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Natural and Social History of the Health-Disease Process as an Epistemological Model for Medical Education (Part 2)

Beatriz Elina Martínez-Carrillo[1], Arturo G. Rillo[1],
José Arturo Castillo-Cardiel[2], Imelda García-Arqueta[1],
Marta Liliana Palacios-Jaimes[1]
[1](*Faculty of Medicine / Autonomous University of the State of Mexico, Mexico)*
[2](*School of Medicine / Quetzalcoatl University, Mexico)*

Abstract: *How to enable the articulation of epistemological models at hierarchical levels of integration that represent the complex phenomenological system of the health-disease process? To explore this question, the study was conducted with the purpose of analytically reconstructing the natural and social history of the health-disease process. From the methodological scope of philosophical hermeneutics, documentary sources were analyzed to develop the destructive moment and continue with the construction of the understanding horizon of the historical evolution of the theoretical models of the medical sciences. In the development of the study the stages of the natural history of the disease are described from the model proposed by Leavell and Clark. It emphasizes the conceptualization of the relationships between agent, host and environment that determine the appearance and resolution of the disease. In addition, the clinical horizon is a fundamental component of the natural evolution of the disease in men because it helps to identify the transit of the apparent state of health to the clinical manifestation of the disease. It is concluded that the natural and social history of the health-disease process constitutes a scientifically based model that makes it possible to give meaning to medical rationality, both at the healthcare level and at the educational and research level.*

Key Word*: Ecological triad, epistemological model, health-disease process, medical education, natural history.*

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I. Introduction

Among the problems of a philosophical nature that explore positions to generate knowledge in medical sciences, the following question stands out: How to enable knowledge of the health-disease process during the educational process to learn medical sciences? In the flexnerian tendency of medical education [1], this questioning is concreted in the training of the physicians through the conceptualization of the evolution of the health-disease process through the biomedical model [2] and the biopsychosocial model [3]. More incidentally, and above all to favor the epidemiological and preventive approach of the disease during medical education, the model of the natural history of the disease and the levels of prevention, developed in 1953 by Leavell and Clark, is used [4,5]. These models respond to four aspects that have changed the practice of the general practitioner during the last 30 years described by Howie *et al*: the population health agenda, the "perverse incentives" in the quality and outcomes framework (QOF) in care medical, the patient's access to health services, and the learning opportunities that the medical student has [6]; because each of them responds to different levels of approach to the health-disease process [7]. This implies that the biomedical, biopsychosocial and natural history models of the disease converge in the reality in which health and disease develops, so that the following question can be explored: Is it possible to use an epistemological model for the teaching of medicine that makes it possible to understand and represent the complexity of the health-disease process?

Derived from the development of medicine that is reflected in the existence and co-existence of different models, the model of the natural and social history of the health-disease process stands out (Fig. 1), which is based on the natural evolution of the disease, it is understood as a model that systematizes the explanation of the dialectic relationship between health and illness that is established when moving from the state of health to the state of illness; or, from the disease to health [8]. In the transition from health to illness, the model outlines the biological, social, emotional and spiritual phenomena that occur from the moment in which the man, in apparent health, is exposed to risk. It also considers the determining factors involved so that exposure to risk leads to biological alterations until it presents clinical manifestations. If the signs and symptoms subside, the patient will approach healing, or the disease will become chronic and present complications during its evolution. Chronic or complicated illness can remit or produce disability or death [9,10].

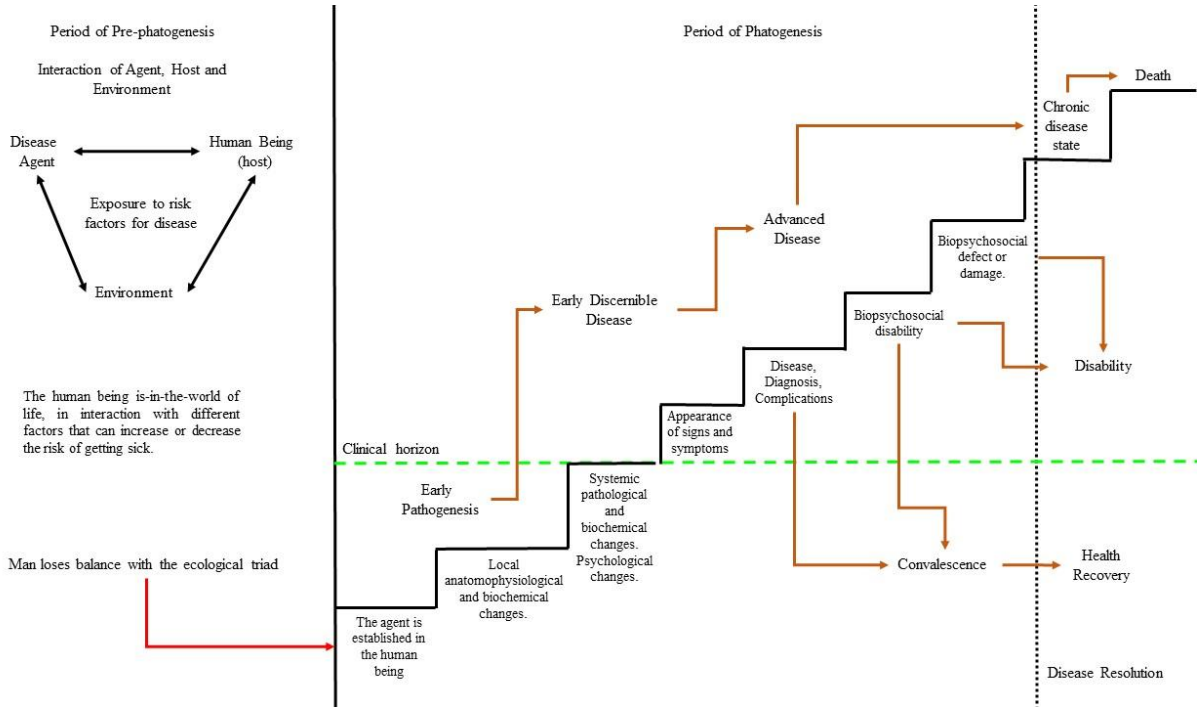

Figure 1: Schematic representation of the natural and social history of the disease. (Image modified from Leavell and Clark [4])

Considering this approach, the challenge in medical education is centered on the possibility that scientific and empirical models have to explain health and disease in different scenarios of the patient's daily life [10-12]. This implies the need to incorporate aspects of an ecosocial, epidemiological, biomolecular, immunological, physiopathological and clinical nature into the understanding of the natural history of the disease, taking into account the advance of knowledge in medical science. Each aspect represents schematically a plot of the dialectical relationship between health and disease. Although this representation is objective and true, it propitiates the symbolic understanding of this relationship, so that the epistemological problem that arises is how to enable the articulation of the different models modeled in the understanding of health and disease in successive levels of integration corresponding to different hierarchical levels of the complex phenomenological system of the health-disease process. In this line of reflection, a problematic field circumscribed to the following questioning is identified: is there a model of epistemic nature that shows, theoretically or materially, the possibilities of application and development of medical sciences in their integration for medical training?

For the development of the approach to this epistemological problem, it is necessary to integrate scientific facts, theories, hypotheses and paradigms, which underlie the cognitive and explanatory structures that are offered in a trans-hierarchical, systemic and complex way, linked to complex autopoietic patterns of evolution that can be shown through the following epistemic axes: readability, imaginability and intelligibility; constructing (or epistemically basing) a model of the health-disease process, as it is thought to be. In this context, the study initially went through the identification of epistemological models of interest for medical education. The results have been presented in the first part of the investigation [13]. To complete the research process, the study was conducted with the purpose of analytically reconstructing the natural and social history of the health-disease process.

II. Material And Methods

A documentary analysis study was made from the interpretive hermeneutic approach [14]. The epistemological position from which the study is based is the philosophical hermeneutics elaborated by Hans-Georg Gadamer. Gadamerian hermeneutics offers the possibility of understanding the human being's experience of being-in-the-world from the tradition in which it is situated [15]; so that each time he interacts with the world of life, he understands differently.

By belonging to a tradition, understanding approaches the mobility of meaning and the historicity of man; so that the objectivity of the understanding lies in the consciousness of the effective history [16]. In this direction, the design of the study included four moments: starting point, horizon of meaning, destructive

moment and constructive moment [17]. In this communication the results obtained are presented when developing the destructive moment that was oriented to the realization of the analytical model of the natural and social history of the health-disease process.

III. Results and Discussion

Continuing the line of reflection enunciated by Francis Bacon [18], to build a natural philosophy of medicine, John Ryle [19], in the book *The natural history of disease* published in 1936, introduces to the field of medical sciences the idea of understanding the doctor as a naturalist, so that he based the need to study the diseases that affected the human being considering him as an animal immersed in his environment, both physical, biological and psychological. By conceptualizing the natural history of man in the disease, he oriented it to glimpse the holistic approach of medicine.

In 1940, Macfarlane Burnet [20], consolidates the paradigm of the natural history of the disease by supporting the ecological point of view of the infectious diseases of man, as well as the description of the host-agent relationship as a conceptual antecedent to understand infection and immunity and, consequently, the susceptibility-resistance binomial in the context of the theory of clonal selection.

On the other hand, the investigation of chronic diseases gradually appropriated the concept of the progression of the disease in the individual over time [21]. The events that underlie the diseases showed a temporal and spatial continuity that allows establishing the prognosis of the outcome of the disease with a high probability. By 1954, the natural history of the disease is conceptualized as the process "which begins with the very first forces that initiate it in the environment or elsewhere, and continues through the resulting changes that take place-until equilibrium is reached, or defect, disability, or death ensues" [22]. Advances in the understanding of infectious, chronic, degenerative diseases, of development as well as the causal explanation of diseases and the approach of the health-disease process from the molecular biology field; have contributed to the current definition of the natural history of the disease as the "natural course of a disease from the time immediately prior to its inception, progressing, through its presymptomatic phase and different clinical stages to the point where it has ended and the patient is either cured, chronically disabled or dead without external intervention" [23].

In the context of this conceptual framework in which the temporal dimension to understand the progression of a natural phenomenon such as disease stands out, the model of the natural history of the disease, as well as the levels of prevention were enunciated in 1953 by Hugh Rodman Leavell and E. Gurney Clark in *Textbook of preventive medicine* (which since the second edition was published with the title *Preventive medicine for the doctor in his community*) [4]. The work of Leavell and Clark made it possible to structure the model considering two periods and a resolution stage (Fig. 1). The periods are: period of prepatogenesis and period of pathogenesis. The resolution stage includes, on the one hand, healing; and on the other, the development of chronic illness or disability; or, death.

Pre-pathogenic period

The pre-pathogenesis period refers to the preliminary period before the onset of the disease; that is, it refers to the time that precedes the interaction between the host, the disease agent, and the environment (Fig. 2). During this period, man is in the world of life in conditions of normality, so that he is in an apparent state of health. In this sense, the period of pre-pathogenesis includes the evolution of the dynamic interactions between physical, chemical, biological and emotional agents that are associated with the production of disease, and the ecological, socioeconomic and cultural factors that surround the subject; that is, it has homeostatic equilibrium. But it also includes the interactions between agents and intrinsic conditions of the individual; or, between these and the environmental factors.

The pre-pathogenic period extends to the establishment of a configuration of factors conducive to the installation of the disease. This implies that it links specific risk factors that stimulate the onset of the disease in the subject and general life risk factors or conditions that allow the existence of specific factors. It also makes it possible to incorporate recent advances related to the participation of spiritual well-being and spirituality as the fourth dimension of the state of human health [24].

It must be recognized that man is in the world of life actively, that is, interacting with all the elements that surround him: the world surrounds the human being. At this point, health is shown as the balance between the agent, the host and the environment in a state of homeostasis. These three elements will be the main actors for the beginning, evolution and end of the disease state; and are referred to as ecological, epidemiological triad or brought from public health [25]. Due to the exposure to different pathogens as well as to environmental conditions that contribute to the level of health that both the individual and the community possess, the period of pre-pathogenesis is a stage in which man has an increased susceptibility to develop the disease, so that it is linked to the conditions of bio-psycho-social and spiritual balance of the subject.

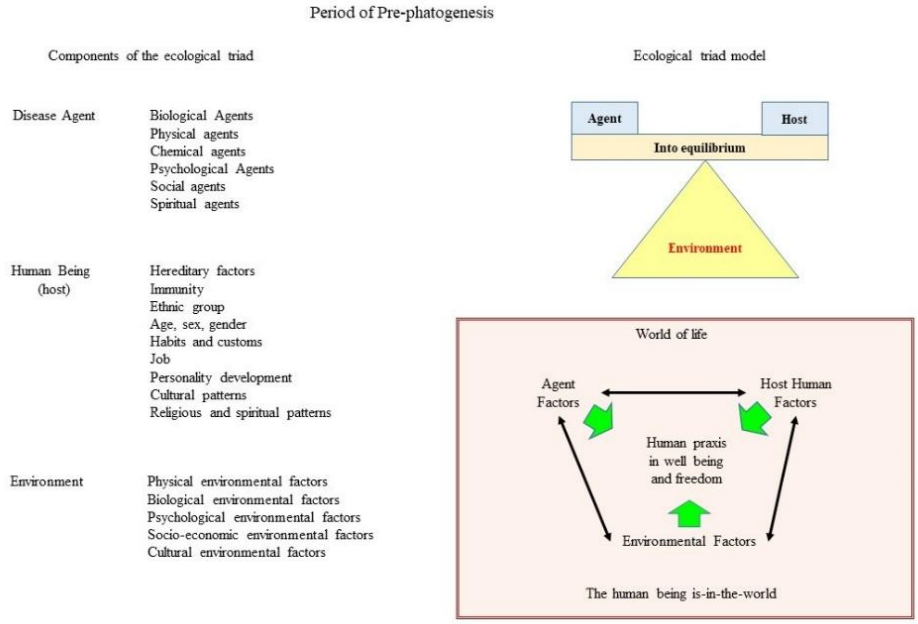

Figure 2: Schematic representation of the pre-phatogenesis period of the natural and social history of the disease. (Image modified from Leavell and Clark [4])

The biopsychosocial [26] and spiritual [27] phenomena that will propitiate the development of the disease in man respond fundamentally to the interaction between the elements of the ecological triad. Interaction, that's reflected as a dialectical and causal process, offering four possibilities in the loss of balance between the agent, the host and the environment (Fig. 3). From an epistemological perspective, the agent responds to the "what" in the ecological triad, associating with the sufficient and necessary causes of the causal model of Rothman [28]; the host represents the "who" of the triad, in predisposing risk factors that enable the onset of the disease will be identified. The environment integrates the "where" of the ecological trail, in which the predisposing risk factors will be identified.

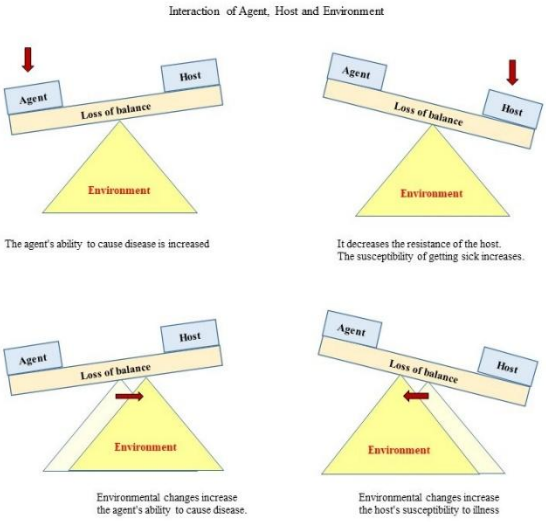

Figure 3: Schematic representation of the variations in the equilibrium of the ecological triad. (Image modified from the following source: https://cursos.campusvirtualsp.org/mod/tab/view.php?id=23154)

The dynamics of the ecological triad will favor or determine the transition of the subject in the health-disease continuum, as expressed by Milton Terris [29] and Hernan San Martín [9], based on the complex balance of the susceptibility-resistance binomial of man that allows him to defend himself constantly from the environmental conditions and potentially pathogenic agents [30,31], making it possible to obtain a positive balance (defense that can be reinforced by primary prevention measures).

The factors in which the human being unfolds when being-in-the-world of life are of different nature. They can be environmental (biological, physical, chemical), behavioral (behavior, risky practices and activities), endogenous (associated with phylogenetic and ontogenetic characteristics), although other factors of a mixed nature have been described, since the factors influence their manifestation environmental and behavioral, acting on an endogenous predisposition of genetic origin [32].

The interaction of the human being (host) with the components of ecological triad (environment and agent), configuring the presence of health risks, which increase the possibility of suffering a disease [33]. From this perspective, two stages have been differentiated in the pre-pathogenesis period: the stage of general life risks and the stage of specific risks. The general risks of life are individual and collective and are the predisposing cause of the disease. Among the specific risks are the genetic potential (biotype), morphology, physiology, temperament, intelligence, etc. Among the general risks of life, are identified: race, sex, age, marital status, physical location, class and social stratum, occupation, availability of bio-psycho-social resources, availability of services and especially health.

Pathogenic period

The second basic element of the model of the natural and social history of the disease is the evolution of the disease in man (Fig. 1). This period begins with the first alterations that pathogens cause in man. Then biochemical disturbances will appear at the cellular level, which continue as functional and later structural alterations of organs, apparatuses and systems [4]; therefore, the difference between a phase of early pathogenesis (also known as the pre-clinical phase of the disease) and the early disease phase (known as the clinical phase) is established. This difference is determined by the clinical horizon.

Early pathogenesis

The early pathogenesis is the historical moment of the evolution of the disease of preclinical or subclinical nature, because in theory, the individual has ceased to be healthy, but there is still no clinical evidence of the disease. It is characterized by two moments: the latency or incubation period and the loss of homeostasis (Fig. 4).

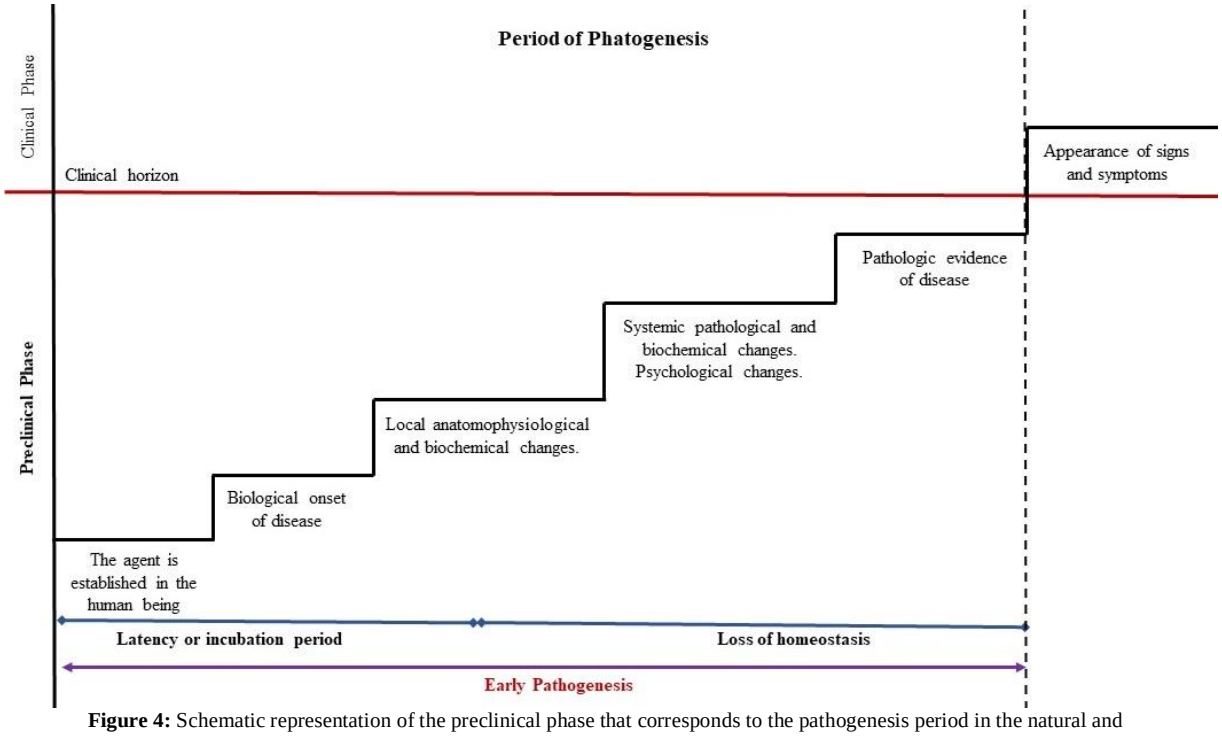

Figure 4: Schematic representation of the preclinical phase that corresponds to the pathogenesis period in the natural and social history of the disease. (Image modified from Leavell and Clark [4])

In the agent-host interaction, some factors act predisposing the host organism to the subsequent action of pathogens, initiating the incubation of infectious agents or the latency time in chronic diseases. During this interaction the moment of onset of the disease is presented.

The loss of homeostasis of the organism of the host is determined by the biochemical, physiological and tissue alterations, giving proof of the installation of the disease in the subject [34,35]; it is characterized by presenting pathological evidence of disease. The biological constants can oscillate in the range of normal values

("homeostasis"); or, to pass that barrier and through diagnostic means (cabinet or laboratory) to be detected as asymptomatic patients among groups potentially exposed to specific risks. Healthy carriers fall into this situation, only that they could have followed in the opposite direction and have positive laboratory tests (for example, latency periods of syphilis).

Because this period is the result of the interaction between the susceptibility-resistance binomial (predisposing cause) of the subject, the environmental conditions (coadjutant and triggering causes) and the potential disease agents (basic causes) with a negative balance, the early pathogenesis there may be recovery and remission towards apparent health or move towards discernible early disease, when signs and symptoms appear when the clinical horizon is exceeded [32].

The clinical horizon is an imaginary line in which the subject or external observers such as family members, or physicians, initiate the perception of the beginning of the clinical stage through the appearance of signs and symptoms of the disease. It is noteworthy that the biological and psychosocial characteristics, individual and collective, can modify the perception of the clinical horizon. Thus, cultural patterns, the opportunity and quality of medical care and health, access to diagnostic resources of the laboratory and the laboratory, offer the interpretative ideological determination in the evolution of the disease.

Early disease

Early disease, within the stage of pathogenesis, is the period of time in which the signs and symptoms of primary disease occur; is delimited at the beginning by the clinical horizon and concludes, schematically with the results of the disease, because it can evolve towards remission, relapse, chronicity and/or complication. It is also possible that there is temporary, partial or total disability, or death (Fig. 1). At this stage, the biochemical, physiological and tissue changes characteristic of the disease that affects the subject progresses and are identified through diagnostic studies, whether in the laboratory or in the cabinet.

The fundamental characteristic of the stage of early disease is the clinical manifestation of the disease. The idiosyncrasy of the human being causes the expression of signs and symptoms of the disease to vary in the population; that is, the expression of the disease is reflected in the intensity or severity of the disease in relation to the particular characteristics of the host. In addition, with the appearance of signs and symptoms, the patient begins the search for medical attention, an action that will lead to establish the diagnosis of the disease and prescribe medical treatment (Fig. 5).

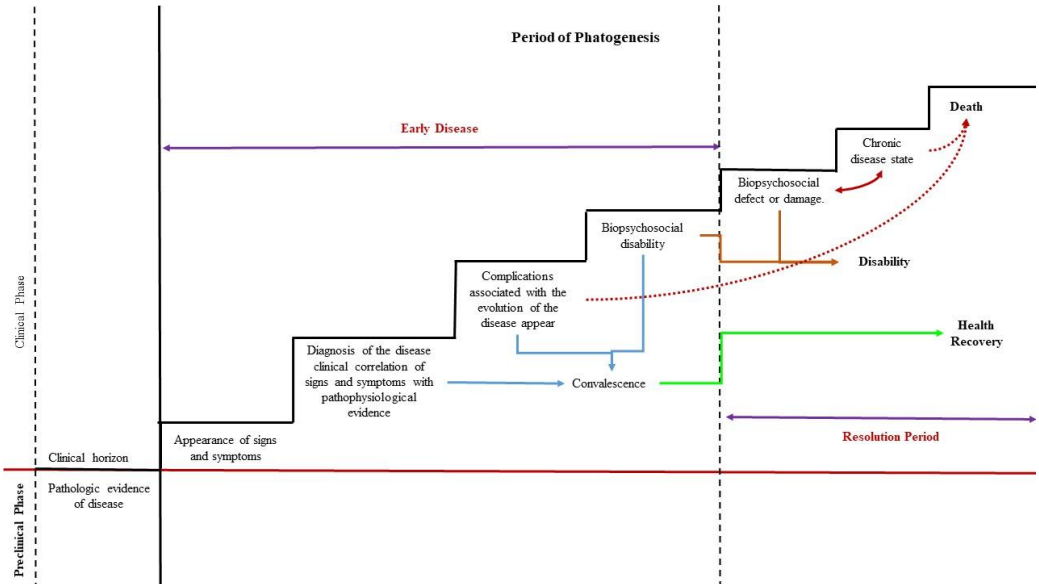

Figure 5: Schematic representation of the clinical phase that corresponds to the pathogenesis period in the natural and social history of the disease. (Image modified from Leavell and Clark [4])

The progression of the disease, in this stage of the natural and social history of the health-disease process, is associated with risk factors that are imposed on the individual and the population; so that the severity is associated to the predisposing and coadjutant causes that appeared in previous stages; but also the class and social stratum, the physical location and the availability of bio-psycho-social, emotional and spiritual resources, especially the availability of medical care in general.

For the understanding of the evolution of the biopsychosocial and spiritual mechanisms that occur in the clinical stage of early disease as well as the articulation with the pre-clinical stage and the results of the disease, various schemes have been used. The model of the iceberg proposed by Evans in 1982 [36], compares

the response that the host makes when exposed to an infectious pathogen, with the response produced at the cellular level and that can be translated into the integration of four levels: the healthy host that does not has exposed to the pathogen, the host that after having been exposed to the pathogen the disease is in the incubation or latency period, the host that clinically shows signs and symptoms of the disease, and the host that dies as a result of the disease primary or the complications derived from it.

Resolution period

The resolution period places the progression of the disease in a specific time line in the life of the patient and throughout his life with the purpose of expressing the evolution of the disease without medical intervention. In this case, the disease can evolve towards the remission of disease; derive in chronicity of the disease or, present complications when aggravated. It can also generate disability or go towards the death of the patient (Fig. 1, Fig. 5).

In the remission of the disease the decrease or disappearance of the signs and symptoms is observed. In this case, the subject approaches the healing and will gradually return to the state of health. For this reason, remission is a state characterized by the absence of active disease; it is not limited to the change or transition from disease to health. The remission of the disease is linked to recurrent events of the disease; that is, the signs and symptoms return so that the subject becomes ill again. It is also possible that the disease is complicated, generates a temporary or permanent sequelae that causes disability, will become chronic or will be directed towards the death of the subject. This evolution is determined by the severity of the disease, defined as "the likelihood of death or organ failure resulting from disease progression and independent of the treatment process" [37]. From this approach, it is stratified in the following levels [38,39]: Stage I: conditions without complications or problems of minimum severity; Stage II: problems limited to an organ or system of organs, significantly increased risk of complications; Stage III: multiple site involvement, generalized systemic involvement, poor prognosis; and stage IV: death.

Chronic and/or complicated illness

The disease without medical intervention presents two alternatives for which it is transiting for resolution. The first way is the installation of a chronic disease as a result of the persistence to the exposure of general risks of life as well as to the specific risks of life, as is the case of diseases such as: obesity, hypertension, diabetes mellitus, neoplastic diseases. Chronic disease is also referred to as non-communicable diseases, and includes the following: cardiovascular disease, chronic respiratory disease, dyslipidemia, metabolic syndrome, rheumatoid arthritis, osteoporosis, depression, sarcopenia and frailty, cognitive impairment, cerebrovascular disease, neurodegenerative diseases.

Chronic diseases are characterized by having a close relationship with unhealthy lifestyles, so that individual factors (beliefs and attitudes), interpersonal factors (social and cultural norms), environmental factors and political factors take on importance [40]; so that the physiopathological mechanisms that underlie chronic diseases are associated with modifiable risk factors, among which tobacco consumption, physical inactivity, salt intake, unhealthy diet stand out due to their importance [41].

The second route of resolution of the primary disease is an unfavorable evolution in which the homeostatic mechanisms are altered so that the original signs and symptoms are exacerbated, new signs and symptoms appear, and new pathological changes arise. This implies that other diseases are added to the initial state of illness, so that the complicated disease, like the chronic disease, develops in the company of co-morbidity. A very representative example is shown in type 2 diabetes mellitus, in which the disease presents, on the one hand, acute complications (diabetic ketoacidosis, hyperglycemic hyperosmolar syndrome, hypoglycemia), and on the other, chronic complications (nephropathy, retinopathy, neuropathy) [42]. This example is also illustrative to indicate that chronic and/or complicated disease progresses towards relapse, disability or death; so that the evolution of the health-disease process depends on the risks imposed on the individual or group by the class and the social stratum, the physical location, the availability of biopsychosocial resources, the availability of resources for general and specialized medical attention.

Disability

When the primary disease, acute or chronic, presents organic or functional alterations that will produce a defect, damage or sequels that predispose the human being to secondary diseases, it is possible that it subsequently presents impairment, disability or disadvantages that may be temporary or permanent; or, partial or total. By 1976, these were considered within the context of the consequences of the disease [43]. From the year 2001, the disability was conceptualized, as well as the functionality of the individual, as a component of health; in which the functions and structures of the body interact, the activities of the individual and the participation in activities of daily life [44]. These characteristics unfold in the context of personal factors and environmental factors.

In the global disability report published in 2011, it is recognized that it is a complex, dynamic and multidimensional phenomenon; and points out that the "disability is the umbrella term for impairments, activity limitations and participation restrictions, referring to the negative aspects of the interaction between an individual (with a health condition) and that individual's contextual factors (environmental and personal factors" [45]. The study of disability has been carried out through an individual and medical perspective, a structural and social approach, although the application of the integral model of biopsychosocial type has prevailed. The prevalence of chronic diseases worldwide, as well as the consequences of accidents, in addition to the social burden of the disease that represents disability, have led the analysis of disability to the field of human rights and development. In this sense, the relationship between disability and poverty is clear.

The evolution of the health-disease process in this stage depends on the risks posed to the individual and the group by the class and social stratum, the physical location, the availability of biopsychosocial resources, the availability of medical and rehabilitative care services through multidisciplinary health teams.

Death

Death is an evasive term to human rationality, so it can be defined from the field of philosophy, biology, medicine, jurisprudence, ethics and bioethics; besides being contextualized from a social, cultural or religious approach. However, the point of confluence is to understand death as an irreversible biological event characterized by the loss of all the vital biological functions that sustain a living organism [46].

In the case of human death, it is generally accepted that diagnosis is established when there is evidence of irreversible loss of consciousness and irreversible loss of ability to breathe [47]. This stage is the maximum expression of susceptibility of the host to the environment and the agents; it is the state in which all resistance mechanisms have ceased. As the culmination of the progression of the disease, it represents the series of events that led directly to death, or the circumstances of the accident or violence that caused the fatal injury.

In the context of the natural history of the disease, death is the final point of the progression of the disease; however, it is important to highlight two fundamental aspects in the understanding of death. The first is the description of the physiopathological mechanisms that are associated with cell death in general [48], and brain death in particular [49]. From the epistemological point of view, it implies the need to establish the physiopathological bases that articulate the capacity of the human being as a being for death, as Heidegger describes it [50], with the loss of homeostasis and the development of homeoresis in disease conditions [51].

The second is the connotation that death has in the field of human life for what acquires singular relevance. Historically, the cult to the death through the ritual realized for the burial of the human body marked the transition between prehistoric communities and primitive communities [52]. In this sense, the development of thanatology and palliative care in the field of health care, developed with the purpose of accompanying the patient in the act of dying. Currently death becomes important in relation to organ donation; what has kept the controversy in the diagnosis of death through criteria related to cardiopulmonary death, "whole brain" death, and "higher brain" death [53].

IV. Conclusion

The complexity of the health-disease process is recognized, so that for its study the integration of inter and transdisciplinary perspectives is currently required. This complexity is transferred to the training of the general practitioner, because it requires to appropriate during his training, different conceptual approaches to address the patient's care. In addition, the scientific advance and the technological application to the field of medical sciences, increases the level of complexity for the learning of medicine.

The current trends in medical education renew the Flexnerian tradition, because it is initially required to acquire knowledge of the conditions of bio-psycho-social and spiritual normality of the human being, to later approach the study of human diseases. This model is consistent with the natural and social history of the health-disease process, so that in order to understand the articulation of the ecological triad and understand the interrelationships that are established when the agent, the host and the environment interact, the student must know the morpho-functional mechanisms of the human being. By learning the biomedical sciences, the student will be able to enter the pre-clinical and clinical stage of the pathogenesis period. Simultaneously, it is introduced in the levels of prevention and acquired the knowledge, skills, attitudes and values coming from the medical profession, as well as from the socio-medical and humanistic disciplines.

In this context, the natural and social history of the disease is shown as a scientific model that allows the student to combine different elements to establish prevention, diagnosis, treatment, rehabilitation and patient support throughout the evolution of the disease. In addition, this model incorporates clinical pictures, biological theories and social, cultural and, lately, spiritual assumptions. In this sense, the limitations of the study carried out lie in the impossibility of making a more exhaustive presentation of the characteristics of each of the periods of the natural and social history of the disease, highlighting the contributions that the advancement of medical sciences future directions in the understanding, deepening and rehabilitation of the model. However, the

contribution of this communication is recognized in two senses. The first is related to the general exposure of each of the stages of the model. The second is oriented to the possibility of epistemologically grounding the pedagogy of medical education.

Finally, it is concluded that the natural and social history of the health-disease process is constituted as a scientifically based model that makes it possible to make sense of medical rationality, both at the healthcare level and at the educational and research level. In the third and final installment of the study, the epistemological framework that derives from the analysis of the model will be exposed.

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