

# Homeostaticology, Iatrogenicology and Salutogenicology

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## ABSTRACT

Health may not be a perfect balance point but efforts can be made to maintain the health in a perfect homeostatic range. Disrupted homeostasis is the underlying issue of all the diseases. Larger and longer the deviations of the body from homeostatic conditions, poorer the ability to regain the original functions will be. George E Billman stated 'Homeostasis: The Underappreciated and Far Too Often Ignored Central Organizing Principle of Physiology'. Lack of clinical diagnosis and treatments on the basis of homeostasis could lead to public health damage, disingenuous medical curriculum, and eventually iatrogenic pseudoscience. Ivan Illich criticized iatrogenesis caused by treatments, health policies, medicalization of life and eradication of autonomous coping skills during illnesses. Antonovsky distinctly stated that the salutogenesis was not limited by the disciplinary borders of one profession but rather an interdisciplinary approach and a question of bringing coherence between disciplines and realise what connects them through the people's ability to comprehend the whole situation and the capacity to use the resources available [called as sense of coherence - SOC] to move in a health promoting direction. Prevention or healing of homeostatic disturbances obviously need interdisciplinary approach of various medical specializations including Physiotherapy. Intensifying impeccable prophylaxis, clinical applications and public health policies on the basis of homeostasis need in-depth and persistent emphasis on 'Homeostaticology', 'Iatrogenicology' and 'Salutogenicology'.

**KEY WORDS:** Homeostasis, Iatrogenesis, Public health, Kinanthropometry, Salutogenesis, Stress, Eustress, Epigenetics, Exercise, Spiritual intelligence, Yerkes-Dodson Law.

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## INTRODUCTION

Health may not be a perfect balance point but efforts can be made to maintain the health in a perfect homeostatic range. Disrupted homeostasis is the underlying issue of all the diseases. Integration of specialized functions of all the organs should render an individual the ability to resist infections and non-communicable diseases, and recuperate from any occasional illness rapidly, to enhance the functional capabilities and survival span. Multicellular organisms depend on two mechanisms to survive:

the regulation and ability to store energy to prevent starvation and the ability to fight against infection [1]. Every homeostatic factor has three-dimensional functionality associated with immunity, metabolism and pH, hence capable of resisting both infections and non-communicable diseases [2]. Homeostatic factors inter - connectedly develop and maintain efficient immune system, metabolic system and acid-base balance system, all contributing to enhance the 'Epigenetic Efficiency' of the body. Epigenetically efficient individuals, in contrast to Disability

Adjusted Life Years [DALYs], could enjoy Morbidity-Attenuated Life Years [MALYs] to become an exemplary septuagenarian, octogenarian, nonagenarian and centenarian, and humans can be classified based on their functional status by applying kinanthropometry [3].

Allostatic load is the long-term result of failed adaptation or allostasis, resulting in pathology and chronic illness, caused by failure of adaptation process of the complex physiological system to physical, psychosocial and environmental challenges or stress [4]. "Numerous studies suggest that stress is a health crisis associated with several diseases such as cardiovascular diseases, anxiety, and depression. Eustress is "good stress" associated with positive feelings and health benefits. Lacking of knowledge about eustress obstructed the development of positive stress" [5]. "Selye had originally postulated a general, nonspecific physiological response to any stressor, later drew a health-centered distinction between eustress and distress. Eustress was the good kind of stress because it was associated, presumably, with positive feelings and healthy bodily states; distress was the bad kind, associated with negative feelings and disturbed bodily states [eustress may enhance immune system competence while distress may impair it]. Lazarus drawn a distinction between harm, threat and challenge. Harm refers to psychological damage that had already been done e.g., an irrevocable loss. Threat is the anticipation of harm that has not yet taken place but may be imminent. Challenge results from difficult demands that we feel confident about overcoming by effectively mobilizing and deploying our coping resources" [6].

Another dominating approach for understanding eustress was developed on the Yerkes-Dodson Law which suggests that stress is beneficial to performance until some optimal level is reached, after which performance will decline [7]. Yerkes-Dodson Law states that a relationship between arousal and behavioral task performance exists, such that there is an optimal level of arousal for an optimal performance whilst over- or under-arousal reduces task performance [8]. The Yerkes-Dodson Law predicting an interaction between difficulty of task and motivation as determinants of learning is

confirmed [9]. "Cannon's research formed the basis for much of our modern understanding of the physiological response systems involved in linking emotions, such as fear, with illness. The dramatic suddenness of the illness following the threat, coupled with a lack of any apparent injury, exposure to toxins, or infection, through physiological response mechanisms initiated by fear, precipitate death itself - Voodoo Death" [10]. Individuals who cannot successfully combat the stressors lacking skills or resources to cope, eventually cripple or die. The key elements in the salutogenic development are, firstly, the orientation towards problem solving and, secondly, the capacity to use the resources available [11].

Stressors could be entropic leading to disorder in humans and social systems but salutogenic 'sense of coherence' represents the forces of negative entropy preventing initial tension from being transformed into stress [12]. *Negentropy* is the opposite of entropy specifically refers to the energy imported and saved by the system [energy extracted from its external environment], for its survival, stability and improvement of its internal organization [order and stability], and, therefore, it is a mechanism of self-regulation, capable of sustaining itself and maintaining balance [13]. Humans should regularly revive themselves and adapt various strategies to channelize their energy to face the ongoing challenges and unpredictable vicissitudes of life. According to the strength model, self-control is a finite resource that determines capacity for effortful control over dominant responses and, once expended, leads to impaired self-control task performance, known as ego depletion [14]. "Ego-depletion can be overcome by increasing vitality, and people who feel vital will replenish their resources faster. Sleep patterns, blood glucose level, diet, exercise, social relatedness, mood, and the satisfaction of basic psychological needs are the limited resources that can influence vitality for ego replenishment and executive functioning. Nature and/or daylight could provide individuals with a free and generally available source for ego-replenishment" [15]. "All people face a lifetime of uncertain length but one that is certainly finite. The awareness of both one's ultimate fate and one's

probable proximity to it could influence the life one chooses to lead. Socioemotional selectivity theory is a life span theory that posits that perceived time remaining in life [time perspective] is a critical determinant of motivation, to individuals who face foreshortened futures [limited time perspective] due to life-limiting medical illness” [16].

Socioemotional selectivity theory claims that the perception of time plays a fundamental role in the selection and pursuit of social goals [17]. Spiritual Intelligence helps to fulfill the potentialities of the individuals’ abilities through the non-cognitive virtues to prepare them to solve the everyday problems for life creatively and constructively in the new situation of the socio-psycho-physical environment for attaining the highest knowledge and wisdom [18]. Spiritual intelligence is the expression of innate spiritual qualities through our thoughts, actions and attitude and it helps a person to [i] understand and simplify the personal life, family life and working life [ii] calm and focused in the face of crisis and chaos, a more selfless and humane attitude towards others and a more enlightened and relaxed perspective on life [iii] be more successful thereby contributing in the growth and development of an organization [19]. What are the assets and contributions of the medical disciplines and medical professionals for humans to live optimistically, meaningfully and successfully? “Man’s consciously lived fragility, individuality, and relatedness make the experience of pain, of sickness, and of death an integral part of his life. The ability to cope with this trio in autonomy is fundamental to his health. To the degree to which he becomes dependent on the management of his intimacy he renounces his autonomy leading to decline in his health. The true miracle of modern medicine is diabolical. It consists of making not only individuals but whole populations survive on inhumanly low levels of personal health” [20].

*Primum non nocere* [First do no harm] is the phrase that embodies the principle of nonmaleficence, a fundamental bioethical standard within health care [21]. No species of fallibility is more important or less understood than fallibility in medical practice [22]. More people die annually from medication errors than from

workplace injuries, and in combination with the financial cost, medical errors easily rise to the top ranks of urgent, widespread public problems [23]. “Iatrogeny has many consequences: it has a human cost, a social cost and a psychological cost. The human cost is related to the direct consequences of iatrogeny on human health: death, permanent or temporary disabilities. The social cost, on the other hand, integrates the human tragedy generated, but also the work stoppages or even the lesser performances of the victims of iatrogenism. Finally, the psychological impact includes the loss of confidence in the medicine and its caregivers of the affected patients since iatrogenia is very poorly understood by our society” [24]. “Iatrogeny remains a constant challenge to all members of the health team who must be made aware from the onset of their roles and responsibility to their patients with particular reference to patients’ rights and well-being. Medical schools must be at the forefront of responding to these challenges and reflect this by constant review of their training programmes” [25].

Academic physicians practicing and teaching mainstream medicine made Nazi crimes against humanity possible and efficient. Teachers and learners of health professions should become familiar with this legacy of the Holocaust” [26]. “Of genocide, Kuper writes, ‘the word is new, the crime ancient’. Genocide is a global phenomenon and has been present in every historical period. Genocide-specific mortality rates are high, increasing, and far in excess of mortality rates than the catastrophic epidemics. The health sequelae of genocide may be chronic, lifelong, and difficult to treat, increasing the burden of disease in affected communities for decades after the killing has ended accompanied by substantial impact on global health economy [27].

“There are consistent psychological and sociological experiments suggesting that people at all levels of society will be ready to do what they told or to obey explicit orders to kill. Doctors are clearly no exception, and one can only hope that the humanisation programmes will make genocide rarer in the future” [28]. “Doctors are trained to be humanitarian but have not the expertise to explain why cruelty, suffering,

hatred and other evils exist in the world. Doctors do, however, have the responsibility of trying to understand why in this country, in several continents, some of their professions have conceived, encouraged, organized, promoted, conspired, colluded or collaborated with genocide. There have been various attempts in recent years to humanize doctors by changing the medical curriculum, by exposing students and young doctors to great non-scientific novels, poetry, and plays, by making psychology and bioethics compulsory in the preclinical years” [29]. Various forms of malevolent malpractices and iatrogenic damages to the extent of causing an irreparable multifaceted global chaos could be done by medical professionals from any medical discipline. In general, what is man’s ultimate purpose in life; competition or compassion? Is mankind in great peril of perishability?

**Homeostaticology:** “Homeostasis is an underappreciated and far too often ignored central organizing principle of physiology. Homeostasis is not static and unvarying; it is a dynamic process that can change internal conditions as required to survive external challenges. The health and vitality of the organism can be said to be the end result of homeostatic regulation. Disruption of homeostatic mechanisms is what leads to disease, and effective therapy must be directed toward re-establishing these homeostatic conditions” [30]. Homeostasis is not merely a synchronic [same time] servo-mechanism that maintains the status quo for organismal physiology but from the perspective of developmental physiology, homeostasis is a robust, dynamic, intergenerational, diachronic [across-time] mechanism for the maintenance, perpetuation and modification of physiologic structure and function [31]. “A regulated variable is any property or condition of the extracellular fluid that is kept relatively constant in the internal environment in order to ensure the viability [survival] of the organism. The range of values of the regulated variable that the system attempts to maintain is called as set point [refers to the “desired value”]. The set point is generally not a single value; it is a range of values” [32].

Homeostasis is regulated by three different mechanisms; Osmoregulation, Thermoregula-

tion and Chemical Regulation, under the control of various systems of the body like Respiratory system, Endocrine system, Reproductive system, Urinary System and Nervous system [33]. “Multiple controlled variables typically contribute to the stability of a given regulated variable. Homeostatic circuits can be broadly divided into two classes – those that have a single fixed set point and those with multiple or adjustable set points. The fixed set point circuits are characteristic of regulated variables that have a narrow dynamic range, such as arterial [pO<sub>2</sub>] or blood calcium concentration. Homeostatic systems with fixed set points are regulated solely by changing the flows, such as calcium resorption, excretion, storage and utilization. The adaptability of systems with a single set point is limited by the homeostatic range of the regulated variable; when the regulated variable deviates beyond the acceptable range [for example in extreme environments when the buffering capacity of the system is overwhelmed], the system can undergo catastrophic pathological changes. The failure of one homeostatic circuit may lead to a disruption of other connected circuits, resulting in particularly dangerous scenarios of *cascading failures*, for example, sepsis” [34].

Immunodiversity could be better understood through Advancing Estimation and Gradation of Immunologic Status [AEGIS] if immuno-diagnostics is formulated on the basis of homeostasis [2]. Application of AEGIS needs basic understanding of three-dimensional functionality of each homeostatic factor [Red Blood Cells, Hemoglobin, White Blood Cells, Platelets, Plasma Proteins, etc.,] or organ that has interrelationships with metabolism, acid-base balance and immunity [Figure 1, Table 1, Table 2 and Table 3]. Each homeostatic factor is capable of resisting both non-communicable diseases and infections. Immune functions could deteriorate in the presence of dysfunction of even one homeostatic factor. It should be noted that if the literatures show the impact of a disease on a homeostatic factor/organ, it can also be interpreted as if the disease was due to disturbances in the homeostatic factor/organ. Rectifying the dysfunctional homeostatic factor[s] should be the principal strategy to regain immunocompetence.

**Table 1:** Scientific excerpts to relate three-dimensional functionality of Bone.

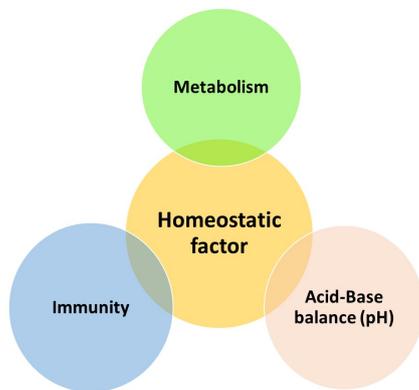
BONE		
Immunity	Metabolism	pH
Increased recognition of the complex interactions between the immune system and bone led to the development of the interdisciplinary osteoimmunology field [35].	Patients with Diabetes [Type 1, Type 2] suffer from bone disease as a complication to diabetes. Bone turnover is decreased and bone microarchitecture is compromised leading to impaired bone quality. Furthermore, an increased risk of falling in diabetes patients and possible harmful side effects secondary to diabetes treatment may further increase the fracture risk [36].	The linkage between bone and the body acid-base status can be described as both a blessing and a curse. Bone performs this buffering process in the defense against major systemic acid-base perturbations. It appears that more investigations are needed in order to evaluate the role of osteoblast- osteoclast interaction in the pathogenesis of acid-induced bone disease. Disturbance in the acid-base status of the organism induce prominent changes in the chemical composition of bone [37].

**Table 2:** Scientific excerpts to relate three-dimensional functionality of Skeletal muscle.

SKELETAL MUSCLE		
Immunity	Metabolism	pH
Skeletal muscle has emerged as a potent regulator of immune system function. As such, skeletal muscle might be the central integrator between sarcopenia and immune senescence in an aging biological system. Therapeutic approaches targeting skeletal muscle might be able to restore both muscle and immune system function. [38]	Skeletal muscle is recognized as vital to physical movement, posture, and breathing. Muscle is a primary site for glucose uptake and storage, and it is also a reservoir of amino acids stored as protein. With loss of skeletal muscle, protein and energy availability is lowered throughout the body. Muscle loss is associated with delayed recovery from illness, slowed wound healing, reduced resting metabolic rate, physical disability, poorer quality of life, and higher health care costs. These adverse effects can be combatted with exercise and nutrition [39]	Short-term effects of acid-base balance on protein metabolism seem to translate to long-term effects on skeletal muscle mass. Correction of acidosis seems to preserve muscle mass in patients with kidney disease. Chronic metabolic acidosis could adversely affect physical function. Reduction in interstitial pH could be sufficient to activate proteolytic mechanisms in skeletal muscle [40].

**Table 3:** Scientific excerpts to relate three-dimensional functionality of Red blood cells and Hemoglobin.

RED BLOOD CELLS AND HEMOGLOBIN		
Immunity	Metabolism	pH
The paramount function of the red blood cells [RBCs] is oxygen carriage but the RBCs are both mechanical and biochemical barriers against infections, bacteria, and blood parasites [41].	Low hemoglobin concentration in patients with diabetes mellitus is associated with a more rapid decline in glomerular filtration rate than that of other kidney diseases [42].	As the oxygen saturation of hemoglobin [sO <sub>2</sub> ] increases, the base excess is changed in the acidic direction, or as the sO <sub>2</sub> decreases, the base excess is changed in alkaline direction [43].



**Figure 1:** Three-dimensional functionality of homeostatic factors. Further detailed investigations can be conducted using this model to understand the three-dimensional functionality of various homeostatic factors.

From the view of three-dimensional functionality, if RBC count and Hemoglobin are in homeostatic range, it means the pH of the body also in the homeostatic range, is it not? If RBC count and Hemoglobin are in homeostatic range, it means the immune system of the body is also highly competent [immunocompetent], is it not? If RBC count and Hemoglobin are not in homeostatic range, it means the pH of the body also very likely not in the homeostatic range, is it not? If RBC count and Hemoglobin are not in

homeostatic range, it means the immune system of the body also very likely not in the competent state [immunodeficiency], is it not? If RBC count and Hemoglobin are not in homeostatic range, there can be various other associated metabolic dysfunctions and diseases [as shown in Table 3], is it not? Can medicines or vaccines easily execute their intended actions on an individual with disrupted homeostatic circuits? Accompanying the progressive erosion of a coherent sense of physiology as an intellectual discipline, there has been a tendency to lose sight of the homeostatic principles that underpin physiological science [44].

**Iatrogenicology:** “Unfavourable impact of treatments on patients’ health can affect both psychological [iatropsychogeny] and physical condition [iatrosomatopathy] [45]. “The side effects and risks associated with the medical intervention are called iatrogenesis. These side effects are also called adverse drug reactions [ADRs]. Most of the literature establishes that modern medicine is one of the major threats to the world health” [46]. “Drug iatrogenesis corresponds to

the pathology or any clinical manifestation undesirable for the patient induced by the administration of one or more medicines. The objective of pharmacovigilance is the monitoring of adverse effects resulting from the use of medicinal products and 'products for human use'. It is a system that relies on the contribution of health professionals who are required to report any serious or unexpected adverse reactions that may be caused by a drug" [47]. "Cascade iatrogenesis can be initiated by various factors and events, including medications, nursing or medical interventions, diagnostic tests, medication errors, medical devices, and lack of interventions to prevent avoidable problems such as constipation. Even a small event or change in routine may initiate it. More often, a mishap in the complex healthcare system impacts a frail older adult with limited physiologic reserves" [48].

Iatrogenic diseases are a persistent and important reason for admission to the ICU, and the risk factors, causes and consequences remain unchanged since 1980 causing negative impact on the health and resources of the society [49]. "Research on iatrogenic injuries and technology dependency is sparse in light of the expansive use of technology in health care today. Many of the publications are single case reports of an iatrogenic injury related to a specific type of device. Little has been done to analyze these reports in a collective fashion" [50]. Medical error is largely grounded in poor communication in clinical team settings [between and across teams] which is a symptom of medical culture's ingrained autocracy [51]. "Iatrogenic comorbidity" refers to the unfavorable modifications in the course, characteristics, and responsiveness to treatment of an illness that may be related to previously administered therapies. The likelihood of iatrogenic comorbidity needs to be considered in clinical practice" [52]. With the multitude of drugs prescribed to a single patient adverse drug reactions are bound to occur [53].

"The best way to reduce iatrogenic results is prevention but clearly identified preventive methods and their evaluation for efficacy are also scarce. A posteriori evaluation of emerging medical or diagnostic procedures, i.e., after

several months of marketing, thus remains the best guarantee for improving the quality of care" [24]. "The human body is dynamic and does not follow the linear laws. Doctors have been predicting the unpredictable futures of patients based on very few knowable parameters of the body during the routine check-up. Unfortunately, time evolution in any dynamic system follows a non-linear rule. To know the future of any individual one should be able to understand the whole organism [man]. This is impossible in the present set up in science. Routine screening of apparently healthy people is the most dangerous activity in hi-tech medical care system. Trying to keep the well healthy by promoting good life style and acquiring tranquility of mind should be the thrust areas. Over investigation and over treating damages the inbuilt repair mechanism of the human system and might even result in death" [54]. Critical illness is inherently iatrogenic: it only develops in those patients who have been resuscitated from an otherwise life-threatening disorder, and its subsequent evolution is shaped by the beneficial and adverse consequences of therapeutic and supportive interventions [55].

"Drug-induced iatrogenic toxicities are common in critically ill patients and have been associated with increased morbidity and mortality. Early recognition and management of iatrogenic toxicities is essential; however, the diagnosis is usually complicated by the underlying critical illness, comorbidities, and administration of multiple medications" [56]. Iatrogenic pathology in elderly population has even a bigger impact due to conjugation of two major demographic phenomena: an absolute and percentage increase of elderly population parallel with an increase of prevalence of iatrogenic pathology with age [57]. "Risk factors of iatrogenic disease in the elderly are drug-induced iatrogenic disease, multiple chronic diseases, multiple physicians, hospitalization and medical or surgical procedures. Interventions that can prevent iatrogenic complications include a geriatric interdisciplinary team" [58].

"In geriatrics, the concept of cascade iatrogenesis has been developed: the serial development of multiple medical complications that can be set in motion by a seemingly

innocuous first event. For instance, postoperative respiratory failure is common among elderly patients who underwent elective surgery or orthopedic treatment after a fracture; suffering an adverse event during hospitalization is strongly associated with a poorer prognosis following discharge. The concept is highly relevant to psychiatric practice” [59]. “Iatrogenic wounds are a common but often overlooked concept. They can lead to increases in hospital stays, therapy costs, repeat surgeries, and implant removal. If not handled properly, these wounds have a very poor prognosis and will cause serious physical and psychological harm to patients, which may result in medicolegal disputes” [60].

A case of simple urinary lithiasis resulted in several severe complications demonstrating the iatrogenic risk related to any medical treatment, including simple procedures [61]. “Iatrogenic ureteral injuries and strictures are relatively common complication of pelvic surgery and radiation treatment. Left untreated they are associated with severe short- and long-term complications such as urinoma, septic state, renal failure, and loss of a renal unit” [62]. Majority of emergency department visits for adverse drug events among dialysis patients were attributed to medications that affected blood constituents, almost certainly being driven by oral anticoagulant use [63].

“Iatrogenic neuropathies are unintended peripheral nervous system complications that occur during the course of a patient’s medical care. Many specific etiologies of iatrogenic neuropathies exist, and they can be classified into mechanical, ischemic or medication-related nerve injuries” [64]. “Iatrogenic injury to the femoral neurovascular bundle is not uncommon during primary and revision total hip replacement and can result in permanent weakness, pain and poor function. Patients with a low body weight and the elderly may be at a higher risk of iatrogenic injury due to increased proximity of the neurovascular structures to the hip. Application of this knowledge may serve to reduce the risk of iatrogenic injury to these structures and thereby improve patient satisfaction and outcomes” [65]. The maternal morbidity and mortality rate with iatrogenic factors was high

and majority of these factors were avoidable [66]. “Neonatology – ‘A Six Finger Exercise’ was first used with special emphasis on the sixth finger—pediatrica iatrogenica. This area had been a major factor in the development of this new field and must always remain a concern for those who care for the newborn” [67].

“Technological iatrogenesis is stimulated by the infusion of technological innovations into complex healthcare systems. While health information technologies have helped to make healthcare safer, this has also produced contemporary varieties of iatrogenic errors and events” [68]. Even simple clinical assessments [like respiratory rate, muscle girth] are ignored or neglected, amidst the strong reputation for sophisticated diagnostics. For instance, thigh muscle atrophy from a knee surgery can be commonly found but the patients would never know its impact on their functions [gait, postural control, return to sport, etc.,] solely due to lack of awareness, though this awareness can be developed through muscle girth tests [an inch tape costs just 10 INR !!] – Table 4 and 5.

**Table 4:** Thigh girth measurement as on 10.04.2015 [a year later post-surgery] of a 47 years old male [Left knee surgery for Anterior cruciate ligament repair].

	Right Lower Limb	Left Lower Limb
Thigh [10 cm above patella]	42 cm	39.5 cm
Thigh [25 cm above patella]	55 cm	52 cm

**Table 5:** Thigh girth measurement as on 16.03.2020 [a month later post-surgery] of a 45 years old male [Left knee surgery for Anterior cruciate ligament repair].

	Right Lower Limb	Left Lower Limb
Thigh [8 cm above patella]	40 cm	39 cm
Thigh [20 cm above patella]	53 cm	48 cm

“Ivan Dominic Illich, 1975 in his book Medical Nemesis, argues that industrialised society widely impairs quality of life by overmedicalising life, pathologizing normal conditions, creating false dependency, and limiting other more healthful solutions. This frequently caused more harm than good and rendered many people in effect lifelong patients” [69]. “Illich argued that modern medicine had hubristically taken on a mission to eradicate pain, sickness, even death. He described three types of iatrogenesis: clinical, or the direct harm done by various medical treatments; social, or the medicalisation of ordinary life; and cultural, meaning the loss of traditional ways of dealing with suffering. He coined

the term ‘Sisyphus syndrome’, meaning the more healthcare given to a population, the greater its demand for care” [70]. “Health, argues Illich, is the capacity to cope with the human reality of death, pain, and sickness. Technology can help, but modern medicine has gone too far turning people into consumers or objects, destroying their capacity for health. Health, or the autonomous power to cope, has been expropriated down to the last breath” [71].

**Salutogenicology:** “Salutogenesis refers to a scholarly orientation focusing attention on the study of the origins of health, contra the origins of disease. Salutogenesis model is in harmony with developments across the social sciences that seek better understanding of positive aspects of human experience” [72]. The sense of coherence [SOC] is a concept that can be applied at different system levels, at an individual level, a group [family], on organizations and societal level [73]. “Antonovsky believed that health was represented by a spectrum ranging from disease to wellness and that stress and an individual’s ability to respond to it determined where they would be on that spectrum and his work indicates that one’s resources determined the impact of a stressor. We proposed an expanded definition of salutogenesis that includes five aspects of environmental generalized resistance resources [GRR] that can address or alleviate specific causes of stress - SOC, biophilia, relaxation response, self-empowerment, and prospect and refuge” [74].

Antonovsky distinctly stated that the salutogenesis was not limited by the disciplinary borders of one profession but rather an interdisciplinary approach and a question of bringing coherence between disciplines and realise what connects them through the people’s ability to comprehend the whole situation and the capacity to use the resources available [called as sense of coherence - SOC] to move in a health promoting direction [11]. To strengthen the knowledge base of salutogenesis, the Global Working Group on Salutogenesis [GWG-Sal] identified four key conceptual issues to be advanced: [i] the overall salutogenic model of health; [ii] the SOC concept; [iii] the design of salutogenic interventions and change processes in complex systems; [iv] the application of salutogenesis beyond health

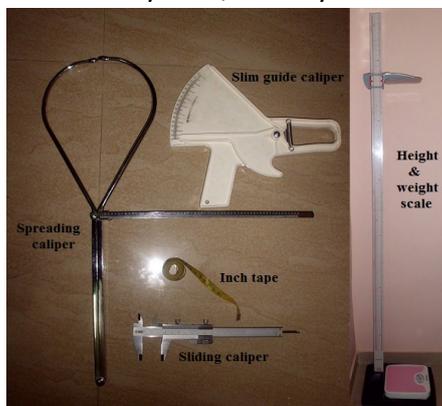
sector [75]. Antonovsky had an expansive interest in the roles of culture in salutogenesis and his writings included attention to the role of culture in: [a] shaping life situations; [b] giving rise to stressors and resources; [c] contributing to life experiences of predictability, load balance and meaningful roles; [d] facilitating the development of the sense of coherence and [e] shaping perceptions of health and well-being [76]. The application of salutogenesis in curative settings is specific, since it is about implementing salutogenesis into a territory which is still predominantly dominated by the paradigm of pathogenesis [77].

Antonovsky’s salutogenic model has received considerable attention in the health sciences and salutogenesis offers a promising perspective on the health and well-being of users of residential aged care [78]. “Research on intrapartum interventions in maternity care has focused traditionally on the identification of risk factors and on the reduction of adverse outcomes with less attention given to the measurement of factors that contribute to well-being and positive health outcomes. There is an absence of salutogenically-focused outcomes reported in intrapartum intervention-based research” [79]. “Salutogenic framing is rarely used in maternity care research with healthy participants. An increase in research that measures salutogenically orientated outcomes could, eventually, provide a balance to the current over-emphasis on pathology in maternity care design worldwide” [80].

The Clubhouse model of psychosocial rehabilitation is very consistent with the salutogenic orientation and main salutogenic concepts [81]. “Schools are an excellent setting for health promotion in children and adolescents. In particular the school subject physical education offers high potential in this regard. A high sense of coherence mobilizes generalized resistance resources, results in positive coping strategies and contributes to well-being and health. Successful health promotion therefore depends on an interaction of children, parents and teachers” [82]. “Taking care of one’s own health is probably the most neglected part of an individuals’ life. The SOC is defined as ‘the way of perceiving life and ability to manage successfully the

infinite number of stressors that one encounters in one's life independently'. SOC functions as our "sixth sense" for survival and helps in the generation of our health-promoting ability. Antonovsky claimed that SOC can be learned and that it develops over the lifespan but it fluctuates dynamically throughout life. Antonovsky postulated that SOC was mainly formed in the first decades of life. Comprehensibility – To understand the problem, Manageability – To realize that threat can be managed with the available resources and Meaningfulness – To extract something meaningful from the stress.

Typical GRRs are Physical and Chemical [money, housing, clothing, food, power, intact neurological and immune system, healthy behaviors, etc.],



**Figure 2:** Tools used in Heath Carter somatotype test. Somatotype assessments and kinanthropometry are not routinely applied in the clinical settings though they could contribute to comprehensive understanding of the homeostatic conditions and functional capacities of unhealthy individuals with different types of diseases. Periodic somatotype assessments and personalized kinanthropometry for hemiplegic patients could be very useful and clinically relevant to understand the disease progression and regulate the lifestyle accordingly to evade crippling disabilities and premature loss of life.

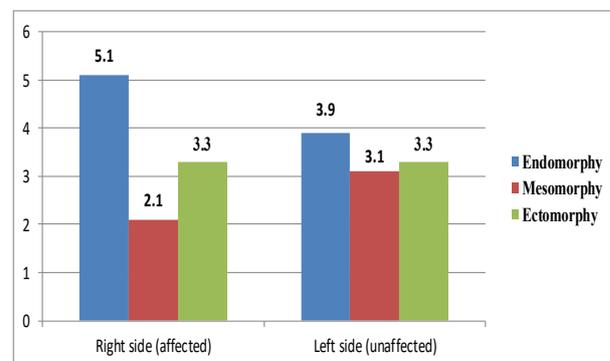


**Figure 3:** Deformed right hand and right foot. Disuse atrophy, paralysis, spasticity, contractures and deformities were also found associated with his long-term disability. In addition, sarcopenia has begun to worsen his functional capacity but until now he is capable of managing his basic self-care independently.

Cognitive [intelligence, knowledge, experience, education], Emotional [self-esteem], Interpersonal Relations [social support, interaction] and Macrosocial [culture, religion]. GRRs help us to make sense of the countless stressors and hardships which we constantly confront. Studies suggest that there exists a positive association between well-being and SOC, and an inverse association between SOC and disease, disabilities, and symptoms including health complaints, dysfunctions and distress, physical symptoms and illness, burnout, sickness absence frequency, and self-rated health. Thus, salutogenesis model hence proves to be consistent in preserving health through SOC and GRRs" [83]. Let us have a glance at a clinical scenario of a 63 years old male hemiplegic patient [developed right-sided stroke at the age of 30] and incorporate salutogenic views [Figure 2, Figure 3, Figure 4, Table 6 and Graph 1].



**Figure 4:** Independent bicycling ability of right-sided hemiplegic male. More than 30 years he has been able to ride the bicycle. He had acquired this rare possibility after several weeks of hardwork after developing stroke when he was 30 years old. Improvements in fitness variables from cycling must have tremendously contributed to his survival post-stroke.



**Graph 1:** Asymmetrical somatotype characteristics of this hemiplegic patient. Application of Heath Carter anthropometric somatotyping revealed distinct somatotype for the affected side [Ectomorphic Endomorph] and unaffected side [Balanced Endomorph] of the body.

**Table 6:** Sense of Coherence: [i] will power [ii] past experience engaging in hard manual labour [iii] ability to do sustain a poverty livelihood from the income generated by wife’s daily wages and meagre monthly pension given to his mother for his father’s services in Indian Military. It was also understandable perusing his medical records that his level of disability was never properly tested using a specific disability evaluation scale before issuing a disability certificate to him to derive apt benefits from any government scheme.

<b>Comprehensibility</b>	Paralysed arm and leg cannot be fully recovered.
	Advanced treatment facilities unavailable in the town.
	Cannot afford long-term physical rehabilitation.
<b>Manageability</b>	Dependency on unaffected left upper extremity and left lower extremity.
	Self-trained the dexterity of the unaffected left upper extremity to look after independent self-care and instrumental handling [Scissors, Writing with pen, Drawing etc.,].
	Extracting the best possible cooperation from paralysed extremities concomitantly to stay independent.
<b>Meaningfulness</b>	Regaining balance and strength to the extent to propel bicycle instead getting crippled.
	Doing some occupation pertaining matrimonial affairs in rural tier.
	Adopted a 6 months old female child when he was 40 years old, which must have augmented his enthusiasm to live purposefully not sorrowfully.

**DISCUSSION**

“Every clinician is responsible for evaluating their own practice in a robust and meaningful way, and need to be able to critically review research done by others” [84]. “Distribution of valuable research discoveries are needed for the continual advancement of patient care. Publication and subsequent reliance of false study results would be detrimental for patient care. Research misconduct generally does not include unintentional errors, but rather intentional misrepresentations of research data, processes, and/or findings” [85]. “Over the past 35 years, patients have suffered from a largely hidden epidemic of side effects from drugs that usually have few offsetting benefits. The pharmaceutical industry has corrupted the practice of medicine through its influence over what drugs are developed, how they are tested, and how medical knowledge is created. Meeting the needs of the drug companies has taken priority over meeting the needs of patients” [86].

Dark triad refers to the constellation of narcissism, machiavellianism, and psychopathy – ‘The malevolent side of human nature’ [87]. Advancements in the domain of exercise biomechanics and exercise prescription are unknown to many professionals in various medical specializations. Sufficient evidences exist to support the plethora of health benefits of exercises [prophylactic and therapeutic] and the devastating effects of sedentary life [3]. “Exercise truly can be considered

“medicine” [88]. Though it looks like we have extensive researches done in the field of exercise, even basic biomechanical interpretations of skeletal muscle stretch are missing. Stretching exercises are the most indispensable to enhance/exhibit/retain versatile functional capabilities for healthy longevity but at the same time they could be the riskiest if the selection/prescription of stretching exercises are iatrogenic without profound knowledge in musculoskeletal anatomy and stretch science. If the biomechanics of normal movement patterns are observed and understood thoroughly, numerous Simple Integrated Flexibility Tests [SIFT] could be generated to rapidly diagnose the functional limitation of an individual. For instance, getting up from the floor [from lying to standing is an example of SIFT] could reveal various erroneous movements caused by inflexibility and muscular imbalances [89].

There are instances where patients exclusively need exercise-based rehabilitation and they would be also responding very well to exercises but medicines or polypharmacy rendered at par act as an iatrogenic barrier which cannot be easily communicated to the patient or any member of the rehabilitation team. The team is a symbiotic relationship complementing and supporting each other’s skills, communicating openly and clearly with one another and holding themselves mutually accountable [90]. “Lencioni has described five dysfunctions of

teams. The first dysfunction is “absence of trust”, and fear of conflict, lack of commitment, avoidance of accountability and inattention to the results were the other dysfunctions” [91].

While traditional intellectual reasoning and procedural knowledge have helped building the communities we live in, there is a growing scientific understanding that we need emotionally balanced and better-fitting prosocial frameworks [empathy and compassion] for coping with the uncertainties and complexities of life and addressing new challenges of the modern world [92]. “Mistakes are ubiquitous in medicine; when confronted by error, physicians may experience anxiety, guilt, and self-doubt. Assessments reveal their imposter syndrome when they reach the extreme end of self-doubt, so even positive feedback could not buffer their insecurities [93]. “Our work in medicine often exposes us to the darker side of human existence. There is homelessness, drug addiction, abuse, neglect, trauma, and lots for our psyche to absorb. Keeping a humane outlook amidst all this is indeed a difficult job, but that’s what humanism in medicine is all about! [94].

Unequal reputation for medical professionals with unique medical specialization should be perceived as an obstacle to the progression of the health care sector. “Societies that provide uniform access to cognitively stimulating environments help individuals to achieve their potential but also bring to bear differences in intelligence. Education is not the great equalizer, but rather generates individual differences rooted in genes” [95]. It is the responsibility of physical therapists to upgrade the perception of other members of healthcare teams about their profession [96]. Physiotherapists, Dieticians and Exercise professionals have much better scope to become trailblazers in the forthcoming years to revamp the public health system and set spectacular trends in interdisciplinary health care to the people [2]. “Every citizen deserves a lengthy, healthy and successful life. Survival competence and successful ageing basically require [i] ability to counteract gravitational force through adequate muscle strength, flexibility and postural control [ii] healthy nutrition [iii] optimal respiratory efficiency at rest and during physical activity

[iv] mental health and [v] supportive family. Blending spiritual intelligence, Antonovsky’s salutogenesis, Fries’ compression of morbidity and Meikirch’s model of health could prevent early onset of age-related morbidities and premature mortalities. Spiritual intelligence, Holistic health, Agriculture, Research and Eldercare [SHARE] should be integral components of an equitable public health model” [97].

Athletes know their training intensities and performance standards but various labourers [farmer, load man, mason, shepherd, fisherman, road worker, washer man, house keeper, street sweepers, manual scavenger] may not know that they possess excellent health status, almost equivalent or even better than the successful athletes, despite their exposures to highly challenging climatic conditions, environmental hazards and socioeconomic pressures [3]. “The salutogenic model of health is concerned with ubiquitous tensions that do have the potential to convert to health-threatening levels of stress. Generalised resistance resources arise from the cultural, social and environmental conditions of living and early childhood rearing and socialisation experiences, in addition to idiosyncratic factors and chance. If specific resistance resources [government, NGO, charity to impart control over/avoid/reinterpret/adapt to a specific stressor] are more readily available to those with lots of generalized resistance resources [e.g. money], specific resistance resources might actually contribute to a widened equity gap. Equality in access to specific resistance resources depends on a reasonably fair distribution of generalized resistance resources, so health promotion needs to keep both types in focus [98]. Not everyone responds to stress in a same way or pathological way, it is difficult to unravel the health mystery based only on the knowledge about the individuals’ physical conditions and stressors experienced [99].

“Underlying individuals’ unique, invaluable, and enigmatic metaphysical qualities, the human organism is, in a physical sense, essentially a self-regulating biochemical machine. At any moment, our thoughts and feelings, our actions, metabolism and physical well-being all stem from the sum of dynamic, intricate biochemistry

working within a distinctive genetic context; innumerable biochemical reactions are taking place to prepare the enzymes, hormones, neurotransmitters and all that we need to undertake the tasks required for daily life. We are truly wonderfully crafted" [100]. "Biological evolution created our species, characterized by a terrible mixture of humanity and inhumanity, a species sometime benevolent, sometimes evil, both are characterized by the continuous swing from the most wonderful achievements in science, biology, technology and the arts, to the most terrible catastrophes, barbarism, wars and genocides. Wilson characterized human species as an ecological aberration: 'By every conceivable measure humanity is ecologically abnormal'. The worst enemy of man after physical catastrophes is man himself. Medicine has not been particularly involved with the health of future communities and with our survival as a species. A political movement by enlightened physicians, scientists, anthropologists and politicians should attempt to redirect the course of events and stop the progress of a sixth mass extinction of life. Can the medical leadership, the medical thinkers, the medical establishment, remain apathetic"? [101].

## CONCLUSION

Many criticisms targeting at the medical profession have been valid and insurmountable. We are in 'dark triad era' and medical profession has also been playing a supportive role to this malevolent era undoubtedly, but we can still hope to guide the society and develop an enlightened civilization by applying salutogenesis. Medical professionals from all specializations should try to integrate Homeostasis, Salutogenesis, Iatrogenesis, Spiritual intelligence, Epigenetics, Yerkes-Dodson's law, Eustress, Ego depletion/replenishment, Negentropy, Exercise, Dietetics [Foods Obstruct and Overcome Diseases] and Socioemotional selectivity theory, to refine health care and medical education to manoeuvre the civilization. Medical conferences and journal publications should give importance to reforms. Contemporary medical field encompasses multiple ultra-

modern specializations [including Physiotherapy] and all the medical professionals tend to commit medical errors and iatrogenic damages either occasionally or frequently [mostly unintentionally despite competence or due to incompetence or even intentional to sabotage the public health, and many of which might go unnoticed]. Salutogenic approach could see the assets of homeostasis and accentuate its application in the health care to curb or eradicate iatrogenic damages. Preventing iatrogenesis needs acceptance of weaknesses and flaws in the medical procedures and incompetence of medical professionals. If one physiological parameter was found in excess or less in quantity in an individual through a clinical test, the immediate inquisitiveness should be "What used to be the normal range of this physiological parameter of this individual when he/she was in healthy state?", but hardly anyone in this world has their personal health records documented during their healthy states, is it not? Lack of immunodiagnostics to evaluate the immunologic status of the individuals before and after vaccination is classical example of a perplexing medical procedure with iatrogenic potential. AEGIS is a model recommended to blend credible immunologic tests and overall assessment of homeostasis to estimate and grade the immunologic status of individuals, to be used for general health check-up and disease management. Not all the role can be done by one medical professional, hence, the medical education has got subdivided into multiple specializations. Have these subdivisions been made to create subordinates, hierarchies and autocracies? All subdivided medical disciplines have very hard syllabi in both under-graduate and post-graduate curriculum to develop peculiar skills to support interdisciplinary health services to the patients and transdisciplinary researches to advance the medical profession.

It is well-known that different medical specialties should play their role within their professional ambit but to deliver health care on the principle of homeostasis, at least a slight overlap and interconnectedness in the functions of every interdisciplinary team member is necessary and inevitable, which should not be viewed as unethical and trivial. For instance, a Physio-

therapist who is managing a hemiplegic patient should try to reset the homeostatic conditions of the patient not just the 'mobility-stability' training only, so obviously need to know the reports of biochemical investigations, possible 'medicine-exercise' interactions, and continue to monitor/document the functional status of the hemiplegic patient to understand the impact of the entire rehabilitation protocol. This should be regarded as an excellent learning opportunity for all the professionals in the rehabilitation team. If such essential learning opportunity for medical professionals is inherently absent or intentionally blocked in the health care system, it would augment iatrogeny and iatrogenic pseudoscience. Kinanthropometry evaluations show altered body composition with disability [ABCD] and premature functional deterioration [not only profound impact on activities of daily living and basic bipedalism, even impairment in quadripedalism takes place due to severe gravitational torque deficiency syndrome] even among apparently health individuals, thus we have extremely diverse human populations on the planet ranging from best homeostasis to worst allostasis. Many humans enter into unhealthy ageing trajectory very early in life, and struggle to even maintain minimum essential VO<sub>2</sub> max, gait and various key fitness variables, eventually acquiring multiple morbidities and get ruined irreversibly by polypharmacy or iatrogenesis. Quite amazingly, though modern medicine has become iatrogenic [as viewed by Illich, BM Hegde], humans are accustomed to survive with below-average resources and knowledge to learn about their health and healthy living, predominantly through coping strategies and self-discovered salutogenic pursuits. Iatrogenesis and medical malpractices cannot be restrained easily without learning in detail about homeostasis, iatrogenesis and salutogenesis as Homeostaticology, Iatrogenicology and Salutogenicology, respectively.

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