

DISEASE DETECTIVES – PART THREE

PATTERNS, CONTROL AND PREVENTION

Recognizing and Describing Patterns in Health-related Event

Interpreting Data Tables, Charts & Graphs of Health-related Events

TABLE is a set of data arranged in rows and columns with single or multiple indicators

- use clear and concise title that describe the what, where and when of the data collected
- should be simple with 2-3 variables
- should be self-explanatory
- codes, abbreviations, and symbols should be explained in detail in a footnote
- specific units of measure for the data should be given
- totals should be provided
- when the data is not original, source should be provided in a footnote at the bottom of the table

Vol. 54 / No. 14		MMWR						369	
TABLE II. (Continued) Provisional cases of selected notifiable diseases, United States, weeks ending April 9, 2005, and April 10, 2004 (14th Week)*									
Reporting area	Legionellosis		Listeriosis		Lyme disease		Malaria		
	Cum. 2005	Cum. 2004	Cum. 2005	Cum. 2004	Cum. 2005	Cum. 2004	Cum. 2005	Cum. 2004	
UNITED STATES	266	295	111	112	1,265	1,975	247	298	
NEW ENGLAND	11	6	2	5	41	195	6	25	
Maine	—	—	—	1	2	18	—	—	
N.H.	2	—	1	1	14	9	2	—	
Vt.	—	—	—	—	1	7	—	1	
Mass.	5	3	—	1	18	107	3	17	
R.I.	1	1	—	—	1	18	1	2	
Conn.	3	2	1	2	5	36	—	5	
MID. ATLANTIC	80	59	23	29	926	1,467	64	67	
Upstate N.Y.	20	11	7	6	144	476	14	10	
N.Y. City	4	5	4	3	—	—	29	29	
N.J.	16	9	5	11	381	281	14	14	
Pa.	40	34	7	9	401	710	7	14	
E.N. CENTRAL	55	73	17	15	33	49	15	20	
Ohio	28	32	6	7	20	11	3	4	
Ind.	1	7	1	2	2	—	—	3	
Ill.	7	14	—	—	—	—	3	4	
Mich.	15	18	5	4	3	—	7	4	
Wis.	4	2	5	2	8	38	2	5	
W.N. CENTRAL	10	6	9	3	37	20	9	20	
Minn.	1	—	2	2	33	6	1	8	
Iowa	—	1	3	—	1	5	2	1	
Mo.	7	4	2	1	2	9	5	4	
N. Dak.	1	—	1	—	—	—	—	1	
S. Dak.	—	1	—	—	—	—	—	1	
Nebr.	—	—	—	—	—	—	—	1	
Kans.	1	—	1	—	1	—	1	4	
S. ATLANTIC	59	67	25	16	203	197	61	90	
Del.	—	1	N	N	25	36	—	2	
Md.	16	10	3	3	116	108	18	23	
D.C.	1	2	—	—	1	4	1	4	
Va.	4	5	1	—	22	6	7	6	
W. Va.	3	2	—	1	2	1	1	—	
N.C.	7	7	6	4	14	31	8	5	
S.C.	—	2	—	—	5	1	1	4	
Ga.	6	5	4	3	—	5	12	13	
Fla.	22	33	11	5	18	15	13	33	
E.S. CENTRAL	3	13	5	5	4	8	9	8	
Ky.	1	3	—	1	—	1	2	1	
Tenn.	—	5	2	4	4	2	5	1	
Ala.	2	5	3	—	—	—	2	5	
Miss.	—	—	—	—	—	5	—	1	
W.S. CENTRAL	4	30	2	13	6	16	19	24	
Ark.	1	—	—	1	—	—	1	1	
La.	3	2	1	1	—	1	—	2	
Okla.	—	2	—	—	—	—	2	1	
Tex.	—	26	1	11	6	15	16	20	
MOUNTAIN	24	21	—	2	1	4	14	12	
Mont.	1	—	—	—	—	—	—	—	
Idaho	1	1	—	1	—	—	—	—	
Wyo.	2	4	—	—	—	1	1	—	
Colo.	5	3	—	1	—	—	8	5	
N. Mex.	1	—	—	—	—	—	—	1	
Ariz.	6	5	—	—	—	1	2	1	
Utah	3	7	—	—	1	1	3	3	
Nev.	5	1	—	—	—	—	—	2	
PACIFIC	20	20	28	24	14	19	50	32	
Wash.	1	2	2	5	—	2	2	1	
Oreg.	N	N	2	4	1	7	1	4	
Calif.	19	18	24	15	12	10	42	27	
Alaska	—	—	—	—	—	1	2	—	
Hawaii	—	—	—	—	N	N	3	—	
Guam	—	—	—	—	—	—	—	—	
P.R.	—	1	—	—	N	N	—	—	
V.I.	—	—	—	—	—	—	—	—	
Amer. Samoa	U	—	U	U	U	U	U	U	
C.N.M.I.	U	U	—	U	—	U	—	U	

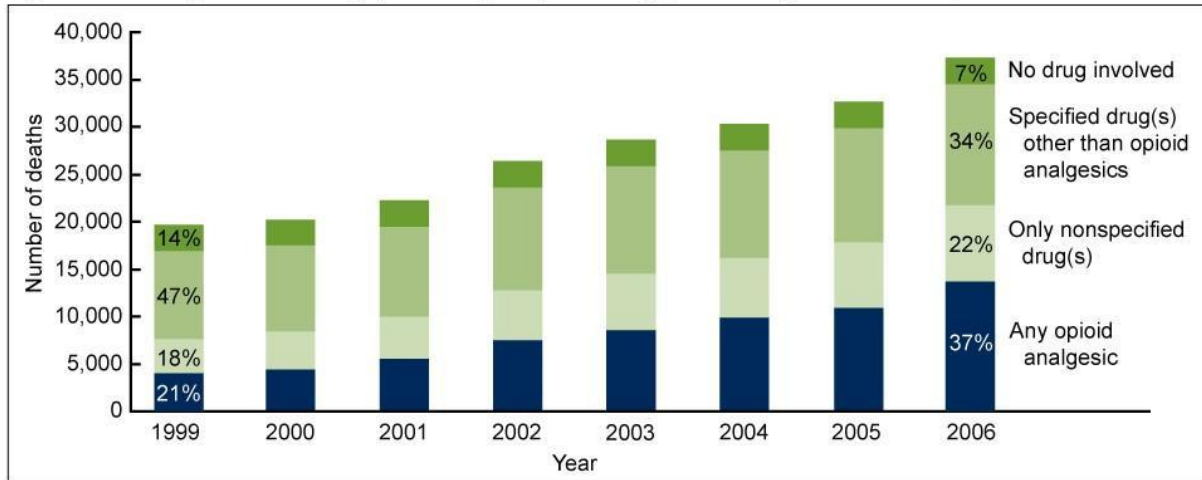
N: Not notifiable. U: Unavailable. —: No reported cases. C.N.M.I.: Commonwealth of Northern Mariana Islands.
* Incidence data for reporting years 2004 and 2005 are provisional and cumulative (year-to-date).

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GRAPH is a method of showing quantitative data using the x-y coordinate system.

- simplest graphs are the most effective
 - should be self-explanatory
 - each variable shown should be clearly differentiated by legends
 - the x-axis is used for variables which is the method of classification (independent variable e.g. time)
 - the y axis shows dependent variable which is a frequency of measure (e.g. number of cases)
 - Examples: histogram, line graph, frequency polygon, scatter diagram

Figure 1. Poisoning deaths involving opioid analgesics, other drugs, and no drugs: United States, 1999–2006



NOTE: Access data table for Figure 1 at http://ftp.cdc.gov/pub/Health_Statistics/NCHS/Publications/Data_Briefs/db022/fig01.xls.

SOURCE: CDC/NCHS, National Vital Statistics System.

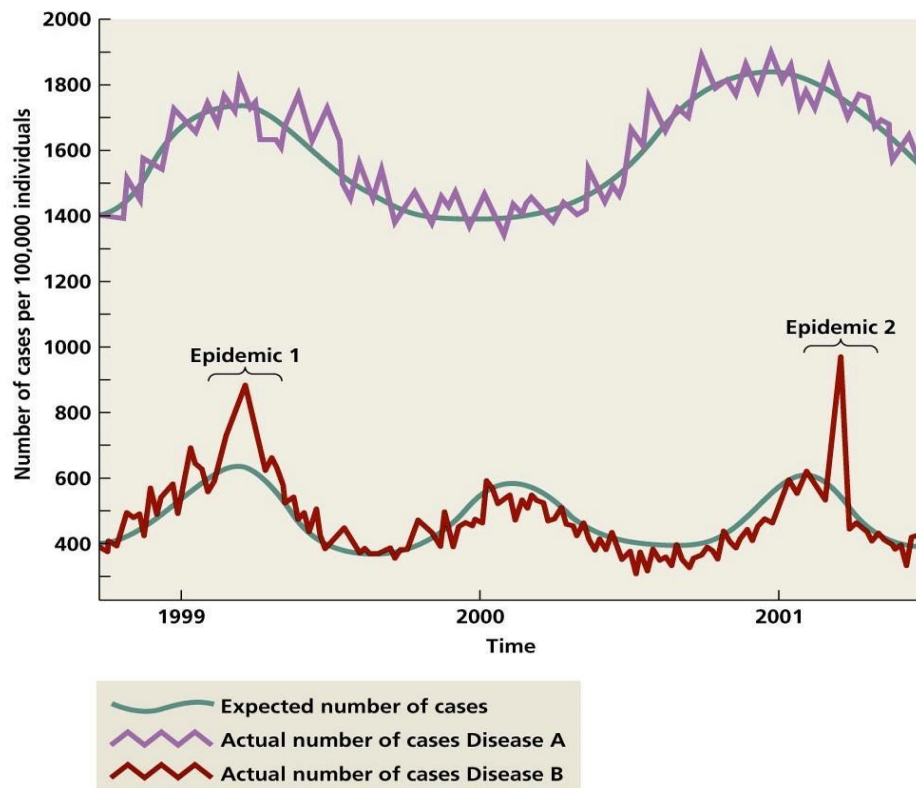
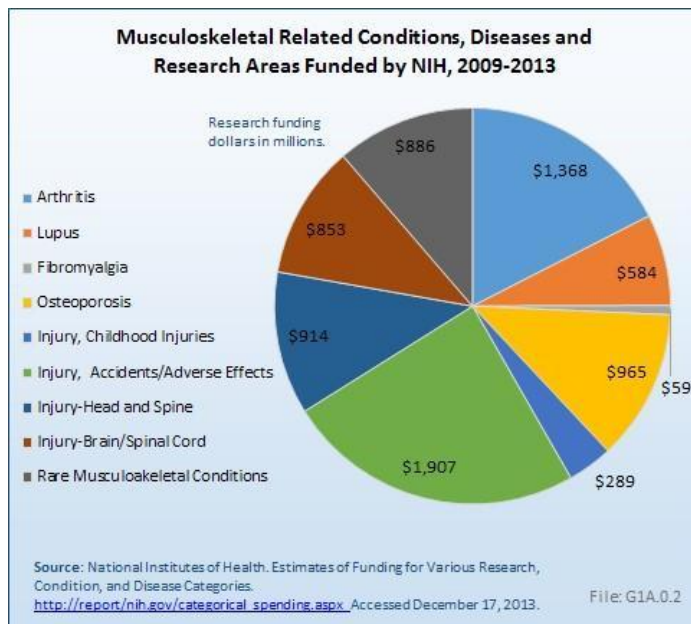
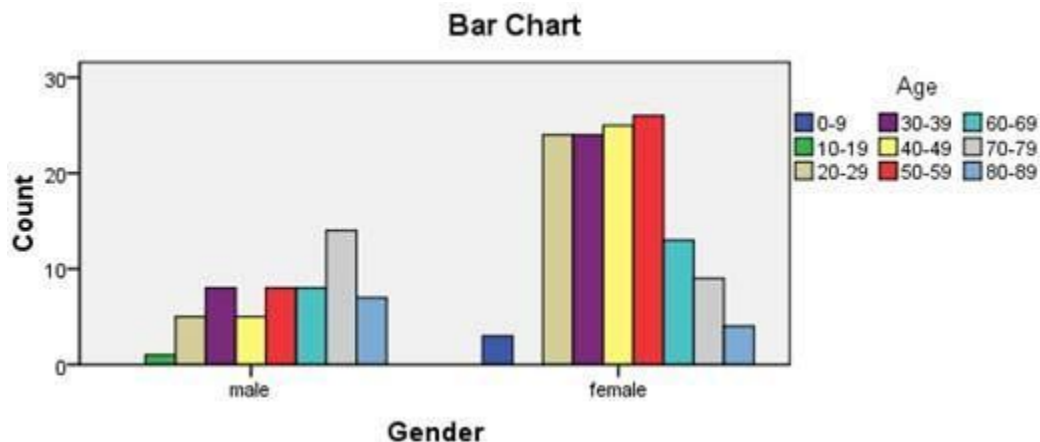


CHART is a method of showing epidemiological data using only one coordinate or a single variable.

- Bar Charts
 - each value or category of variable is represented by a bar
 - length of bar is proportional to number of persons/events in that category
- Pie Charts
 - size of slices show proportional contribution of each component part
 - useful for showing component parts of a single group or variable
 - when comparing components of more than one group or variables use a 100% component bar charts as it is difficult to compare two pies
- Maps (Geographic Coordinate Charts)-show location of events/attributes
 - **Spot Map** - shows where an event took place or a disease condition exists - useful for showing geographic distributions - does not take into consideration size of population at risk therefore, does not show risk of the event occurring in a particular place
 - **Area Map** (Choropleth Map) - display events or rates geographically



PANDEMIC



Measures of Disease Frequency – Prevalence and Incidence

- o **prevalence** of an event refers to the **total number of existing cases** at a point in time.
- o The prevalence of a disease or health-related condition is useful for those in the health professions who must deliver services to the public in the form of medicine, hospital beds or medical equipment so enough equipment is available.
- o **incidence** of a health event refers to **the number of new cases** during a certain time period.
- o Epidemiologists will use incidence to help understand risk factors and determine sources and causes of disease or injuries by measuring different variables in relation to the new cases.

$$\text{Incidence rate} = \frac{\text{\# of new cases of disease during a specific time period}}{\text{\# of people at risk}}$$

$$\text{Prevalence} = \frac{\text{Total \# of cases (old \& new)}}{\text{\# of people at risk}}$$

Epidemiological measures include:

- o **counts** – absolute number of persons who have a disease or characteristic of interest
- o **risk** - The probability that an individual will be affected by, or die from, an illness or injury within a stated time or age span.
- o **rate** – number of cases occurring *during a specific period*; always dependent on the size of the population during that period.

$$\text{Rate (\%)} = \frac{\text{number of cases}}{\text{population at risk}} \times 100$$

- o **ratio** – value obtained by dividing one quantity by another – a ratio often compares two rates.

$$\frac{\text{Number or rate of events, items, persons, etc. in one group}}{\text{Number or rate of events, items, persons, etc. in another group}}$$

- o **proportion** – the comparison of a part to the whole as the number of cases divided by the total population – *does not have a time dimension*, It can be expressed as a decimal, a fraction, or a percentage

$$\frac{\text{Number of persons or events with a particular characteristic}}{\text{Total number of persons or events, of which the numerator is a subset}} \times 10^n$$

Epidemiology Measures

Occurrence

Association

Incidence
1. Incidence Proportions

Relative (calculated by division)
1. Risk Ratio

Measure of Risk using Percentage, Ratios, Proportions and Rates as birth, mortality

Epidemiologic Measures Categorized as Ratio, Proportion, or Rate

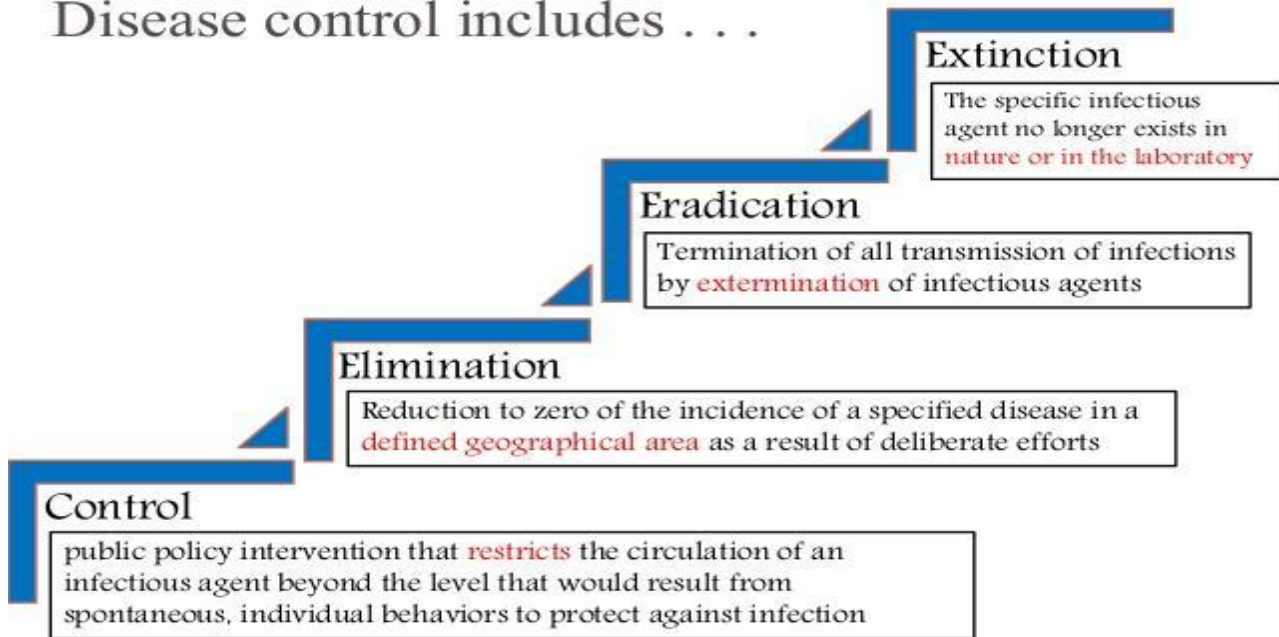
Condition	Ratio	Proportion	Rate
Morbidity (Disease)	Risk ratio	Attack rate	Person-time incidence rate
	(Relative risk)	Incidence proportion)	
	Rate ratio	Secondary attack rate	
	Odds ratio	Point prevalence	
	Period prevalence	Attributable proportion	
Mortality (Death)	Death-to-case ratio	Proportionate mortality	Crude mortality rate
			Case-fatality rate
			Cause-specific mortality rate
			Age-specific mortality rate
			Maternal mortality rate
			Infant mortality rate
Natality (Birth)			Crude birth rate
			Crude fertility rate

Control vs. Prevention Strategies

CONTROLLING INFECTION AND DISEASE

- Eliminating the agent by using antibiotic or other medications
- Strengthening the immune system of the host by immunizations
- Eliminating the possible vectors – as reducing the mosquito populations
- Preventing contamination as by the proper cooking handling, cooking, and storage of food
- Isolating infectious individuals
- Using healthy habits as hand washing, proper sleep, diet, and exercise

Disease control includes . . .



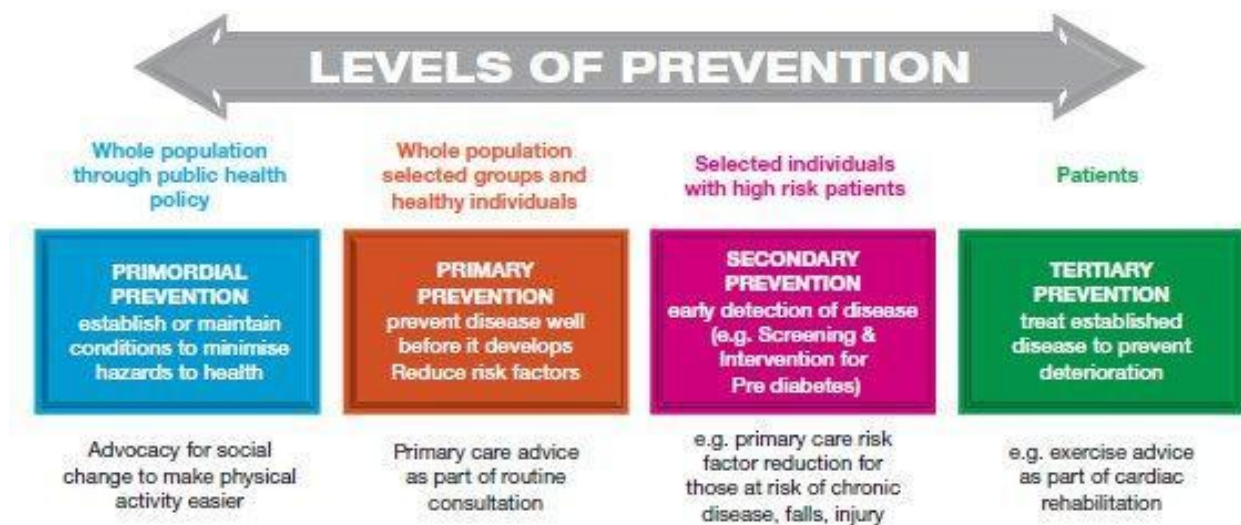
Types of Control Strategies – Breaking the Agent/Host/Environment triad

- Control Methods regarding the Reservoir of Infection
 - o Diagnosis and Treatment
 - o Screening
 - o Isolation
 - o Reporting
 - o Animal reservoirs
- Control Methods regarding the Mode of Transmission
 - o Sanitization, disinfection, sterilization
 - o Water
 - o Food
 - o Other vehicles
 - o Vector control
 - o Handwashing
- Control Methods regarding the Susceptible Host
 - o Vaccination
 - o Chemoprophylaxis – drugs given to exposed and susceptible hosts
 - o Maintaining a healthy life style
 - o Limiting exposure to sources of infection

- o Personal protective equipment

Types of Prevention Strategies

- Level of Prevention
 - o **Primordial** - Measures designed to avoid the development of risk factors in the first place, early in life – example- many adult health problems (e.g. obesity, hypertension) develop in childhood because this is when lifestyles are formed so developing healthy lifestyles is essential.
 - o **Primary** - Promote general health and avoid risk factors for disease – examples include immunization against disease, maintaining a healthy diet and exercise regimen as well as utilizing protective measures to prevent susceptibility and presymptomatic disease
 - o **Secondary** - Early detection and timely treatment – examples include treatment of hypertension to avoid cardiovascular diseases and cancer screening
 - o **Tertiary** -Rehabilitation and prevention of further disease or disability – examples include surgical procedures that halt the spread or progression of disease



Primary Prevention Approaches

Population-Based Approach:

- Preventive measure widely applied to an entire population (public health approach)
- Strive for small absolute change among many persons
- Must be relatively inexpensive and non-invasive

High-Risk Approach:

- Target group of individual at high risk
- Strive for strong risk factor control
- Often times requires clinical action to identify the high risk group and to motivate risk factor control.

Control and Prevention of Communicable Disease

1. **DIAGNOSIS:** It is first step in the control of a disease. The disease should be diagnosed and treated immediately and effectively. This will prevent the spread of an infection.

2. **NOTIFICATION:** As soon as a disease is detected, it should be notified immediately to the local health authority. This helps in taking immediate preventive measures to control the spread of the disease.
3. **ISOLATION:** The infected patient must be isolated in hospital or at home, if hospitalization is not possible. The period of isolation depends on the period of communicability of the disease. Isolation of the infected patient prevents the spread of infection.
4. **TREATMENT:** Treatment should be given to the infected patient and also to the carrier of the infection. Sometimes all the people in the community are treated, even if they do not have the disease. These measures effectively prevent the spread of infection. **Prophylaxis** is treatment given to exposed individuals to prevent illness prior to onset of symptoms.
5. **QUARANTINE:** It means restricting the activities of healthy and normal persons till the incubation period of a disease is over. These healthy persons might have come in contact with the disease without actually suffering from it. So quarantine is necessary to prevent the spread of infection from these persons to others who have not been exposed to the disease. Quarantine is necessary for international travelers who have the possibility of carrying infections. Isolation is the restricting of activities of persons who are ill or who are either convalescent or chronic carriers of an illness until they are no longer able to transmit infection to others.
6. **INVESTIGATION:** The health authorities should conduct field investigation of infected person and also infected areas. Suspected and also infected cases must be confirmed by laboratory tests.
7. **DISINFECTION:** Disinfection of the excreta and articles used by the patient will prevent the spread of infection. Disinfection must be done both when the patient is suffering from the disease and after recovery or death.
8. **BLOCKING OF TRANSMISSION:** Most of the diseases spread through water, air and insect. So adequate measures should be taken to prevent the spread of infection through these channels.
 - o Water borne infections can be prevented by boiling water and also milk.
 - o Air borne infections can be prevented by wearing masks, isolating the patient in a separate room, dust control and disinfection of air.
 - o Vector borne diseases can be prevented by using suitable insecticides.
9. **IMMUNIZATION:** It is a very effective and easy method by which communicable diseases can be prevented. Some diseases which can be effectively controlled by immunization are small pox, poliomyelitis, diphtheria, whooping cough, tetanus, tuberculosis and measles.
10. **HEALTH EDUCATION:** The public should be taught about the importance of maintaining a clean environment, immunization etc. It involves the responsibility of paramedical persons and the co- operation of the public.

Prevention and Control of Non-communicable Diseases

- **Viewing health from a public health perspective**
A public health approach which focuses on population and risk factors rather than on individuals' symptoms or diseases is important to achieve the goal of promoting health and preventing diseases, addressing the underlying factors that determine health, and increasing the effectiveness and efficiency of healthcare system.
- **Understanding health determinants**
Health determinants cover people's genetic predisposition, lifestyles and other behavioral factors, social relationships with families, friends and community, and the powerful forces of the general socio-economic and cultural environment where they learn, play, work and live.
- **Describing cluster of risk factors**
Many of NCD diseases share common behavioral risk factors. For example, four of the most important NCD - diseases of the circulatory system, cancer, chronic respiratory diseases, and diabetes mellitus - share three major behavioral risk factors, namely smoking, physical inactivity and unhealthy diet, which are mediated through common biomedical risk factors, notably excess weight, hypertension and adverse lipid profile. Alcohol misuse also contributes to the health burden of cancer, heart diseases and injuries and poisoning
- **Adopting the life-course approach**
Individuals are influenced by factors acting at all stages of the life span and the risk of developing NCD accumulates with age. It is important to secure growth and development in early life, maintain the highest possible level of function in adult life as well as maintain independence and prevent disability in older life.
- **Identifying preventive strategy**
Using the 4 levels of prevention (Primordial, Primary, Secondary and Tertiary Prevention) is key to NCD prevention and health promotion.
- **Balancing population-wide versus individual-based approaches**
A population-wide strategy for prevention targets at controlling the determinants of health in the population as a whole while an individual-based (also known as high risk) strategy for prevention identifies high-risk susceptible individuals and offers them some individual protection. The key challenge is to achieve a balance between population-wide and individual-based approaches.
- **Considering health disparity**
Some disparities in health are inevitable because of genetic and biological make-up in individuals, but health disparities are often attributed to differences in personal lifestyle, exposure to material resources and opportunity of receiving healthcare services
- **Recognizing the importance of health literacy and social marketing in communicating health messages**
The health literacy of the whole population needs to be increased. Social marketing, as an effective health promotion method, can motivate people to use health information and change behavior in ways that promote and maintain good health.
- **Setting health priority**
There is never sufficient funding to address all important health problems, so priorities need to be set.

Injury Prevention

The scope of injuries addressed by public health practitioners is broad and includes:

- Falls among the elderly, children and those with limited mobility
- Unintentional poisoning by household chemicals or medication
- Fire and fireworks-related injuries
- Drowning or other water-related injuries in the home or during recreation
- Motor vehicle injuries caused by distracted driving, drunk or other impaired driving
- Intentional violence against children or the elderly, at home, work or school
- Sexual assaults and suicide
- Opioid overdose

Merck One Page Manual for Health

Diet and Nutrition

- Eat less (yes, this means you), particularly less sugars, simple carbohydrates, trans fats, and saturated fats.
- Eat more fruits, vegetables, and whole grains.
- Vary your diet.
- If your medical condition requires a special diet, *follow it*.

Vitamins and Supplements

- If you're a breastfed baby, take vitamin D; if you're a bottle-fed baby, use formula with iron.
- If you're over 50 years old, take calcium and vitamin D.
- If you're pregnant (or thinking of becoming pregnant), take prenatal vitamins.

Substance Use

- Don't smoke (and if you do, *don't* smoke in bed).
- Drink alcohol only in moderation (if that's hard for you, don't drink at all).
- Don't take any drugs that aren't intended to treat a medical problem.

Exercise and Sleep

- Do 30 to 60 minutes of structured exercise (aerobic *and* resistance) that is appropriate for your age and medical condition (fun is good) *at least* 3 times per week.
- Walk more—and take the stairs.
- Keep as regular a sleep schedule as possible.

Infections

- Wash your hands before eating and cooking.
- Store, prepare, and cook foods (particularly meats) appropriately.
- Drink only clean or treated water.
- Practice safe sex.
- Wash minor wounds with soap and water and keep covered.
- Use appropriate clothing and insect repellent when mosquito or tick exposure is likely.
- Don't do intravenous drugs, and if you do, don't share needles.

Injuries and General Safety

- Wear a seatbelt; if you're a child, use a car seat.
- Wear a helmet while riding a bicycle or motorcycle and use other protective gear as appropriate for the activity (recreation or occupation).
- Store and handle firearms safely.
- Follow the accepted safety procedures for your job and recreational activities.
- Don't operate vehicles or power equipment while intoxicated, overly sleepy, or distracted.
- Look before crossing or entering a road, changing lanes, or merging.
- Wear a life vest while boating, don't dive into shallow water, and learn to swim.
- Have working smoke and carbon monoxide detectors in your home.

Mental Health

- Treat others as you would be treated.
- Accept responsibility for your actions; also take responsibility for someone or something besides yourself.
- Make *and keep* friends.
- Act nicer: Don't speak ill to or about others.
- Practice mind-calming techniques (for example, meditation or prayer).
- Don't sweat the small stuff and be sensible about what's small.
- With adversity, change what you can, live with what you can't, and try to know the difference.
- When you do something, do your best (but don't expect more from yourself than your best).
- Do something useful for your family and community.
- Understand that you will die (yes, you) and you will experience pain and loss.

Health Care

- Brush your teeth at least twice a day.
- See a dentist regularly for cleaning and examination.
- See a health care practitioner regularly for age-appropriate and sex-appropriate screening (blood pressure, glucose, and lipid levels; Pap smears, mammograms, and colon cancer screening; prenatal screening) and vaccinations.
- Be cautious about sun exposure and wear sunscreen.
- If something feels wrong physically or mentally, see appropriate practitioners: If you trust them, do what they advise; if you don't trust them, or if what they say seems too good to be true or doesn't make sense, don't ignore the issue, get another opinion.

If you do all of these things but think you need something more, take the time, effort, and money you'd spend looking for a better supplement, diet, or exercise and instead read a book to a child or help those in your community who are in need.

Yours in Good Health,

Robert S. Porter, MD

Editor-in-Chief, The MSD Manuals

Division C – National Challenges

- Using the Agent/Host/Environment information for a given Health-related Event, propose Control and Prevention Strategies ***Div C National***
- Proposing strategies to evaluate the effectiveness of given and control efforts. ***Div C National***