# Preventive medicine

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## Summary

Preventive medicine is the branch of medicine that deals not only with preventing disease from occurring, but also with halting disease progression and averting complications after disease onset. Disease prevention occurs on five levels, with measures ranging from health policies that affect the general population to specific treatments for particular patient groups: primordial prevention (actions that address environmental, socioeconomic, behavioral risk factors; e.g., smoking cessation campaigns), primary prevention (actions that inhibit the occurrence of specific diseases; e.g., immunization), secondary prevention (actions that inhibit the progress of specific diseases at an early stage to prevent or limit complications; e.g., screening), tertiary prevention (actions that inhibit the progress of specific diseases at an advanced stage to prevent or limit complications; e.g., blood pressure management in patients with hypertension), and quartenary prevention (actions that prevent over-medicalization and offer ethically acceptable interventions; e.g., pursuing nonaddictive strategies to managing chronic pain rather than prescribing opioids). One of the greatest challenges to preventive medicine is the "prevention paradox," which states that preventive measures that benefit large populations have little impact on most people (e.g., even without measles immunization, only a relatively small proportion of the population would contract the disease). This leads to the common misconception that preventive measures provide no benefit to the individual as part of a larger population. Another challenge is poor medical adherence, i.e., the extent to which an individual follows prescribed drug regimens and medical advice, especially in patients who do not feel ill and, therefore, perceive the burden of prevention rather than its long-term benefits. Strategies to encourage adherence include a patient-centered approach, frequent follow-ups, and education regarding long-term consequences of medical conditions, behaviors, and lifestyle.

## Public health interventions

Public health interventions are actions and policies introduced by public health authorities to protect and improve the health of a population. Population-based practice focuses on the health concerns of entire populations and intervenes at the individual, community, and systemic levels. [1]

**Population-based public health interventions [1]**

| | Intervention | Examples | | |
|---|---|---|---|---|
| **Category** | | **System-focused** | **Community-focused** | **Individual-focused** |
| **Case finding and epidemiology** | • Surveillance (public health): collection, analysis, and interpretation of data required for planning and evaluation of public health interventions<br>• Outreach: identifying at-risk populations and informing them about prevention, mitigation, and treatment<br>• Case finding: identifying individuals and families with risk factors and providing them with educational | • Establishing protocols during a pandemic for sharing of case reports and incidence data between providers and local health departments | • Creating hotlines during a pandemic to provide information to the general population and assist in mitigation and control measures<br>• Establishing testing centers during a pandemic to identify cases in the community | • Raising awareness during a pandemic and staying vigilant regarding pertinent symptoms in patients and colleagues<br>• Monitoring local incidence and reporting data during health care worker staff meetings |

| Population-based public health interventions [1] | | | | |
|---|---|---|---|---|
| | Intervention | Examples | | |
| Category | | System-focused | Community-focused | Individual-focused |
| | resources and medical referrals<br>• Health event and disease investigation: gathering data on reported threats to population health in order to develop control measures (see "Disease outbreak investigation")<br>• Screening: for identification of asymptomatic or at-risk individuals in a population | | | |
| **Diagnosis and management** | • Referral and follow-up: directing individuals to health care resources and assessing outcomes<br>• Case management: collaborating with individuals and providers to plan, coordinate, and assess care<br>• Delegated functions: entrusting health care tasks to other authorized personnel | • Developing school policies that implement new guidelines for children with asthma | • Coordinating with the local chapter of the American Lung Association to organize regular asthma information events for students and parents | • Creating an individualized management plan for a child recently diagnosed with asthma |
| **Information, education, empowerment** | • Counseling: developing interpersonal rapport to facilitate coping and self-care<br>• Consultation: deliberation between health care workers and/or experts on the diagnosis or treatment in any particular case<br>• Health teaching: educating the public about health-related conditions and behaviors | • Training physicians and midwives on latest research about the risks of alcohol use during pregnancy<br>• Organizing meetings between a health care worker and the staff at a childcare center to develop a protocol to prevent measles outbreaks | • Developing and distributing posters that aim to reduce alcohol use by women at establishments serving alcoholic beverages<br>• Providing safer sex education at schools | • Providing information about the impact of alcohol use on pregnancy for a reproductive health class in high schools<br>• Providing fertility counseling for young couples at a free health clinic |

| Population-based public health interventions [1] | | | | |
|---|---|---|---|---|
| | Intervention | Examples | | |
| Category | | System-focused | Community-focused | Individual-focused |
| Partnerships and networks | • Collaboration: coordinating cooperation between institutions, groups, and/or individuals directed toward a particular health care goal<br>• Community organizing: uniting individuals to identify and develop strategies to solve public health problems<br>• Coalition building: developing alliances among organizations and institutions to solve public health problems | • Collaborating with senior centers to provide screening of older adults for fall risk | • Introducing a home safety checklist on fall prevention to residents of a senior center | • Conducting home visits to the homes of older adults to assess risks and prevent falls |
| Policy development, promotion, and enforcement | • Health advocacy: promoting public health through collaboration with community stakeholders and engagement with policymakers<br>• Social marketing: deploying marketing techniques to positively influence a target audience's health behaviors<br>• Policy development and enforcement: working with decision-makers to develop laws and regulations to protect and promote public health | • Drafting legislation to mitigate certain risk factors, e.g.:<br>  ◦ Cigarette and soda taxes<br>  ◦ Air pollution regulations<br>  ◦ Smoke-free laws<br>  ◦ Alcohol sales bans<br>• Carrying out an anti-bullying social media campaign in a school district | • Providing free health care for persons experiencing homelessness<br>• Organizing fundraising campaigns for orphan disease research | • Providing reproductive health counseling to a sexually-active teenager |

## Primordial prevention

- **Definition**: actions that address environmental, socioeconomic, and behavioral risk factors that affect a population as a whole to prevent potential disease or injury.

- **Measures** [2][3]
  - Target: entire population
  - Health promotion beginning in childhood to encourage positive and discourage negative lifestyle habits
  - Mass education
  - Legislation
- **Examples**
  - Programs on food safety and nutrition guidelines
  - Campaigns discouraging tobacco and drug use (e.g., smoke-free air laws in public buildings)
  - Building bicycle and sidewalks to promote physical activity

Primordial prevention aims to prevent risk factors from developing in the first place, whereas primary prevention targets existing risk factors to prevent the onset of a disease.

## Primary prevention

- **Definition**: actions targeted at **preventing specific diseases** from occurring to decrease the incidence and, subsequently, the prevalence of those diseases
- **Measures** [3][4]
  - Target: entire population and select groups (healthy individuals)
  - Decrease incidence and, in turn, prevalence of a specific disease
  - Primarily done through
    - Health promotion (health interventions, lifestyle modifications)
    - Environmental modifications (e.g., work safety)
    - Specific protection interventions (immunizations, chemoprophylaxis, safety of drugs and food)
- **Examples**
  - Immunization
  - Lifestyle modification (e.g., smoking cessation to reduce lung cancer risk, exercise to reduce the risk of heart disease, dental care to reduce the risk of tooth loss)
  - Fortification of salt with iodine to prevent iodine deficiency
  - Fluoridation of toothpaste, water, and salt to reduce the risk of dental conditions
  - Fortification of food with folic acid to reduce the prevalence of neural tube defects
  - Health legislation (e.g., seat belt laws, food safety standards, traffic laws)
  - Ocular prophylaxis for all newborns to prevent neonatal gonococcal conjunctivitis

**Overview of preventive counseling** [5]

| Condition | Approach | Population | Age group |
|---|---|---|---|
| **Smoking cessation** | • Inquire about tobacco use and recommend cessation if the patient is a smoker.<br>• Discuss consequences of smoking.<br>• Provide information on smoking cessation strategies:<br>  ◦ Nicotine replacement therapy (e.g., gum, patches, sprays, injections)<br>  ◦ Pharmacotherapy (e.g., varenicline, bupropion)<br>  ◦ Behavioral support | • General population<br>• Pregnant individuals | • All age groups |

**Overview of preventive counseling** [5]

| Condition | Approach | Population | Age group |
|---|---|---|---|
| **Cardiovascular risk factors** | • Promote a healthy diet (rich in vegetables, fruit, whole grain, fiber, and protein; low in saturated fats, red meat, alcohol)<br>• Promote physical activity (≥ 150 minutes of moderate-intensity activity or 75 minutes of high-intensity aerobic activity per week) | • Individuals with known cardiovascular risk factors (e.g., high blood pressure, dyslipidemia, metabolic syndrome)<br>• Individuals with an estimated 10-year cardiovascular disease risk of ≥ 7.5% | • All adults |
| **Sexually transmitted diseases (STDs)** | • Provide behavioral counseling to prevent sexually transmitted infections (e.g., counseling, decrease the number of sex partners, promote safer sex practices) | • All sexually active individuals, esp. such who engage in risky sexual behavior (e.g., lack of condom use, multiple sex partners)<br>• Individuals with diagnosis of STD | • General population with onset of puberty (approx. 12 years of age) |
| **Nutrition** | • Inquire about special diets, e.g., vegan diet, vegetarian diet<br>• Provide dietary counseling to ensure a well-planned diet and prevent nutritional deficiencies, including:<br>  ◦ Calcium deficiency: can result in low bone mineral density<br>  ◦ Vitamin D deficiency<br>  ◦ Vitamin $B_{12}$ deficiency<br>  ◦ Iron deficiency<br>• Recommend nutritional supplementation and consumption of fortified foods (e.g., calcium-fortified foods such as soy products, vitamin D-fortified foods such as plant-based milk alternatives, cereal, juices) | • Adolescents and adults<br>• All pregnant women | • All age groups |
| **Substance use** | • Inquire about substance use and misuse of prescription drugs.<br>• Use screening questionnaires<br>• Recommend psychiatric treatment to patients with positive screening results. | • Adolescents and adults<br>• All pregnant women | • General population with onset of puberty (approx. 12 years of age) |

**Pr**imary prevention helps to **Pr**event disease.

## Secondary prevention

- **Definition**: actions targeted at **early detection** of disease in asymptomatic patients (or while the symptoms of the condition are still mild) to promote **early intervention**
- **Measures** [3]
  - Target: patient groups

- Prevent further progression and complications from the disease
- Consists of a two-step process: screening test to identify disease and **follow-up** for disease management

The screening recommendations covered below are primarily based on the United States Preventive Services Task Force (USPSTF) unless stated otherwise.

Screening complements diagnostics, but it is not a substitute.

**Se**condary prevention helps **Sc**reen.

## Screening recommendations for women by age

- For screening tests in pregnant women, see "Prenatal care."
- For screening tests in transgender individuals, see: "Preventive health care of transgender individuals."

**Screening recommendations for nonpregnant women by age** [5][6][7]

| Age group | Domain | | | |
|---|---|---|---|---|
| | **Cardiovascular** | **Malignancy** | **Infection** | **Other** |
| **18–45 years** | • Hypertension<br>• Hyperlipidemia in women:<br>  ◦ < 40 years of age with risk factors for ASCVD<br>  ◦ ≥ 40 years of age | • **Cervical cancer**: women aged ≥ 21 years | • HIV<br>• Hepatitis B: women with risk factors for HBV infection<br>• Hepatitis C<br>• Syphilis: women with risk factors for syphilis<br>• Chlamydia/gonorrhea:<br>  ◦ ≤ 24 years: all sexually active women<br>  ◦ > 24 years: sexually active women with risk factors for STDs | • Depression<br>• Diabetes mellitus<br>  ◦ Asymptomatic women with both<br>  ▪ Overweight or obesity<br>  ▪ ≥ 1 additional risk factor for T2DM<br>  ◦ History of prediabetes<br>  ◦ Women with HIV<br>• Intimate partner violence: women of reproductive age |
| **45–50 years** | • Hypertension<br>• Hyperlipidemia | • Cervical cancer<br>• Breast cancer: based on shared decision-making<br>• Colorectal cancer | • HIV<br>• Hepatitis B: women with risk factors for HBV infection<br>• Hepatitis C<br>• Syphilis: women with risk factors for syphilis<br>• Chlamydia/gonorrhea: sexually active women with risk factors for STDs | • Depression<br>• Diabetes mellitus<br>• Osteoporosis: women with risk factors for osteoporosis |

**Screening recommendations for nonpregnant women by age** [5][6][7]

| Age group | Domain | | | |
|---|---|---|---|---|
| | Cardiovascular | Malignancy | Infection | Other |
| 50–55 years | | • Cervical cancer<br>• **Breast cancer**<br>• Colorectal cancer<br>• Lung cancer: women with a ≥ 20 pack-year smoking history who either still smoke or quit within the last 15 years | | |
| 55–60 years | | | | |
| 60–65 years | | | | |
| 65–70 years | • Hypertension<br>• Hyperlipidemia<br>• Abdominal aortic aneurysm in women with: [8][9]<br>  ◦ History of smoking [8][9]<br>  ◦ Positive family history in a first-degree relative [8][9] | • Cervical cancer<br>• Breast cancer<br>• Colorectal cancer<br>• Lung cancer: women with a ≥ 20 pack-year smoking history who either still smoke or quit within the last 15 years | • Hepatitis B: women with risk factors for HBV infection<br>• Hepatitis C<br>• Syphilis: women with risk factors for syphilis<br>• Chlamydia/gonorrhea: sexually active women with risk factors for STDs | • **Osteoporosis**<br>• Depression<br>• Diabetes mellitus |
| 70–75 years | | | | |
| 75–80 years | • Hypertension | • Lung cancer: women with a ≥ 20 pack-year smoking history who either still smoke or quit within the last 15 years | | |

## Screening recommendations for men by age

For screening tests in transgender individuals, see: "Preventive health care of transgender individuals."

**Screening recommendations for men by age** [5][6][7]

| Age group | Domain | | | |
|---|---|---|---|---|
| | Cardiovascular | Malignancy | Infection | Other |
| 18–45 years | • Hypertension | • None | • HIV | • Diabetes mellitus<br>  ◦ Asymptomatic men with both of |

**Screening recommendations for men by age** [5][6][7]

| Age group | Domain | | | |
|---|---|---|---|---|
| | **Cardiovascular** | **Malignancy** | **Infection** | **Other** |
| | • Hyperlipidemia in men:<br>  ◦ < 40 years of age with risk factors for ASCVD<br>  ◦ ≥ 40 years of age | | • Hepatitis B: men with risk factors for HBV infection<br>• Hepatitis C<br>• Syphilis: men with risk factors for syphilis | the following:<br>  ▪ Overweight or obesity<br>  ▪ ≥ 1 additional risk factor for T2DM<br>  ◦ History of prediabetes<br>  ◦ Men with HIV |
| **45–50 years** | • Hypertension<br>• Hyperlipidemia | • Colorectal cancer | | • Depression<br>• Diabetes mellitus |
| **50–55 years** | | • Colorectal cancer<br>• Lung cancer: men with a ≥ 20 pack-year smoking history who either still smoke or quit within the last 15 years | | |
| **55–60 years** | | | | |
| **60–65 years** | | | | |
| **65–70 years** | • Hypertension<br>• Hyperlipidemia<br>• **Abdominal aortic aneurysm** in:<br>  ◦ Ever smokers<br>  ◦ Positive family history in a first-degree relative [8][9] | | | |
| **70–75 years** | | | • Hepatitis B: men with risk factors for HBV infection<br>• Hepatitis C<br>• Syphilis: men with risk factors for syphilis | |
| **75–80 years** | • Hypertension | • Lung cancer: men with a ≥ 20 pack-year smoking history who either still smoke or quit within the last 15 years | | |

## Screening for cardiovascular disorders

**Screening for cardiovascular disorders** [5]

| Condition | Test | Population group | Age group | Frequency |
|---|---|---|---|---|
| **Hypertension** | • Blood pressure measurement | • General population | • ≥ 18 years | • Every 3–5 years |
| | | • Individuals at high risk for hypertension (e.g., patients with high to normal blood pressure or obesity) | • **≥ 40 years** | • **Every 1–2 years** |

| Screening for cardiovascular disorders [5] | | | | |
|---|---|---|---|---|
| **Condition** | **Test** | **Population group** | **Age group** | **Frequency** |
| **Hyperlipidemia** [6] | • Lipid panel | • General population | • **40–75 years** | • Every 5 years |
| | | • Patients with a family history of premature ASCVD or familial hypercholesterolemia | • 20-39 years | • No specific recommendation |
| **Abdominal aortic aneurysm** [9] | • Ultrasonography | • Male ever smokers | • **65–75 years** | • **Once** |

## Screening for endocrinological disorders

| Screening for endocrinological disorders [5][7] | | | | |
|---|---|---|---|---|
| **Condition** | **Test** | **Population group** | **Age group** | **Frequency** |
| **Diabetes mellitus** | • Any of the following:<br>◦ Fasting plasma glucose<br>◦ Oral glucose tolerance test (OGTT)<br>◦ Hemoglobin A1C | • General population | • **> 45 years** | • Every 3 years |
| | | • Asymptomatic individuals with both :<br>◦ Overweight or obesity<br>◦ AND ≥ 1 additional risk factor for T2DM<br>• Women with a history of gestational diabetes | • < 45 years | |
| | | • Asymptomatic individuals with a history of prediabetes or gestational diabetes | • All age groups | • Annual |
| | | • Individuals with HIV | • All age groups | • Before and 3–6 months after initiating or switching antiretroviral therapy, then annually if results remain normal |
| | • Either of the following approaches:<br>◦ OGTT<br>◦ Oral glucose challenge test (OGCT) followed by confirmatory OGTT | • Pregnant women (gestational diabetes mellitus) | • N/A | • Once at ≥ 24 weeks' gestation |

| Screening for endocrinological disorders [5][7] | | | | |
|---|---|---|---|---|
| **Condition** | **Test** | **Population group** | **Age group** | **Frequency** |
| **Osteoporosis** | • DXA | • All women | • **≥ 65 years** | • Once |
| | | • Women with risk factors for osteoporosis as determined by a clinical risk assessment tool (e.g., FRAX) | • < 65 years | • No specific recommendation |

## Screening for cancer

| Screening for cancer [5][10] | | | | |
|---|---|---|---|---|
| **Condition** | **Test** | **Population group** | **Age group** | **Frequency** |
| **Colorectal cancer** | • Colonoscopy | • **General population** | • **45–75 years** | • **Every 10 years** |
| | | • Individuals with inflammatory bowel disease (IBD) | • All age groups, beginning 8 years after the onset of IBD or at the time of diagnosis of primary sclerosing cholangitis | • Every 1–2 years |
| | | • Individuals with familial adenomatous polyposis (FAP) | • > 10 years | • Annual |
| | | • Individuals with Lynch syndrome (HNPCC) | • > 20 years | • Every 1–2 years |
| | • CT colonography | • General population | • 45–75 years | • Every 5 years |
| | • Flexible sigmoidoscopy | • General population | • 45–75 years | • Every 5 years<br>• Every 10 years with an annual immunochemical fecal occult blood test |
| | • Fecal occult blood test | • General population | • 45–75 years | • Annual |
| **Breast cancer** [11][12][13] | • Mammography | • Women | • 40–49 years: based on shared decision-making<br>• **50–74 years** | • Every 2 years |

| Screening for cancer [5][10] | | | | |
|---|---|---|---|---|
| **Condition** | **Test** | **Population group** | **Age group** | **Frequency** |
| | • MRI | • Individuals with BRCA mutations | • ≥ 25 years | • Annual |
| | • MRI and mammography | • Individuals with BRCA mutations | • ≥ 30 years | • Annual |
| **Lung cancer** | • Low dose chest CT scan | • Individuals with a ≥ 20 pack-year smoking history who either still smoke or quit within the last 15 years | • 50–80 years | • Annually for up to 3 years |
| **Cervical cancer** | • **Pap smear** | • Women | • **21–65 years** | • **Every 3 years** |
| | • Primary HPV test | • Women | • 30–65 years | • Every 5 years |
| | • HPV/Pap cotest | • Women | • 30–65 years | • Every 5 years |

## Screening for infectious diseases

| Screening for infectious diseases [5][14] | | | | |
|---|---|---|---|---|
| **Condition** | **Test** | **Population group** | **Age group** | **Frequency** |
| **HIV** [15] | • Antigen/antibody immunoassay | • General population | • 13–65 years | • Once |
| | | • Individuals at risk of HIV | • All ages | • Annual |
| | | • Pregnant women | • N/A | • First prenatal visit<br>• High-risk patients: again in the third trimester |
| **Hepatitis B** | • Hepatitis B surface antigen | • Individuals at risk of HBV infection | • Adolescents and adults | • No specific recommendation |
| | | • Pregnant women | • N/A | • First prenatal visit |
| **Hepatitis C** | • Anti–HCV antibody | • All adults | • < 80 years | • Once<br>• Regular screening for individuals at high risk |

| Screening for infectious diseases [5][14] | | | | |
|---|---|---|---|---|
| **Condition** | **Test** | **Population group** | **Age group** | **Frequency** |
| | | • Pregnant women | • N/A | • First prenatal visit |
| **STDs** | • Chlamydia/gonorrhea testing | • All sexually active women | • ≤ 24 years | • New or persistent risk factors |
| | | • Sexually active women with risk factors for STDs | • > 24 years | |
| | | • Pregnant women | • N/A | • First prenatal visit |
| | • Syphilis testing | • Sexually active individuals with risk factors for syphilis | • All age groups | • Every 3 months |
| | | • Pregnant women | • N/A | • First prenatal visit |
| **Asymptomatic bacteriuria** | • Urine culture | • Pregnant women | • N/A | • First prenatal visit |

## Other screenings

| Overview [5][10] | | | | |
|---|---|---|---|---|
| **Condition** | **Test** | **Population group** | **Age group** | **Frequency** |
| **Rh incompatibility** | • Rh blood typing and antibody | • Pregnant women | • All age groups | • First prenatal visit<br>• Repeat at 24–28 weeks gestation if the initial screening result was Rh-positive. |
| **Major depressive disorder** | • Validated screening tools (e.g., Patient Health Questionnaire, Beck Depression Inventory) | • Adolescents | • 12–18 years | • Annual |
| | | • General adult population (including pregnant and postpartum women) | • All age groups | • No specific recommendation; at least once |
| **Amblyopia** | • Vision test | • Children | • 3–5 years | • Once |

| Overview [5][10] | | | | |
|---|---|---|---|---|
| **Condition** | **Test** | **Population group** | **Age group** | **Frequency** |
| **Intimate partner violence** | • Validated screening tools (e.g., HARK screening tool, HITS screening tool, STaT questions, Partner Violence Screen, Women Abuse Screening Tool) | • All women of reproductive age<br>• There are no specific recommendations on screening for other population groups. | | • No specific recommendation |

## Tertiary prevention

- **Definition**: actions taken to optimize care of patients with an existing disease to improve well-being and **prevent complications**
- **Measures** [3]
  - Target: select patient groups
  - Decrease the risk of relapse
  - Decrease morbidity and mortality after the onset of symptoms (e.g., implement strategies to improve treatment adherence)
- **Examples**
  - Adjuvant therapy (e.g., tamoxifen in breast cancer) to reduce risk of cancer recurrence
  - Blood pressure management (e.g., antihypertensives) to decrease risk of a cardiovascular event
  - Diabetes management (e.g., antidiabetic medication, $HbA_{1c}$ monitoring) to decrease risk of chronic kidney disease and/or cardiovascular events
  - Measures to prevent restenosis following myocardial infarction (e.g., low-dose aspirin)

**T**ertiary prevention helps **T**reat.

## Quaternary prevention

- **Definition**: actions taken to **avoid unnecessary medical interventions** by identifying actions that might cause harm rather than benefit patients
- **Measures** [3][16][17]
  - Target: patient groups
  - Prevent overmedicalization (e.g., overdiagnosis, overtreatment)
  - Avoid unnecessary diagnostic studies or treatments without proven efficacy (e.g., only offer ethically acceptable interventions, use treatments previously assessed by randomized controlled trial with low risk of bias)
  - Avoid disease mongering, i.e., widening the definition of certain medical illnesses, to expand markets for those who deliver and/or sell medical treatments.
- **Examples** [18]
  - Avoid hormone replacement therapy after menopause in order to reduce risk of cardiovascular events (e.g., stroke, thromboembolism).
  - Avoid prescribing antibiotics if uncertain that the disease has a bacterial cause (may lead to antibiotic resistance).
  - Discontinue oral antidiabetic medication (e.g., sulfonylureas) due to adverse effects (e.g., multiple hypoglycemic events).
  - Avoid overdiagnosis (e.g., recurrent PSA testing in men without high risk for prostate cancer, MRI or CT scan for lower back pain of < 6 weeks duration or without red flags).

**QU**aternary prevention helps s**QU**eeze out unnecessary treatments.

## Prevention paradox

- **Definition** [19][20]
  - A preventive measure that benefits a population as a whole will offer little benefit to each individual member of that population (population approach to prevention; primordial and primary prevention)
  - A preventive measure that benefits a group of individuals susceptible to a particular disease will offer little benefit to the population as a whole (high-risk approach to prevention; secondary and tertiary prevention).
  - The high-risk approach and the population approach to prevention are complementary, but preventive medicine should prioritize preventing the underlying causes of disease (primordial and primary prevention) over reducing the impact of disease after it occurs (secondary and tertiary prevention).
  - The prevention paradox may lead to the misconception that a measure that provides no immediate benefit to the individual, provides no benefit to the entire population and that a small risk involved in a measure (e.g., vaccination) outweighs the benefits of that measure.
    - Misconceptions derived from the prevention paradox may negatively affect epidemiological policy as well as adherence in the population.
    - Primordial and primary prevention require consistent, long-term education programs for health care professionals as well as the general population to be effective.
- **Examples**
  - While heavy drinking carries a greater risk than moderate drinking, moderate drinking has a greater negative impact on the general population because the number of moderate drinkers is greater than that of heavy drinkers.
  - Seatbelt laws have prevented many severe injuries, yet the overall risk of dying in an accident due to not wearing a seatbelt is still low.

## Disease outbreak investigation

- **Definitions**
  - Disease cluster: an unusual aggregation, real or perceived, of cases of a disease that are grouped together in time and space
  - Disease outbreak: the sudden occurrence of more cases of a disease than expected in a given area, population, and/or season
- **Indentifying outbreaks**
  - Outbreaks are identified by health authorities through reports that may come from hospitals, laboratories, health care providers, and even the general population.
  - After receiving an initial report, health authorities decide on whether to investigate further.
- **Investigating outbreaks**
  - Field investigation involves identifying a potential disease outbreak, forming a hypothesis about its cause, gathering data to test the hypothesis, and finally, developing and implementing control and prevention measures.
  - Steps of the field investigation usually include:
    - Preparing for the investigation
      - Gathering information about the condition, area, and/or population of interest
      - Organizing a team and necessary supplies
    - Confirming the outbreak
    - Establishing a case definition
    - Finding cases and documenting details of each case
    - Developing a hypothesis about the cause of the outbreak
    - Analyzing the gathered data and evaluating the hypothesis
    - Comparing and reconciling with laboratory and/or environmental studies
    - Developing and implementing control and prevention measures
    - Initiating or maintaining surveillance.
    - Communicating the findings to the public

## School health policies

- The Whole School, Whole Community, Whole Child (WSCC) model is a student-centered framework developed by the CDC for addressing health in schools.
- WSCC consists of ten components:
  - Physical education and physical activity
    - Physical activity recommendations are outlined in the Comprehensive School Physical Activity Program, which consists of five components: physical education, physical activity during school, physical activity before and after school, staff involvement, and family and community engagement.
    - Physical education is an academic subject for all K-12 students, which helps to develop motor skills, knowledge, and behaviors for a healthy lifestyle.
  - Nutrition environment and services
    - Food provided to students must meet the Nutrition Standards for School Meals issued by the USDA.
    - Free drinking water must be available to all students throughout the day.
    - The National School Lunch and Breakfast Programs provide nutritious, low-cost or free meals to children each school day.
  - Health education: Integration of health education into the curriculum involves addressing topics such as nutrition, mental health, sexual health, violence prevention, and the use of alcohol, tobacco, and other substances in a variety of subjects and educational settings.
  - Social and emotional climate: A positive emotional climate is essential for proper child development and should be maintained in all aspects of school functioning.
  - Physical environment: School buildings and surrounding environment should be safe from any health threat (e.g., traffic, crime, construction, improper ventilation).
  - Health services: Services from qualified health professionals (e.g., nurses, physicians, physician assistants) should be available to all students.
  - Counseling, psychological, and social services: prevention and intervention to support the mental, behavioral, and social health of students (i.e., with certified school counselors, school psychologists, and school social workers)
  - Employee wellness: School employees should have access to programs, policies, and benefits that promote their health and well-being.
  - Community involvement: partnerships with local groups, organizations, and businesses to encourage students' civic engagement and to share school resources (e.g., school-based health centers and sports facilities) with the community
  - Family engagement: continuous involvement of students' families in educational activities and development