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Review Article

Understanding diseases through the biopsychosocial model: a narrative review

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ABSTRACT

Health and disease are affected by complex interaction of biological, psychological and social factors. Modern understandings now encompass a more holistic approach of disease causation through the biopsychosocial model, which was formerly dominated by the biomedical model, which only focused on genetic and physiological factors to illness. The aim of the study was to review the interactions of biopsychosocial factors in disease causation and their implications for health outcomes. A narrative review of literature was conducted, synthesizing evidence on various factors of disease causation starting with biological factors (age, gender, race, genetics, pregnancy), psychosocial factors (stress, social support, health literacy, cultural beliefs, living conditions), and environmental influences (physical and psychosocial work environment). Biological predispositions interact with psychosocial stressors, environmental exposures, and cultural norms to shape disease risk and progression. Chronic stress, a lack of social support, and health literacy are examples of psychosocial factors that not only directly impact mental health but also alter the course of physical illness. Understanding disease through the biopsychosocial perspectives can guide the development of integrated, person-centered prevention and treatment strategies in both physical and mental health care.

Keywords: Biopsychosocial model, Biological factors, Psychosocial determinants, Public health, Narrative review

INTRODUCTION

Health is the human being's level of metabolic or functional efficiency. It refers to the overall state of a person's mind, body, and spirit and typically denotes the absence of disease, harm, or discomfort. In the past, the presence or absence of sickness was used to determine health. A more comprehensive approach to health was adopted by the World Health Organization (WHO) in 1948. Its constitution defines health as "a state of complete physical, mental, and social well-being, and not merely the absence of disease or infirmity".[1] Concern for the individual as a whole, functioning socially, psychologically, and physically, is reflected in this concept. Disease is a condition in which the structure or functions of any portion, organ, or system of the body are abnormal. It usually shows itself as a distinctive collection of symptoms and signs sooner or later. Health and disease are not merely the consequences of biological processes but are influenced by a complex interaction of biological, psychological, and social factors. This multidimensional perspective gives a more comprehensive understanding of disease causation.

Traditionally, the biomedical model of illness dominated the health care system, focusing mainly on pathogens, genetic abnormalities, and physiological dysfunctions as the primary factors in disease causation. However, this approach neglected the broader social and psychological contexts in which diseases manifest and progress. In response to this limitation, without compromising the benefits of the biological approach, Engel suggested expanding the model to incorporate the psychological and social factors for disease causation. In 1977, George Engel put out the biopsychosocial model, arguing for a more comprehensive framework that acknowledges the

influence of social support, personality traits, coping strategies, psychological stress, and socioeconomic status on health outcomes. The biopsychosocial model explains illness as the outcome of combined influences from biological factors (such as genetics and biochemistry), psychological factors (including mood, personality, and behavior), and social factors (like culture, family environment, socioeconomic conditions, and healthcare systems). It highlights those psychological and sociocultural elements—such as beliefs, coping strategies, and social support—can worsen or improve illness.[2]

Understanding health and diseases from a broader perspective is essential since they are influenced by a variety of positive and negative aspects of the human body, environment, and lifestyle that either cooperate or conflict with one another.[3]

The factors identified in this article were based on the biopsychosocial model, which conceptualizes disease as the outcome of interactions among biological, psychological and social determinants. To support these factors with scientific evidence, a narrative review was conducted.

Literature searches were performed in major databases, including PubMed, Scopus, Web of Science, and Google Scholar. Each factor was searched separately in these databases to determine its association with disease causation. Sample search terms included “age AND disease causation”, “Gender AND diseases”, “genetics AND disease”, “stress AND Health outcomes”, “pregnancy AND morbidity”, “social support AND health”, “cultural beliefs AND disease”, and “Environmental factors AND health”. Relevant studies, review articles, and systematic reviews were studied to highlight how these factors individually or synergistically contribute to the development and progression of disease.

BIOLOGICAL FACTORS

Biological factors encompass the physical attributes of the body and are typically described using the terminology of core biomedical sciences like anatomy, physiology, and molecular biology.[4] These are internal, physiological, and genetic characteristics that impact a person's health. These elements can either increase the risk of developing certain diseases or offer protection against various health conditions. Important biological factors are given below.

Age

Ageing occurs due to the gradual accumulation of cellular and molecular damage over time, which progressively diminishes both physical and mental abilities. This process increases the likelihood of developing health conditions related to different systems like neurological (neurodegenerative), cardiovascular, musculoskeletal, and the immune system, ultimately leading to death.[5]

Age-related diseases

Neurodegenerative diseases

The Most common risk factor for neurodegenerative conditions is aging. Among them, Alzheimer's disease (AD) and Parkinson’s disease (PD) are the most prevalent globally. The occurrence of Parkinson’s disease rises sharply with age, becoming about ten times more common between 50 and 80 years old. The risk of neurodegenerative diseases increases with age due to neuronal degeneration, accumulation of misfolded proteins and changes in brain chemistry and structure.[6]

Cardiovascular diseases

The risk of cardiovascular diseases (CVD), such as hypertension, atherosclerosis, and heart failure, increases with age.[7] As cardiovascular tissues age, they undergo several pathological changes, including thickening of the heart muscle, reduced efficiency in filling and pumping blood, decreased ability to respond to increased demand, stiffening of arteries, and diminished function of blood vessel linings. These alterations contribute to a higher risk of heart-related diseases.[8]

Cancer

Age, a family history of illness, and an unhealthy lifestyle all contribute to a higher risk of cancer.[9] Its occurrence escalates markedly as individuals age, peaking around 85 or 90 years.[10] A lower risk of malignant disease is associated with a younger biological age.[11] The reason older individuals are more prone to cancer isn’t fully understood; it might be that cells gradually accumulate mutations over time until they become cancerous, or that aging makes cells more vulnerable to harmful mutations. Other reasons for increased cancer incidence with time could be impaired DNA repair mechanisms and changes in immune surveillance over time.[9]

Immune system related diseases

Body’s immunity is inversely proportional to age, which reduces the body's ability to fight infections and cancer.[12] As people age, their immune system loses effectiveness in several ways. It struggles to distinguish self from non-self, which contributes to more autoimmune disorders. Cells like macrophages and T cells become slower and less effective at destroying pathogens and remembering antigens, reducing the body's defense against new infections.

In addition, there are fewer white blood cells available to fight new threats, and the production and ability of complement proteins and antibodies decline. These cumulative changes make older adults more susceptible to infections, such as pneumonia and influenza, and also contribute to an increased risk of cancer.[13]

Musculoskeletal disorders

Degenerative musculoskeletal problems and injuries are more common among the elderly. Two of the most prevalent aging-related musculoskeletal conditions are sarcopenia and osteoarthritis (OA).[14] With the advancing age of 80 the sarcopenia (age related loss of muscle mass and function) occurs by 30 to 50%.[15] Age-associated alterations in joint tissues contribute to OA through several mechanisms. While aging and OA are distinct processes, they interact in ways that promote a proinflammatory, degradative environment due to inflammaging and cellular senescence accompanied by the senescence-associated secretory phenotype (SASP). It is also contributed by oxidative stress associated with mitochondrial dysfunction, impaired energy metabolism, and changes in cell signaling resulting from modifications in the extracellular matrix. These factors collectively foster an environment that accelerates joint tissue destruction, increases cell death, and impairs the repair of damaged tissue.[16]

Gender

Genetic susceptibility to diseases, hormonal and reproductive factors, and variations in physiological traits throughout life are among the biological determinants of health and sickness that differ between genders. Moreover, it is important to take into account the interplay between biological and social factors, when understanding gender disparities in health.[17] Discrimination and gender inequality endanger women's and girls' health and well-being. This is attributed to limited mobility, lack of authority in decision making, lower literacy, and prejudiced attitudes from communities, they encounter more obstacles than men when trying to access health information and treatments. Increased health risks for women and girls include illnesses, sexually transmitted diseases, cervical cancer, malnourishment, unwanted pregnancies, and elder abuse.[18]

Cardiovascular diseases are the major cause of mortality in both men and women. Both experience similar ailments as they age whereas acute illnesses are more fatal in men as compared to women. Contrarily, Quality of life of female remain poor as they continue to live with chronic non-life-threatening problems.[17] Specifically in hypertension and heart attack, sex differences and gender experiences are important in understanding these disorders.

Men generally experience heart attack occurring due to occlusion of main coronary arteries whereas heart attack occurring due to occlusion of small vessels are more common in women. Women have a larger lifetime risk of stroke and start at a lower blood pressure threshold, males are more likely than women to develop high blood pressure.[19] There are certain conditions that are specific to gender, like prostate cancer in males and gynaecological cancers (ovarian, uterine, cervix, breast) in females.

Race

The term "race" has frequently been used to refer to biological distinctions between groups that are thought to be hereditary in nature. Racial genetic differences do exist between different races, but there aren't many that have been linked to health.[20] Africans, Caucasians, Pacific Islanders, Asians, and Native Americans are the five main racial groups, according to Risch et al and Karter et al. (2002), looked at the complications that diabetics faced.[21] The study showed that Black, Asian, and Hispanic people had significantly lower rates of myocardial infarction than white people; black people had more strokes than white people; white people had lower rates of end-stage renal disease, and Asian people had significantly fewer lower extremity amputations.[22] Certain ethnic groups are more likely to have sickle cell disease, including African, African and, Hispanic Americans, Mediterranean, Middle Eastern, Asian, and Indian ancestry.[23] Globally, breast cancer is the most common cancer prevalent in women, affecting African-American women with high mortality as compared with white women with high incidence.[24]

Genetics

Genetics is the branch of biology that deals with heredity, genes, and studies variation in living beings. Heredity is the study of how traits are transmitted from one generation to another. All hereditary conditions are genetic, but all genetic conditions are not hereditary. Family is a unit that has distinct genomic and environmental interactions that is an excellent predictor of an individual's vulnerability to specific diseases. Family history plays a significant role as a major risk factor for conditions like CVD, diabetes, cancer, autoimmune disorders, and mental illnesses.[25] A few diseases are caused by a mutation in one gene or multiple genes. Instead, the majority of illnesses are complicated and result from a combination of environmental factors and genetics.[26]

Genetic diseases caused by a mutation in a single gene, often called Mendelian diseases, are usually inherited in a simple pattern. Modes of inheritance for single-gene disorders are autosomal dominant, autosomal recessive, X-linked dominant, and X-linked recessive (Table 1).[27]

Chromosome abnormalities are genetic illnesses characterized by physical or numerical alterations in one or more chromosomes. These chromosomes could be autosomes, sex chromosomes or both. Chromosomal abnormalities are of two types: numerical and structural. In Numerical abnormalities there is deviation from normal diploid number of chromosomes. Examples include Autosomal Trisomies - Down's syndrome (Trisomy 21), Patau syndrome (Trisomy 13) and Edwards syndrome (Trisomy 18); sex chromosomes aneuploidies - Klinefelter's syndrome (XXY, XXXY), Turner's syndrome (female with 45 chromosomes, XO), XYY Syndrome and super females (XXX, XXXX, XXXXX). In structural abnormalities there is genomic rearrangement of

one or more chromosomes. Examples include deletion (cri-du-chat syndrome), inversion (acute myeloid leukaemia [AML]), duplication (Charcot-Marie-tooth disease type 1A), translocation (chronic myelogenous leukaemia [CML]) and mosaicism (Mosaic down syndrome).[28]

Table 1: Modes of inheritance for single-gene disorders.

Inheritance pattern	Description	Common examples of diseases
Autosomal recessive	Parents of affected person are carriers, requires two copies of mutated gene for disease to occur	Sickle cell anemia, cystic fibrosis, phenylketonuria
Autosomal dominant	Affected person has one affected parent, requires one copy of mutated gene for disease to occur	Huntington's disease, neurofibromatosis
X- linked recessive	Males are more affected, disease prevalent in each generation	Haemophilia A
X-linked dominant	If father is affected, all daughters and no son will be affected and if mother is affected, she can have affected sons and daughter's inn same generation	Hypophatemic rickets, ornithine transcarbamylase deficiency.

The abnormalities arising from interplay of environmental influences and several genes are known as multifactorial disorders. Commonly prevalent birth defects like Neural tube defects, congenital heart diseases, cleft lip, and cleft foot are inherited in multifactorial fashion. Adulthood complex disorders like heart diseases and diabetes are most commonly due to multifactorial genetic inheritance.[29]

Pregnancy

A woman's body undergoes major physiological and psychological changes during pregnancy, which can impact several organ systems and result in both immediate and long-term health issues. Long after the index pregnancy, studies have revealed that these pregnancy-specific issues still have an impact on the health of the mother. It is now known that women who have experienced unfavourable pregnancy outcomes in the past are more likely to have metabolic and cardiovascular disorders in the future.[30]

Women who had gestational diabetes mellitus are 36–70% more likely to develop type 2 diabetes in the future. Women who have preeclampsia during pregnancy have a higher lifelong risk of stroke, CVD, and persistent hypertension. Pregnancy related complications like placental abruption, spontaneous preterm birth, stillbirth, and recurrent miscarriages are all linked to an elevated risk of cardiovascular disease.[31] There is 1.5 times increased risk of anxiety, a two-fold increased risk of depression, a four-fold increased risk of post-traumatic stress disorder (PTSD), and a three-fold increased risk of suicide linked to a single first-trimester pregnancy loss.[32] Recurrent abortions is associated with two fold increased risk of coronary heart disease, six times increased risk of venous thromboembolism, three times high risk of anxiety and depression and five times increased risk of PTSD.[32,33]

PSYCHOSOCIAL FACTORS

Social factors are the circumstances surrounding individuals' birth, development, employment, existence, and aging, along with the overarching factors and systems that impact daily life conditions.[34] Psychological factors include meanings and processes at the individual level that affect mental state. There is an interplay of social and psychological factors together known as psychosocial factors, that leave a major impact on an individual's physical and mental wellbeing.[35] Important psychosocial factors were.

Mind-body interactions

Mind-body interaction reflects interactive process of wisdom, belief, thought, and physiological response leading to holistic effect on health.[36] It focuses on how behaviours, emotions, and thoughts affect physical processes and vice versa. The mind-body connection is a real, observable phenomenon that is far from being just theoretical and is crucial to our general well-being.[37] According to studies physical circumstances can influence our mental state, leading to mood problems or cognitive difficulties.[38] Physical problems like chronic illnesses, hormone imbalances, dietary deficiencies, and even abnormalities in gut health can affect mood, worsen anxiety and depression, and affect cognitive performance of an individual.[39,40] The opposite is likewise true for these consequences. Stress, happiness, and anxiety are examples of states that can set off biological reactions that impact digestion, heart rate, immune system performance, and even pain perception.[41,42] For example, according to studies, IBS patients' colonic motility is more impacted by emotions like anger, fear, pain, and anxiety than healthy controls.[43]

Social isolation and loneliness

A person who has little to no social support and no relationships or contacts with other people is said to be socially isolated. Loneliness is the perception that one lacks close, meaningful relationships and a sense of yourself.[44] Loneliness and social isolation have detrimental effects on longevity, quality of life, and mental and physical health.[45] Loneliness cause chronic stress, which further leads to low-grade peripheral inflammation. This low-grade inflammation is found associated with

inflammatory diseases like CVD (coronary heart disease, hypertension), diabetes and autoimmune disorders (systemic lupus erythematosus, rheumatoid arthritis).[46]

Numerous studies have linked loneliness to physiological aging, cancer, obesity, hearing loss, and ill health. Many mental illnesses, including depression, child abuse, alcoholism, insomnia, personality disorders, and AD, can be brought on by loneliness and social isolation.[47]

Environment

Human health is affected by physical and social environment.

Physical environment

In the physical environment, the following elements are important for health: access to different health-related resources, design of community and built environment (land use mix, street connectivity, transportation systems) and exposure to harmful elements, such as air pollution or being close to toxic sites. Thus, the air pollution has been reported to have higher respiratory and cardiovascular mortality and morbidity. Chronic and permanent health concerns like neurodevelopmental issues, birth malformations, and endocrine disruption-related diseases can result from exposure to harmful chemicals.[48]

Health can be indirectly improved by elements like walkable areas and access to green space.[49] Built environment that doesn't provide access to walking or cycling leads to increased risk of diabetes, ischemic heart disease, ischemic stroke and cancers like breast and colorectal.[50] Extreme weather conditions are associated with air pollution, food insecurity, limited access to drinking water and higher incidence of vector borne diseases, eventually leading to higher migration. These disturbances lead to increased respiratory, cardiovascular, and viral diseases; injuries; heat stress; and mental health issues.[48]

Psychosocial work environment

Negative psychosocial work environment worsens cardiovascular, mental and musculoskeletal problems and mortality demonstrating the well-established link between the psychosocial work environment and health.[51] Additionally, consistent workplace stress and imbalance in effort and reward worsen physical and mental health as compared to single factor out of the two.[52]

Health literacy

According to WHO, the ability to "gain access to, understand and use information in ways which promote and maintain good health" for oneself, family, and community is known as health literacy. Numerous studies have demonstrated that low health literacy leads to a number of issues, such as delayed disease diagnosis, poor self-care abilities, increased emergency service use, a rise in the incidence of different diseases, and ultimately an increase in the death rate. This is associated with their inability to undergo screening as they receive lesser information from resources aimed at preventing and controlling disease. For example, diet, exercise, and obesity are all correlated with health literacy. Furthermore, patients' understanding of their ailment, treatment plan, and capacity to make healthcare decisions can all be impacted by inadequate health literacy.[53,54]

Standard of living (living conditions)

A person's occupation, income, and level of education all affect their standard of living, which in turn affects their health, morbidity, and mortality. Living conditions are important social determinants of health. Living circumstances of an individual can affect his mental and physical health directly or indirectly. Substandard living conditions leads to Infections, chronic illnesses, dietary insufficiencies, and mental health problems. Increased incomes may enable people, families, and entire communities to devote more funds to better nutrition, health prevention, and treatment, which could enhance health outcomes. Conversely, people with bad health might not be able to work as long, as hard, or as efficiently as their healthier counterparts, which could result in poorer living standards and incomes for them as well as their families.[55,56]

Sleep health

Sleep health encompasses a number of quantifiable factors, like duration of sleep (the total hours of sleep in a 24-hour period), timing (the placement of sleep within a 24-hour period), sleep continuity or efficiency (the ease with which one falls and wakes up), alertness/sleepiness (the capacity to remain attentively awake), and satisfaction/quality (the subjective evaluation of "good" or "poor" sleep). All these factors are more obviously linked to mental, physical and neurobehavioral health. Circadian misalignment, short-term as well as chronic sleep deprivation, and untreated sleep disorders can all have a major detrimental effect on public safety, mood, and mental and physical health. Being sleep deprived for long duration increases the risk of chronic health conditions like cancer, diabetes, obesity, and cardiovascular disease and raises chances of death. Sleep deficiency can have detrimental effects on individual's skill of problem solving, decision making, controlling emotions and behavior and adjustment to change. Inadequate sleep is also associated with increased risk-taking behavior, depression, and suicide.[57,58]

Stress

WHO defined stress as "The feeling of anxiety or tension brought on by a challenging circumstance". Stress is a natural human response that forces people to face challenges and risks in their lives.[59] Stress can effect health both directly through changes in neuroendocrine and

autonomic responses and indirectly through modifications in behaviours related to health.[60] The body's circulatory, metabolic, neurological, behavioural, and cellular systems are all impacted by prolonged stress, which also raises the risk of diseases like obesity, cardiovascular diseases and cancer.[61] The psychological impact of stress include anger or aggression issues, exhaustion, a sense of helplessness, sleeplessness, sadness, difficulty focusing or remembering things, and more. Chronic stress leads to issues like burnout, anxiety, or depression.[62]

Social support

Social support involves being loved, respected, and to be a part of a group of people who help each other. Strong social support can give people coping skills, resources, and a feeling of community, all of which can help people experience less depression. Stressful conditions have a greater impact on people who have less social support. Higher level of social support is associated with better health outcomes, less psychosocial symptomatology, and healthy lifestyle practices.[63,64]

Family and cultural beliefs

A certain group of people or society's shared beliefs, traditions, and behaviours are referred to as its culture.[65] Common examples of family and cultural beliefs that play an important role in disease causation are discussed below.

Due to a societal preference for boys, girls have been neglected, as evidenced by poor nutrition, immunizations, and preventive care. Girls are 13% more likely than boys to be unvaccinated, and 6% more severely stunted. According to Pande et al, this is the reason why girls in Pakistan and India between the ages of two and five have a nearly 50% higher risk of dying than boys.[66] During visit to doctors, women are typically expected to be accompanied by their husbands, dads, or other male guardians. This cultural barrier contributes to high rates of maternal mortality by delaying important medical interventions, particularly during labor.[67] Beliefs related to menstruation leads to unsafe practices. For example, the custom of chhaupadi in Nepal compels women who are menstruating to remain alone, frequently in huts in dangerous, untamed locations with little amenities. This puts them at risk for assaults, snake bites, and hypothermia.[68] Women are frequently prevented from obtaining the necessary period hygiene items by the taboo around discussing menstruation and the requirement of male guardianship when they leave the house. A study revealed that in India, during menstruation 42.5% of Indian women use old textile pieces and 73.5% reuse them leading to Reproductive tract infections.69 Child marriage is still prevalent in several parts of Africa and South Asia. As adolescent girls are not fully mature and developed, early marriage put them at high risk of life-threatening conditions related to early pregnancy and childbirth such as haemorrhage and obstetric fistulas.[68]

CONCLUSION

The causation of disease is multidimensional phenomenon, occurring due to complex interaction between biological, psychological and social determinants. The biological factors such as age, gender, race, genetics and pregnancy related changes set the physiological basis for health outcomes, psychosocial factors ranging from stress, social support, cultural beliefs, environment, health literacy, sleep further modulate vulnerability or resilience to illness. The biopsychosocial model of disease causation provides a more comprehensive framework than the traditional Biomedical model, offering a better and holistic understanding of various physical and mental health conditions. Understanding the synergistic effect of these determinants help to develop effective preventive strategies, targeted interventions and equitable health policies. By integrating biological insights with psychological understanding and social context, healthcare systems can move toward more person-centered and sustainable models of health promotion and disease prevention and management.

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