves as a laboratory because, in their occupational environment, workers tend to be exposed to measurable amounts of pollution.

- If no link between a workplace pollutant and worker ill-health can be demonstrated, then that pollutant is unlikely to have measurable consequences for human health beyond the work environment owing to comparative lack of frequency and concentration of exposure experienced by those not working in that specific environment.
These are environmental hazards that take a far greater toll on human life and suffering in absolute terms compared to those environmental determinants of concern in the developed world.
For example, the environmental, transponder transport of contaminants through the food chain has resulted in global chemical contamination. Other transboundary issues include acid precipitation, ozone, greenhouse gasses, and hazardous wastes. Global ecological integrity (i.e., the ability of life-support systems to sustain themselves in the presence of polluting forces) and global change (including concerns about climate change from global warming, ozone depletion, and the loss of biodiversity) have given people reason to adopt the WHO maxim: "Think globally, act locally." Reducing wastes and consumption at the local level can have positive effects on the entire earth's ecosystems.
Thanks