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## Review Article



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## Acute diseases: An epidemiologic perspective

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### ABSTRACT

Many underdeveloped countries still struggle with the public health issue of acute illnesses, especially with the emergence of injuries as a major category of acute diseases. Control of the acute disease is challenging particularly when it occurs as an outbreak, either in isolation or as part of a wider epidemic. This narrative review summarizes the definition, epidemiologic transition, pattern and modes of spread, classification, epidemiologic measures, community burden, prevention, control, and future challenges of acute disease. This review is to provide a reference for epidemiologists, clinicians, researchers, and policymakers.

**KEYWORDS:** Acute disease; Spread; Transition; Classification; Burden

### 1. Introduction

Acute (relatively severe disorder with an abrupt onset and brief symptom duration) and chronic (less severe but lasts for long periods even a lifetime) diseases are the two main categories of illnesses. Acute disease ends in complete recovery or passes into a chronic phase or death[1-6].

Acute diseases are still a public health problem in many developing nations, especially with emergence of acute injuries and re-emerging of old infectious diseases. Acute diseases gained more interest, especially after the emergence of acute COVID-19 pandemic[7]. The control of acute diseases is challenging particularly when it occurs as an outbreak, either in isolation or as part of a wider pandemic. Although acute diseases are not a specific goal or target of Millennium Development Goals, most of the Goal 3 Targets

contribute to prevention and control of these diseases, *e.g.* by 2030, eliminate all preventable infant and young child deaths, as well as AIDS, tuberculosis, and malaria epidemics; combat hepatitis, water-borne illnesses, and other communicable diseases; and reduce by half the number of global traffic-related fatalities and injuries as well as the number of illnesses and fatalities brought on by hazardous chemicals and air pollution[8-10].

### 2. Methods

In this narrative literature review, we searched PubMed and Google Scholar for complete texts of papers published in English. The keywords used included acute disease and acute illness in combination with definition, epidemiologic transition, pattern of spread, modes of spread, classification, epidemiologic measures, community burden, prevention, control, and future challenges. All retrieved literature was screened for inclusion in the review. Also, standard textbooks of epidemiology were screened for the relevant heading of the review. We included the most relevant and recent publications. It is not necessary to include all articles in the narrative review on a topic[11].

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### 3. Definition

There is currently no universally applicable definition of acute illness. There is a lot of variety in how the phrase “acute sickness” is used among professional communities (such as those in medicine, public health, academia, and policy). When a disease’s course lasts three months or less, the term “acute” is frequently used, particularly in the context of acute discomfort. According to some academics, acute illness is a short-term condition that usually goes away within six months. Acute diseases differ in severity *e.g.* acute flu does not compare with rabies[12-15].

Hypothetically, acute and chronic are the opposites of a spectrum[2]. In reality, there may be one or more of the following events that contribute to the relationship between acute and chronic illnesses: 1) a patient is admitted with an acute exacerbation of a chronic illness, such as pneumonia in a patient with chronic renal failure[16]; 2) a patient is admitted with acute disease and one or more unrelated chronic illnesses; and 3) a combination of acute and chronic illnesses, such as mild acute and chronic diseases, severe acute and mild chronic diseases, severe chronic and mild acute diseases, and severe acute and chronic diseases[17]. Table 1 summarizes the differences between acute and chronic diseases[18-20].

There are some related terms to be mentioned:

Subacute disease is a vaguely defined term that is not acute, the symptoms of which are midway between acute and chronic disease, they are less severe yet last longer than those of an acute condition. It is slow but persistent *e.g.* subacute bacterial endocarditis, or subacute sclerosing panencephalitis[21-23].

Peracute disease: Very acute, very severe, fulminant, or violent disease. Peracute disease has a very short duration, is quickly fatal,

or results in sudden death, *e.g.* sudden infant death syndrome. Peracute is not to be confused with preacute (before)[24].

Acute medicine is a branch of internal medicine and emergency care that deals with the prompt and early therapy of emergency cases by specialists[25].

Acute care is the early and specialized management of patients with a variety of medical disorders requiring emergency care often within 48 hours[26].

Acute hospitals or acute medical units are concerned with short-term medical and/or surgical treatment and care. Long-term conditions are increasingly being addressed mostly in community settings[26].

### 4. Epidemiological transition

In the late 19th and early 20th centuries, epidemiology focused on lethal acute infectious diseases as the main causes of morbidity and death. Chronic diseases replaced acute ones in the second part of the 20th century. This is known as the epidemiologic transition[27,28].

Since recent years, the predominant types of sickness seen in primary care have moved from mostly acute illness to chronic progressive illness, frequently with comorbidity. With chronic disorders like mental illness becoming more common in a wealthy societies, their significance in developing countries is rising. Hamilton[29] & Omran[30] described three phases of the epidemiologic transition: 1) The age of pestilence and famine (very high morbidity and mortality rates with very low life expectancy due to hunger, wars, epidemics of infectious diseases); 2) The age of receding pandemics (progressive decline in morbidity and

**Table 1.** Differences between acute and chronic diseases (modified after [18-20]).

Items	Acute disease	Chronic disease
Definition	A disorder or condition with rapid onsets and short duration	A disorder or condition with gradual onsets and long duration
Onset/Appearance	Very sudden (rapid or recent) and worsen over a short period	Gradual. May not appear for a long time
Duration	Short-term (a few days to a week or two), some progress to chronicity	Long-term, usually six weeks or more, often months or years, even indefinite duration
Causes	Identified, mostly infectious agents. Sometimes non-infectious	Usually uncertain. Unhealthy diet and lifestyle increase risk
Effects	Usually short-term, rarely long-term harmful health effects	Usually have long-term health effects
Relapse	Rare	Multiple periods of relapse during illness
Symptoms	Differ according to the nature of the disease	Might overlap, commonly weight loss, shortness of breath, and confusion
Accurate diagnostic tests	Available for most diseases. Diagnosis is usually binary (yes or no)	Not available for most diseases. Diagnosis has an ambiguous place within a spectrum
Complete cure	Usual by appropriate therapy (return to normal life)	Rare. Medication slows progression
Complications	Less common, mostly complete recovery	More common, complete recovery is rare
Specific prevention	Vaccines and chemoprophylaxis are available for some diseases	Modification of behavior, lifestyle, and dietary habits
Caregiver	Physician dominant, patient passive	Team care (physician and patients self-management)
Future uncertainty	Rare	Common
Morbidity measures	Incidence or attack rates	Incidence and prevalence rates
Example	-Infectious: Rabies, cholera, hepatitis A; -Non-infectious: Burns, cardiac attack	-Infectious: Tuberculosis, leprosy -Non-infectious: Cancer, arthritis, hypertension, diabetes mellitus

mortality rates with an increase in life expectancy due to sanitation, urbanization, and scientific and medical advances); 3) The age of degenerative and man-made diseases (morbidity and mortality rates continue to decline and life expectancy rises even more)[31]. The majority of appointments in general practice nowadays are for exacerbations of chronic diseases, with acute infectious illness making up a relatively minor part of such consultations[32]. However, the success of control of infectious diseases was not maintained even in the developed world. Due to emerging or new diseases (*e.g.* HIV, hepatitis C, COVID-19, monkeypox) and re-emerging diseases (*e.g.* tuberculosis, malaria)[33,34]. There is a double burden of chronic diseases that are emerging and ancient acute infectious diseases in many low- and middle-income nations[35].

## 5. Epidemiological pattern of spread

Acute diseases have different epidemiologic patterns of spread:

### 5.1. Individual cases

Acute diseases attack human beings individually (single patient) here and there with different types of symptoms due to exposure to some causes *e.g.* micro-organisms, extremes of temperature, and chemical leakage[36]. Local surveillance relies on notification of individual cases of disease. In some rare diseases, one case is sufficient to justify an epidemiologic inquiry (*e.g.*, rabies, plague, polio)[37].

### 5.2. Sporadic cases

Due to climatic effects and harmful substances, acute disease arises seldom and erratically and occasionally attacks multiple people at once (non-epidemiologically related)[36,37].

### 5.3. Diseases clustering

The term “cluster” refers to an extremely high occurrence of a relatively uncommon disease (either infectious or non-infectious) or event within a specific geographic area or time frame, which is frequently thought to be caused by exposure to environmental factors[37-39].

### 5.4. Endemic diseases

These diseases are always present in society and attack a large number of people. These diseases are usually infectious[36]. The quantity of a particular disease that is regularly present in a location is known as the baseline or endemic level of the disease. Hyperendemic refers to persistent, high levels of disease[37].

### 5.5. Epidemic disease

Epidemic disease describes a spike, frequently abrupt, in the number of instances of a disease above what is typically anticipated in that population and that area[5,37]. The cause is usually infectious due to mass gatherings with poor sanitation and natural disasters like earthquakes and famines[36]. When an agent and susceptible hosts are both present in sufficient numbers and the agent can successfully spread from a source to the susceptible hosts, epidemics will ensue[37].

### 5.6. Outbreak

The terms “outbreak” and “epidemic” are interchangeable; however, an outbreak is frequently used to refer to a smaller geographic region or closed community. Surveillance data that show an increase in reported cases or an unusual clustering of cases by time and location can be regularly and promptly analyzed to identify outbreaks[5,37].

### 5.7. Pandemic

Pandemic is an epidemic that has spread across numerous continents or countries and typically affects a lot of people[5,37,40].

### 5.8. Syndemic

A syndemic is the accumulation of two or more concurrent or succeeding epidemics or disease clusters in a defined population with biological interactions that worsen the prognosis and burden of disease and are triggered by changes in socioeconomic, environmental, cultural, and/or political factors over time[41,42]. A recent example is COVID-19 syndemic. COVID-19 pandemic is combined with the non-communicable diseases epidemic as both inter-acting on backgrounds of inequality and poverty[43].

## 6. Modes of spread of acute diseases

All non-communicable acute diseases are non-transmissible (not spread from source to susceptible host). Not all infectious diseases are communicable, even though all acute communicable diseases are infectious *e.g.* tetanus[5]. Acute infectious diseases have several modes of transmission: 1) direct contact through kissing, skin-to-skin contact, sexual contact, contact with soil or droplet spread through inhalation of aerosols during talking, coughing, or sneezing; and 2) indirect transmission including air-borne occurs when infectious organisms are carried by droplet nuclei or dust suspended in air; vehicle-borne such as water, food, blood, and fomites; and vector-borne like fleas, mosquitoes, and ticks transmit an infectious agent through mechanical methods or encourage growth or alterations in the agent (biologic transmission)[5,37].

## 7. Causes

Responsible agents for acute diseases can be identified because of their acute onset and simple cause-effect relationship(s)[27]. They are mostly infectious agents and sometimes non-infectious. Infectious causes can be viral, bacterial, or parasitic. Non-infectious acute illnesses can be due to physical agents (*e.g.* electric shock, radiation, injuries), chemical agents (*e.g.* heavy metals, poisons, drug intoxication), allergic (*e.g.* anaphylaxis, insect bites), metabolic (*e.g.* hypoglycemic coma), organ dysfunction (*e.g.* acute renal failure, acute myocardial infarction, cerebral stroke) and acute exacerbation of chronic infectious diseases[5].

## 8. Classifications

There is no standard classification of acute diseases. Acute disease or illness can be infectious and communicable *e.g.* cholera and measles; infectious and non-communicable *e.g.* tetanus or non-infectious (non-communicable) *e.g.* stroke, myocardial infarction, acute toxic exposures, and injury[5].

Acute infectious illnesses are caused by certain pathogenic microorganisms or parasites. They consist of those in the International Classification of Diseases chapter, certain infectious and parasitic diseases, some diseases of the respiratory system (*e.g.* influenza, pneumonia), and a few local infections listed elsewhere (*e.g.* urinary tract infections)[44,45].

Acute illness may be minor (*e.g.* upper respiratory tract infections) or serious (*e.g.* stroke, myocardial infarction, seizure). The report of The King's Fund Organization divided acute illness into four categories: 1) acute minor or self-limiting illness (*e.g.* upper respiratory tract infections, dyspepsia, infective diarrhea, aches, backache, headaches, itching); 2) acute major illness that could be self-limiting or require treatment (*e.g.* myocardial infarction, stroke, hemorrhages); 3) acute exacerbation of existing major illness (exacerbations of asthma, chronic obstructive pulmonary disease, left ventricular failure, inflammatory bowel disease, diabetic coma); and 4) acute presentation of a new chronic illness (*e.g.* stroke, intestinal obstruction)[46].

## 9. Epidemiologic measures

### 9.1. Measures of occurrence

Measures of occurrence include morbidity and mortality rates. These can be crude, specific, or adjusted rates. Incidence and prevalence rates are used to measure morbidity pattern of acute diseases. The number of new cases of a disease in a given population over a predetermined time is referred to as the incidence. There are two ways to compute it: either as cumulative incidence or as

incidence rate (incidence density) (incidence proportion). The incidence rate is calculated using the numerator-the number of new cases that happen over a certain time-and the denominator-the total time that each member of the population is exposed to risk (total person-time follow-up). It takes into account the various periods that cohort members have been disease-free. The numerator of cumulative incidence is the number of new cases over a given time divided by the number of individuals who were disease-free at the start of the period. It represents a certain person's risk of contracting the illness. It is a proportion rather than a rate and presumes a constant cohort. On the other hand, the prevalence is the number of persons with a disease at a specified point in time. It may be point prevalence or period prevalence[5,37,47-49].

Mortality rates such as proportional mortality rate (the proportion of deaths in a certain population over some time attributable to different reasons); case-fatality ratio (the number of deaths caused by disease during a certain time divided by the number of new cases of that disease identified during the same time); and cause-specific mortality rate (the number of deaths due to a specific cause divided by the total population at the midpoint of the time)[5,37,47].

### 9.2. Measures of association or risk

Odds ratio is the ratio of the odds of exposure in cases to the odds of exposure in control and relative risk that is the ratio of incidence among exposed and incidence among unexposed; both indicate the presence or absence of association between the factor under study and the disease[5,37,47,49,50].

### 9.3. Measures of potential impact (effect on population)

The most important is the attributable fraction in the population (quantifies the anticipated decline in new cases in the population that would happen if the risk factor was eliminated), and the attributable fraction in the exposed (the probability that an exposed case developed the disease as a result of the risk factor in question) [5,37,47,49].

## 10. Community burden

The term "burden of disease" refers to the overall, cumulative effects of diseases concerning the number of people with impairments in a community. Burden of disease analysis is useful for assessing performance, setting priorities, allocating resources, and creating knowledge. In practice, this analysis involves many disease specialists, epidemiologists, and policymakers. In the 1990s, World Health Organization established a methodological concept to measure the global burden of disease based on the disability-adjusted life year (DALY) computed as the sum of the years lost due to specific premature death and years lost due to disability for incident cases of the health condition[51-54].

Worldwide the major reasons for global burden of disease and death are infectious diseases (HIV/AIDS, malaria, measles, diarrheal diseases, lower respiratory tract infections, and perinatal conditions) and injuries (road traffic accidents, falls, and violence)[53,55-57]. A hospital-based study described a high burden of acute disease at a large referral center in northern Madagascar with trauma being the most frequent pathology observed, though infectious diseases were largely responsible for adult mortality[58].

The incidence of communicable diseases has declined over the last century in high-income countries, however recent global epidemics of emerging and re-emerging diseases *e.g.* severe acute respiratory syndrome, Middle East respiratory syndrome, measles, avian influenza, Ebola virus, Zika virus, and COVID-19 disease, have resulted in a renewed focus on infectious diseases[59-62]. A recent systematic review in 2019 noticed that six infectious diseases were among the top ten reasons for DALYs in children *vs.* lower respiratory infections (ranked 2nd), diarrheal diseases (3rd), malaria (5th), meningitis (6th), whooping cough (9th), and sexually transmitted infections (10th). In adolescents aged 10-24 years, injuries were among the top reasons for DALYs: road injuries (ranked 1st) and interpersonal violence (5th). The five causes that were in the top ten for the ages 10-49-year age group were road accidents (1st), HIV/AIDS (2nd), low back pain (4th), headache disorders (5th), and depressive disorders (6th). In 2019, ischemic heart disease and stroke were the top-ranked reasons for DALYs in the 50 years and older age groups[63].

## 11. High-risk groups of acute illness

Immunocompromised patients *e.g.* HIV/AIDS, leukemia, steroid therapy, immune suppressive therapy, chemotherapy, radiation, immunotherapy, targeted anti-cancer therapy, and bone marrow transplant[64] are all susceptible to infection by common pathogens and opportunistic organisms that do not cause disease in immune-competent people. Infection may result from organisms that are universally present *e.g.* *Pneumocystis carinii*, or from reactivation of previous viral or mycobacterial infection[65].

Infants and children are susceptible to acute infectious diseases, especially with low vaccination coverage for vaccine-preventable diseases. Historically infections encompassed the major reasons for children's morbidity and mortality, and many preventable and treatable acute infections are still the main killers of young children, especially in developing countries. Pneumonia, diarrhea, and malaria caused about 30% of global deaths among children below 5 years of age in 2019[66,67]. Also, children are at high risk of injuries. The most frequent reasons for child injuries are falls, road accidents, road traffic injuries, poisonings, drowning, burns, and scalds[68,69].

Geriatrics: Acute diseases are associated with severe complications and fatality in the elderly. They are frailer and have a high burden

of chronic illnesses[70]. Many elderly people are living with long-term morbidities and frequently require episodic admissions to acute hospital facilities, to treat either exacerbation of their long-term diseases or an acute unrelated condition[71].

## 12. Prevention

Prevention refers to measures taken to prevent diseases with ultimate goal of eliminating, eradicating, or reducing the impact of disease and disability. There are five important and complementary levels of prevention of acute diseases depending on the natural course of illness that is primordial and primary prevention in the pre-pathogenesis or health phase; and secondary, tertiary, and quaternary prevention during the pathogenesis or disease stage[72,73].

### 12.1. Primordial (preprimary) prevention

Primordial prevention, a relatively new concept, is a set of activities planned to prevent the emergence of the predisposing economic, social, and cultural patterns associated with an enhanced risk of diseases through health promotion of general population to prevent exposure to risk factors. Many adult diseases have their early origins in childhood[74-79]. It is mainly applied to chronic diseases and indirectly contributes to preventing their acute exacerbation *e.g.* preventing risk factors of hypertension. Childhood blood pressure is positively related to adult blood pressure and this relation can be tracked from childhood through to maturity[80,81].

### 12.2. Primary prevention

Primary prevention includes activities taken before the onset of the disease to prevent its occurrence. It is targeted to susceptible people to prevent the occurrence of disease. It could be specific *e.g.* vaccination and chemoprophylaxis or non-specific *e.g.* environmental, food, drink, and water sanitation, health education, accident prevention, personal hygiene, and vector control[73,82].

### 12.3. Secondary prevention

Secondary prevention includes activities targeted to patients to stop the progress of the disease and prevent complications *e.g.* screening before the onset of signs and symptoms, early diagnosis after the appearance of signs and symptoms, and treatment[73,82]. Many acute diseases are self-limited or treated with a simple course of antibiotics or other medications. Some life-threatening acute diseases *e.g.* cardiac attack, exacerbation of bronchial asthma, pneumonia, appendicitis, and acute organ failure, require urgent medical care to prevent further complications[83].

### 12.4. Tertiary prevention

Tertiary prevention includes activities targeted to patients to reduce or limit impairments, and disabilities, minimize suffering and rehabilitate handicapped people *e.g.* palliative care, disability limitation, and rehabilitation[73,82].

### 12.5. Quaternary prevention

Quaternary prevention is collective health action applied when the patient is complaining of illness but there is no identified disease. It aims to prevent over-diagnosis and over-medicalization with unneeded medical procedures that could potentially hurt more than benefit such as unnecessary check-ups and screening without evidence, use of antibiotics in upper respiratory tract infections, and correct application of rehabilitation techniques[84-86].

## 13. Future challenges

Labeling a disease as acute or chronic cannot explain its nature, nor predict its outcomes. The duration of acute, subacute, and chronic diseases is a challenging task. There is a need for a standard definition of these terms at a specific time and onset together with adherence to specific lists of diseases to facilitate comparisons over time and between different localities. This lack of specificity in definitions has an impact on researchers as well as healthcare professionals and patients who are looking for clear ways to assess the progression of an illness. Thresholds are routinely altered, going from six months to three months or even increased to a year or more, which just serves to further confuse the situation.

A nationwide electronic health record is challenging for surveillance and comprehensive assessment of the leading reasons for acute diseases and injury burden in the population, particularly those causing premature death. Many healthcare systems are slow to adapt to focus on acute conditions. Quantification of the community burden of acute diseases is another challenge for many countries.

The necessity of acute care hospitals needs to be adequately assessed. Calculating a patient's early warning score is a mean of highlighting deteriorating patients. Early warning scores are now routinely applied throughout the whole acute hospital. Infectious diseases are still a threat to public health with a need to redirect resources where needed and mitigate the risks posed by these diseases.

## 14. Conclusion

Acute diseases both emerging and reemerging, whether infectious or non-infectious, are still a public health problem in both developing and developed countries. Control of these diseases is

challenging particularly when they occur as epidemics. It is the task of epidemiologists, clinicians, researchers, and policymakers to formulate and implement a policy for their prevention and control.

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The authors report no conflict of interest.

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### Authors' contributions

AE: conception of the research idea, drafting of the manuscript, and revising it for intellectual content; HSA: writing, drafting, and revising the manuscript.

## References

- [1] Schoenbach V, Rosamond W. Understanding the fundamentals of epidemiology an evolving text, 2000. [Online] Available from: Fundamentals of epidemiology - An evolving text [Accessed on November 20, 2022].
- [2] Dorland W. *Dorland's illustrated medical dictionary*. London: Saunders; 2003.
- [3] Stedman TL. *Stedman's medical dictionary for health professional and nursing*. 5th ed. New York, NY: Lippincott, Williams & Wilkins; 2005.
- [4] Webber R. *Communicable disease epidemiology and control. A global perspective*. 2nd edition. Wallingford, United Kingdom: CAB International; 2005.
- [5] Merrill R, Timmreck T. *Introduction to epidemiology*. Jones and Bartlett Publishers; 2006.
- [6] *Mosby's medical dictionary*. Marie T. O'Toole, editor. 9th ed. Elsevier/ Mosby; 2013.
- [7] Tuzun H, Özbaş Ç, Budak B, Altunay G, Aksakal FNB. Patterns in the relationship between acute COVID-19/long COVID-19 and quality of life: A cross-sectional study of patients attending a tertiary care hospital in Turkey. *Asian Pac J Trop Med* 2022; **15**(6): 274-282.
- [8] IISD (The International Institute for Sustainable Development). *Sustainable development goals. IISD perspectives on the 2030 agenda for sustainable development*. IISD; 2016.
- [9] Raviglione M, Maher D. Ending infectious diseases in the era of the Sustainable Development Goals. *Porto Biomed J* 2017; **2**(5): 140-142. doi:10.1016/j.pbj.2017.08.001.
- [10] United Nations. The 2030 Agenda and the sustainable development goals: An opportunity for Latin America and the Caribbean (LC/

- G.2681-P/Rev.3), Santiago, 2018.
- [11] Demiris G, Oliver D, Washington K. Chapter 3 - Defining and analyzing the problem. In: *Behavioral intervention research in hospice and palliative care. Building an evidence base*. Academic Press; 2019, p. 27-39. [Online] Available from: <https://www.sciencedirect.com/science/article/pii/B978012814449700003X> [Accessed on November 27, 2022].
- [12] Starfield B. Point: The changing nature of disease: Implications for health services. *Med Care* 2011; **49**(11): 971-972. doi:10.1097/MLR.0b013e318233a0c1.
- [13] MedicineNet. Definition of chronic disease. 2016. [Online] Available from: <http://www.medicinenet.com/script/main/art.asp?articlekey=33490> [Accessed on November 27, 2022].
- [14] Bernell S, Howard SW. Use your words carefully: What is a chronic disease?. *Front Public Health* 2016; **4**: 159. doi:10.3389/fpubh.2016.00159.
- [15] Whitlock J. The difference between acute and chronic illnesses. What use of these terms means for your health. [Online] Available from: <https://www.verywellhealth.com/chronic-definition-3157059> [Accessed on November 27, 2022].
- [16] NICE. *Management of chronic obstructive pulmonary disease in adults in primary and secondary care*. London: NICE; 2004. [Online] Available from: [www.guidance.nice.org.uk/CG](http://www.guidance.nice.org.uk/CG) [Accessed on November 27, 2022]
- [17] Hunter S. Distinguishing between acute and chronic elements of ill health when assessing patients. *Nurs Times* 2009; **105**(37): 20-23.
- [18] Holman HR. The relation of the chronic disease epidemic to the health care crisis. *ACR Open Rheumatol* 2020; **2**(3): 167-173. doi:10.1002/acr2.11114.
- [19] Lockshin MD. Differences between acute and chronic disease: Comment on the article by Holman. *ACR Open Rheumatol* 2020; **2**(5): 300. doi:10.1002/acr2.11146.
- [20] Sapkota A. Acute disease vs. chronic disease- Definition, 13 differences, examples. [Online] Available from: <https://microbenotes.com/acute-vs-chronic-disease/> [Accessed on November 27, 2022].
- [21] *Mosby's dictionary of medicine, nursing & health professions*. 11th edition. Mosby; 2021.
- [22] Stoppler MC. Definition of subacute. [Online] Available from: <https://www.rxlist.com/contrast/definition.htm> [Accessed on November 27, 2022].
- [23] The free medical dictionary. [Online] Available from: <https://medical-dictionary.thefreedictionary.com/subacute+disease>. [Accessed on November 27, 2022].
- [24] Wikipedia, the free encyclopedia. Acute (medicine). [Online] Available from: [https://en.wikipedia.org/wiki/Acute\\_\(medicine\)](https://en.wikipedia.org/wiki/Acute_(medicine)) [Accessed on November 27, 2022].
- [25] Dowdle JR. Acute medicine: Past, present, and future. *Emerg Med J* 2004; **21**(6): 652-653. doi:10.1136/emj.2003.012211.
- [26] Warrell D, Cox T, Fith J. *Oxford textbook of medicine*. Oxford: Oxford University Press; 2005.
- [27] Wang J. Basic principles and practical applications in epidemiological research. *Quant Sci Biol Med* 2002; **1**: 380.
- [28] Gerstman B. *Epidemiology kept simple. An introduction to traditional and modern epidemiology*. 3rd ed. Wiley-Blackwell; 2013.
- [29] Hamilton C. Diseases of affluence and other paradoxes. *Aust Financ Rev* 2004; **8**.
- [30] Omran AR. The epidemiologic transition: A theory of the epidemiology of population change. *Milbank Q* 2005; **83**: 731-757.
- [31] Weisz G, Olszynko-Gryn J. The theory of epidemiologic transition: The origins of a citation classic. *J Hist Med Allied Sci* 2010; **65**(3): 287-326. doi:10.1093/jhmas/jrp058.
- [32] Greenhalgh T. *Primary health care: Theory practice*. BMJ Books; 2007.
- [33] Barrett R, Kuzawa C, McDade T, Armelagos G. Emerging and re-emerging infectious diseases: The third epidemiologic transition. *Ann Rev Anthropol* 1998; **27**: 247-271.
- [34] Sanders JW, Fuhrer GS, Johnson MD, Riddle MS. The epidemiological transition: The current status of infectious diseases in the developed world versus the developing world. *Sci Prog* 2008; **91**(Pt 1): 1-37. doi:10.3184/003685008X284628.
- [35] Sarukhan A. *The epidemiological transition (or What we died, die and will die from) is global*. Barcelona Institute for Global Health; 2017. [Online] Available from: <https://www.isglobal.org/en/healthisglobal/-/custom-blog-portlet/la-transicion-epidemiologica-o-de-que-moriamos-morimos-y-moriremos-/3098670/0> [Accessed on November 27, 2022].
- [36] Das E. Classification of diseases in homeopathy. National Health Portal India. [Online] Available from: [https://www.nhp.gov.in/Classification-of-diseases\\_mtl](https://www.nhp.gov.in/Classification-of-diseases_mtl). [Accessed on October 26, 2022].
- [37] CDC. *Principles of epidemiology in public health practice. 3rd edition An introduction to applied epidemiology and biostatistics*. Atlanta, USA: Department of Health and Human Services. Centers for Disease Control and Prevention (CDC) Office of Workforce and Career Development; 2012.
- [38] Porta M. *A dictionary of epidemiology*. Oxford University Press, USA; 2008, p. 42-43.
- [39] Rezaeian M. The concept of disease clustering for public health specialists. *Middle East J Family Med* 2009; **7**(3): 25-27.
- [40] Miquel P. *Dictionary of epidemiology*. Oxford University Press; 2008, p. 179.
- [41] Singer M, Bulled N, Ostrach B, Mendenhall E. Syndemics and the biosocial conception of health. *Lancet* 2017; **389**(10072): 941-950. doi:10.1016/S0140-6736(17)30003-X.
- [42] Weiss NM. A Critical perspective on syndemic theory and social justice. *Public Anthropol* 2021; **3**(2): 285-317.
- [43] Baradaran A, Ebrahimzadeh MH, Baradaran A, Kachooei AR. Prevalence of comorbidities in COVID-19 patients: A systematic review and meta-analysis. *Arch Bone Jt Surg* 2020; **8**(Suppl 1): 247-255. doi:10.22038/abjs.2020.47754.2346.
- [44] Mercer AJ. Updating the epidemiological transition model. *Epidemiol Infect* 2018; **146**(6): 680-687. doi:10.1017/S0950268818000572.
- [45] World Health Organization. *International statistical classification of diseases and related health problems*. 10th revision, 5th ed. Geneva: World Health Organization; 2019. [Online] Available from: <https://icd.who.int/browse10/2019/en#/> [Accessed on November 5, 2022].
- [46] Jones R, White P, Armstrong D, Ashworth M, Peters M. *Managing acute*

- illness. *An inquiry into the quality of general practice in England*. London: The King's Fund; 2010. [Online] Available from: [https://www.kingsfund.org.uk/sites/default/files/field/field\\_document/managing-acute-illness-gp-inquiry-research-paper-mar11.pdf](https://www.kingsfund.org.uk/sites/default/files/field/field_document/managing-acute-illness-gp-inquiry-research-paper-mar11.pdf) [Accessed on November 1, 2022].
- [47] Bailey L, Vardulaki K, Langham J, Chandramohan D. *Introduction to epidemiology*. Open University Press; 2005.
- [48] Miller A, Goff Jr. D, Bammann K, Wild P. Cohort studies. In: Ahrens W, Pigeot I. (Editors). *Handbook of epidemiology*. Springer; 2005.
- [49] Kasim K. *Basic concepts of modern epidemiology: Epidemiology and research*. 1st ed. LAP LAMBERT Academic Publishing; 2012.
- [50] Szumilas M. Explaining odds ratios. *J Can Acad Child Adolesc Psychi* 2010; **19**(3): 227-229.
- [51] Mathers C, Bernard C, Iburg K, Inoue M, Ma Fat D, Shibuya K. *Global burden of disease in 2002: Data sources, methods and results. GPE Discussion Paper No. 54*. Geneva: World Health Organization; 2003.
- [52] Centers for Disease Control and Prevention. *The burden of chronic diseases and their risk factors*. USA: CDC, Atlanta; 2004.
- [53] Lopez AD, Mathers CD, Ezzati M, Jamison DT, Murray CJ. Global and regional burden of disease and risk factors, 2001: Systematic analysis of population health data. *Lancet* 2006; **367**(9524): 1747-1757. doi:10.1016/S0140-6736(06)68770-9.
- [54] Murray CJ. Towards good practice for health statistics: Lessons from the Millennium Development Goal health indicators. *Lancet* 2007; **369**(9564): 862-873. doi:10.1016/S0140-6736(07)60415-2.
- [55] Lopez AD, Mathers CD, Ezzati M, Jamison DT, Murray CJL, editors. *Global burden of disease and risk factors*. Oxford University Press; New York: 2006.
- [56] World Health Organization (WHO). *The global burden of disease: 2004 update*. Geneva: World Health Organization; 2008.
- [57] Institute for Health Metrics and Evaluation (IHME). *Findings from the global burden of disease study 2017*. Seattle, WA: IHME; 2018.
- [58] Kannan VC, Andriamalala CN, Reynolds TA. The burden of acute disease in Mahajanga, Madagascar - a 21 month study. *PLoS One* 2015; **10**(3): e0119029. doi:10.1371/journal.pone.0119029.
- [59] Jones KE, Patel NG, Levy MA, Storeygard A, Balk D, Gittleman JL, et al. Global trends in emerging infectious diseases. *Nature* 2008; **451**(7181): 990-993. doi:10.1038/nature06536.
- [60] Rezza G, Nicoletti L, Angelini R, Angelini R, Romi R, Finarelli AC, et al. Infection with chikungunya virus in Italy: An outbreak in a temperate region. *Lancet* 2007; **370**(9602): 1840-1846. doi:10.1016/S0140-6736(07)61779-6.
- [61] Quaglio G, Demotes-Mainard J, Loddenkemper R. Emerging and re-emerging infectious diseases: A continuous challenge for Europe. *Eur Respir J* 2012; **40**(6): 1312-1314. doi:10.1183/09031936.00111712.
- [62] European Centre for Disease Prevention and Control. (ECDC). *Rapid risk assessment. Zika virus disease epidemic. Seventh update, 8 July 2016*. Stockholm: ECDC; 2016. [Online] Available from: <https://ecdc.europa.eu/sites/portal/files/media/en/publications/Publications/RRA-Zika-virus%20epidemic-seventh-update-final.pdf> [Accessed on August 25, 2022].
- [63] GBD 2019 Diseases and Injuries Collaborators. Global burden of 369 diseases and injuries in 204 countries and territories, 1990-2019: A systematic analysis for the Global Burden of Disease Study 2019. *Lancet* 2020; **396**(10258): 1204-1222. doi:10.1016/S0140-6736(20)30925-9.
- [64] Dropulic LK, Lederman HM. Overview of infections in the immunocompromised host. *Microbiol Spectr* 2016; **4**(4). doi:10.1128/microbiolspec.DMIH2-0026-2016.
- [65] King T. Respiratory tract and pleura. *Elsevier's Integrated Pathol* 2007; 197-216. Doi: 10.1016/B978-0-323-04328-1.50014-0.
- [66] Shulman ST. The history of pediatric infectious diseases. *Pediatr Res* 2004; **55**(1): 163-176. doi:10.1203/01.PDR.0000101756.93542.09.
- [67] UNICEF, 2022a. Childhood diseases. [Online] Available from: <https://www.unicef.org/health/childhood-diseases> [Accessed on November 15, 2022].
- [68] The Australian Parenting Website. Childhood injuries: Common causes and prevention. [Online] Available from: <https://raisingchildren.net.au/toddlers/safety/home-pets/childhood-injuries> [Accessed on November 15, 2022].
- [69] UNICEF, 2022b. Child and adolescent injuries. [Online] Available from: <https://www.unicef.org/health/injuries>. [Accessed on November 15, 2022].
- [70] Hung WW, Liu S, Boockvar KS. A prospective study of symptoms, function, and medication use during acute illness in nursing home residents: Design, rationale and cohort description. *BMC Geriatr* 2010; **10**: 47. doi:10.1186/1471-2318-10-47.
- [71] Williams A. Patients with comorbidities: Perceptions of acute care services. *J Adv Nurs* 2004; **46**(1): 13-22. doi:10.1111/j.1365-2648.2003.02961.x.
- [72] Last JM. *A dictionary of epidemiology*. Oxford University Press; 2001.
- [73] Sosis Z, Donev D. Contemporary concept and definition of health Care. In: Donev D, Pavlekovic G, Kragelj L, editors. *Health promotion and disease prevention. A handbook for teachers, researches, health professionals and decision makers*. Forum for Public Health Cooperation Stability Pact for South Eastern Europe Project; 2007, p. 341-353.
- [74] Starfield B, Hyde J, Gervas J, Heath I. The concept of prevention: A good idea gone astray?. *J Epidemiol Comm Health* 2008; **62**(7): 580-583. doi:10.1136/jech.2007.071027.
- [75] Weintraub WS, Daniels SR, Burke LE, Franklin BA, Goff Jr DC, Hayman LL, et al. Value of primordial and primary prevention for cardiovascular disease: A policy statement from the American Heart Association. *Circulation* 2011; **124**(8): 967-990. doi:10.1161/CIR.0b013e3182285a81.
- [76] Pellanda EC, Pellanda LC. Primordial prevention and wearable health devices: The wearables in cardiology. *Arq Bras Cardiol* 2016; **106**(6): 455-456. doi:10.5935/abc.20160094.
- [77] Nobre M. Cardiovascular disease prevention levels. *Rev Soc Cardiol Estado de São Paulo* 2019; **29**(1): 14-17.
- [78] Hattis R. The 5 stages of disease and prevention. A new, more useful classification system. [Online] Available from: [https://www.academia.edu/42383273/The\\_5\\_Stages\\_of\\_Disease\\_and\\_Prevention\\_March\\_2022\\_update\\_w\\_references](https://www.academia.edu/42383273/The_5_Stages_of_Disease_and_Prevention_March_2022_update_w_references) [Accessed on April 3, 2020].
- [79] Hussain M. Primordial prevention: The missing link in neurological



- care. *J Family Med Prim Care* 2021; **10**(1): 31-34. doi:10.4103/jfmpe.jfmpe\_1806\_20.
- [80]Soudarssanane M, Mathanraj S, Sumanth M, Sahai A, Karthigeyan M. Tracking of blood pressure among adolescents and young adults in an urban slum of puducherry. *Indian J Commun Med* 2008; **33**(2): 107-112. doi:10.4103/0970-0218.40879.
- [81]Azegami T, Uchida K, Tokumura M, Mori M. Blood pressure tracking from childhood to adulthood. *Front Pediatr* 2021; **9**: 785356. doi:10.3389/fped.2021.785356.
- [82]Shipkovenska E, Lyubomirova K. Preventive health care and disease prevention. In: Donev D, Pavlekovic G, Kragelj L, editors. *Health promotion and disease prevention. A handbook for teachers, researchers, health professionals and decision makers*. Forum for Public Health Cooperation Stability Pact for South Eastern Europe Project; 2007, p. 356-372.
- [83]Merkle J. Acute diseases. Integrative family medicine. [Online] Available from: <https://www.ifmofsa.com/articles/general/category/47769> [Accessed on October 25, 2022].
- [84]Gervas J. Quaternary prevention in the elderly. *Rev Esp Geriatr Gerontol* 2012; **47**(6): 266-269.
- [85]Martins C, Godycki-Cwirko M, Heleno B, Brodersen J. Quaternary prevention: Reviewing the concept. *Eur J Gen Pract* 2018; **24**(1): 106-111. doi:10.1080/13814788.2017.1422177.
- [86]Martins C, Brodersen J, Bülow J, Haase C. Quaternary prevention as a tool to prevent overdiagnosis in the clinical practice. *BMJ Evidence-Based Med* 2019; **24**: A3.

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