

EPIDEMIOLOGICAL INTERSECTION: THE REVELATION OF COVID-19 PANDEMIC

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Summary: Human existence and their health rely on their intellectual interactions with ecosystem which eventually accompanies brilliant technological innovations. At par with the technological progress, humans also have been facing several intimidating communicable and non-communicable diseases. Amidst such disease threats, humans have discovered multiple ways to uplift the average life span all over the globe but still not up to the fitness benchmarks of healthy ageing trajectory. COVID-19 has specifically revealed the fragility of humans as they continue succumbing exponentially to the interactions of this communicable disease with their existing non-communicable diseases like hypertension, cardiac pathology and diabetes. In human evolution, the COVID-19 pandemic could be the most perfect synapse or intersection of non-communicable diseases with this transmissible disease leading to a situation that can be even named as “Global Medical Stampede” characterized by sudden increase in the number of patients requiring life-saving procedures for which there is lack of adequate manpower and technological support in health care system. This whole chaotic scenario could easily trigger acute psychological and physiological stress primarily caused by fear among the public favoring the frightening consequences of the pandemic. This article aims to suggest refinement in public health paradigms to enable preparations to face such disease threats from the immediate future without further procrastination.

Key words: COVID-19, Pandemic, Epidemiological Transition, Public Health, Compression of Morbidity, Polypharmacy, Pharmacogenomics, Co-morbidities, Somatotype, Healthy ageing.

Introduction: Human existence and their health rely on their intellectual interactions with ecosystem which eventually accompanies brilliant technological innovations. At par with the technological progress, humans also have been facing several intimidating communicable and non-communicable diseases. Amidst such disease threats, humans have discovered multiple ways to uplift their life span all over the globe but still not up to the fitness benchmarks of healthy ageing trajectory. One of the primary reasons for this deviation from healthy ageing trajectory is our incomplete understanding of the human diversity on the basis of body constitution, lifestyle, fitness level, diseases and treatments that affect the humans at individual level. At any given point of time, every individual belongs to anyone of the thirteen somatotypes classified by Heath and Carter, developed on the basis of three physique determinants; Endomorphy, Mesomorphy and Ectomorphy.

Somatotype diversity is unimaginably vast even under each of these thirteen somatotypes namely; Ectomorphic mesomorph, Mesomorph ectomorph, Balanced mesomorph, Endomorphic mesomorph, Mesomorphic ectomorph, Balanced ectomorph, Central, Mesomorph endomorph, Balanced endomorph, Mesomorphic endomorph, Endomorphic ectomorph, Endomorph ectomorph and Ectomorphic endomorph. It was found that a larger percentage of population display ‘Mesomorphic Endomorph’ body type, though they differ a lot among themselves in appearance, body mass index, fat percentage and functional status [1].

Undeniably, the analysis at the genomic level for each individual (or each citizen) is a highly laborious task to trace the genetic dissimilarities responsible for inter-somatotype and intra-somatotype variations, the data gathered by non-invasive and inexpensive anthropometric methods in combination with assessments of vital signs and metabolic status (level of glucose, cholesterol, hemoglobin) done by the trained health care professionals could be of great help to develop health care solutions despite the highly complicated somato-

type diversity. So far, we have remained ignorant, negligent and have not curiously endeavored to gather such baseline health data of every citizen. The devastating effects of this ignorance and negligence will become evident during emergency situations like pandemic.

Refining Public Health Paradigms: A pandemic is defined as “an epidemic occurring worldwide, or over a very wide area, crossing international boundaries and usually affecting a large number of people” [2]. For quite some time the health status of humans had given an impression that the technological progress has almost vanished or considerably diminished the morbidities and mortalities caused by transmissible diseases, hence the attention got chiefly shifted to researching and managing non-communicable diseases (metabolic syndrome, degenerative joint diseases). It used to be thought that the epidemiological transition the shift from infectious and deficiency diseases to chronic non-communicable diseases was a unidirectional process but in fact a reversal of the trend sometimes occurs with some diseases disappearing and others re-emerging, because the health and disease patterns of a society evolve in diverse ways as a result of demographic, socioeconomic, technological, cultural, environmental, biological changes and changes in the practice of medicine [3]. But COVID-19 outbreak has exposed the risks of interaction of infectious disease with already existing co-morbidities which can be understood with the help of the published literatures pertinent to the ongoing pandemic that specifically analysed the clinical investigations done on the high-risk groups.

We assessed the prevalence of comorbidities in the COVID-19 infection patients and found underlying disease, including hypertension, respiratory system disease and cardiovascular, may be a risk factor for severe patients compared with Non-severe patients [4]. Unhealthy lifestyle encompassing smoking, alcoholism, lack of exercise and malnutrition may also have been putting the individuals who attract COVID-19 almost in

an inescapable state. Based on the systematic review, we can calculate that the smokers were 1.4 times more likely to have severe symptoms of COVID-19 and approximately 2.4 times more likely to be admitted to an ICU, need mechanical ventilation or die compared to non-smokers [5]. It is also quite natural that rapid pandemics trigger acute physiological and psychological stress in humans, needless to say, ultimately setting up an effective foundation at individual level to acquire multiple endangering health issues even if the infectious agent has not actually affected them. This acute stress could be primarily determined by the age, family structure, socioeconomic status and past experiences, in association with swift transition to unusual law-imposed protocols like quarantine and curfew. Man's fear is fear of something or for something; of illness, loss of money, dishonour, his health, family and social status whose inter-relationships determine the intensity of fear [6].

Fear is further fuelled when infection control techniques and restrictive practices such as quarantine and isolation are employed to protect the public's health [7]. Uncontrolled fear could be solely instrumental in deepening and disseminating the detrimental effects of an unpredictably progressing pandemics. Fear of being socially marginalized and stigmatized as a result of a disease outbreak may cause people to deny early clinical symptoms and may contribute to their failure to seek timely medical care [8]. Because of their evolving nature and inherent scientific uncertainties, outbreaks of emerging infectious diseases can be associated with considerable fear in the general public or in specific communities, especially when illness and deaths are substantial [9]. Fear and anxiety are potent enough to disturb the homeostasis of the body particularly by causing imbalance in the functions of autonomic nervous system, leading to aggravation of fight or flight response. Acute stress-induced activation of SAMS (Sympathoadrenomedullary system) can be a health hazard [10].

Based on the type, timing and severity of the applied stimulus, stress can exert various actions on the body ranging from alterations in homeostasis to life-threatening effects and death [11]. We can imagine or ascertain the unfavourable outcomes of the interaction of COVID-19, fear-induced alterations in homeostasis and co-morbidities, whose magnitude is probably under the control of temporary curfew and quarantine mechanisms minimizing the exposure of high-risk groups to this novel corona virus. Fear epidemic is inevitable in the present era because of the technology that keeps updating the statistics of epidemiology of the infectious disease, the sufferings of victims and non-victims and the ways the public are stringently controlled by defence personnel. By developing effective behavioural and health education strategies and providing timely attention to the special needs of affected populations, we can ensure that, no matter what the infectious disease, we can limit the associated epidemic of fear and stigmatization [9]. But the question is what is the

appropriate time to introduce effective behavioural and health education strategies? Certainly, it should be pre-pandemic, is it not? COVID-19 has shown us the rush all over the globe to seek emergency health care whilst all the institutions (political, medical, economic) were in an absolutely unprepared state to tackle this infectious disease till it was declared as a pandemic. Contemporary pandemics and outbreaks of disease (H1N1 influenza virus, H5N1 influenza virus, severe acute respiratory syndrome (SARS)-associated coronavirus), serve as poignant reminders of our global vulnerability to emergent threats to human health and our current inability to predict or prevent such events [12].

Currently, there is no validated treatment for this zoonotic 2019-nCoV infection associated with low to moderate mortality rate, for which the main strategies are symptomatic and supportive care, such as keeping vital signs, maintaining oxygen saturation and blood pressure, and treating complications, such as secondary infections or organs failure [13].

Though it was found initially that the lungs are primarily involved organ in COVID-19 culminating in severe acute respiratory distress but later the co-morbidities have got attributed to the critical impediments interfering with recuperation of those who are infected. The virus has a preferential tropism to human airway epithelial cells and the cellular receptor ACE2 [14]. The binding of SARS CoV 2 on ACE2 causes an elevated expression of ACE2, damaging the alveolar cells which, in turn, trigger a series of systemic reactions and even death [15]. Patients with previous cardiovascular metabolic diseases may face a greater risk of developing into the severe condition and the comorbidities can also greatly affect the prognosis of the COVID-19 and on the other hand, COVID-19 can, in turn, aggravate the damage to the heart [16].

Lack of validated treatment for COVID-19 must have been challenging the medical experts and their team quite a lot in formulating appropriate clinical decisions specific to every individual whose co-morbidities should also be addressed at par in the life-saving circumstance. It is highly likely that the infected individuals (especially the elderly) with co-morbidities may also have been already consuming multiple medicines. Polypharmacy is a complex and worrying phenomenon that merits more research associated with concomitant use of over five medications [17].

Polypharmacy was associated with duplicated therapy and contraindicated drug combinations [18]. The unfavourable effects of polypharmacy are also well established based on which it is clearly understandable that thorough evaluation of every COVID-19 infected individual will be a time-consuming procedure or even impractical. Specifically, the burden of taking multiple medications has been associated with greater health care costs and an increased risk of adverse drug events (ADEs), drug-interactions, multiple geriatric syndromes (Falls, Urinary incontinence, Cognitive impairment, functional decline, Malnourishment) and medication non-adherence [19]. It is also possible that the admin-

-istration of medicines for symptomatic care in COVID-19 have been leading to poor recovery or even deaths due to ADRs. Adverse drug reactions (ADRs) are a major public health concern and cause significant patient morbidity and mortality [20].

Efforts have been still in progress to prescribe specific medicines to treat the individuals based on the inherited differences (genetic polymorphisms) and pharmacogenomics. Just over a hundred years later we are on the verge of being able to identify inherited differences between individuals which can predict each patient's response to a medicine [21]. Pharmacogenomics focuses on the identification of genome variants that influence drug effects, the pharmacokinetics and pharmacological effects of most medications are determined by genes encoding drug metabolizing enzymes, transporters, targets, and disease modifying genes [22]. With the availability of affordable and reliable testing tools, pharmacogenomics looks promising to predict, reduce, and minimize ADRs in selected populations [20]. ADRs (Adverse Drug Reactions) can be reduced not only by adherence to prescribing guidelines, suitable monitoring and regular medication review, but also by the implementation of pharmacogenomic procedures in the clinical setting [23].

Epigenetic regulation of genetic expressions is predominantly under the control of the choices of the individuals (exercise, food intake, smoking, medicine intake) apart from various stresses posed by the environment, to build or ruin the resistance to communicable and non-communicable diseases. More recently, there is increasing evidence that individual phenotypic differences may also result from epigenetic alterations such as histone-acetylation or DNA-methylation but the overall complexity of epigenetics in drug action, however, is so far only little understood [24]. Therefore, it is transparent that humans are not only completely capable of or equipped in handling pandemics like COVID-19 but also to treat every disease impeccably. We need to be meticulous in our study of this disease, voracious in our appetite to learn its secrets, and tireless in our efforts to combat its spread [25]. It may not be necessary that the medical field should immediately commence researches to work at advanced level but prudently revisiting and revamping the basics will suffice as there have been many fundamentally unclear terminologies, missing links and neglected determinants of health and diseases. Even an attempt was made to modify the terminology 'Diastolic Blood Pressure' as 'Baseline Systolic Blood Pressure' to particularly enhance the understanding of blood pressure related pathologies [26].

Measurement of the respiratory rate does not require complex technology but the level of documentation of vital signs in many hospitals is extremely poor, and respiratory rate, in particular, is often not recorded [27]. It is unambiguous that the Breathing Rate/Rhythm Evaluation Ascertains Total Health (BREATH), hence cannot be neglected in the clinical assessments and future researches. Enthusiastic discussions were happ-

-ening among the experts in ResearchGate forum about who discovered 120/80 mmHg as normal blood pressure [28].

Till now, we are unable to trace the author, journal publication and research methodology that claims 120/80 mmHg as normal blood pressure. Consequently, this is the most perfect time to rigorously rectify the basics of all the domains of the medical field and also refine the public health paradigms to be well prepared as a team (at national and international level) to support Human Development Index in accordance with demographic trends (specifically the gerontological trends). Increases in the world's older population have posed a significant challenge to available health care resources [29].

As an immediate future endeavour to face disease catastrophes, Governments can begin collecting the basic health data about every citizen and repeat the same periodically, at least, once in a year. With the advanced technologies available, Governments are able to gather unique identity details of all the citizens (like AADHAAR in India). Similarly, Government accredited professionals and health care institutions can be utilized in collecting fundamental health related data of every citizen. Experts in information technology could also develop suitable software to facilitate storing and retrieving of the data of health status of every citizen whenever needed. Well educated citizens can also be encouraged to directly upload their personal health status information duly assessed and documented by the Government accredited health care professionals in such software. Non-invasive assessments based on anthropometry can be given prime importance but few invasive assessments are also necessary to detect the metabolic ailments, with equitable focus on both rural and urban areas. Although there now is better understanding of the uses to which anthropometric data can be applied, public health and clinical practice have benefited little because of insufficient applied research and development [30].

Disparities between rural & urban areas to access health care services were alarming, the challenge of quality health services in remote rural regions has to be met with a sense of urgency, thus, the "Health is at the Bottom of In-Justice" [31]. In general, Government can use these baseline health data of every citizen to understand the disease trends in the country and formulate precautionary and health promotion measures. Also, during pandemics like COVID-19 such baseline data of health of citizens could help the Government to pay attention to or navigate tracking of the high-risk groups (or to stratify the cohorts) probably more easily and to effectively work in coordination with health departments. Medical researchers can also utilize the baseline health data of citizens to channelize their scientific investigations in more specific directions and find solutions to diseases specific to age, sex and somatotype before technologies like pharmacogenomics become feasible and affordable. It is high time to accept the significant role the exercise professionals and dietitians

could do in refining and supporting public health paradigms as they do have powerful tools to assess the individuals and inculcate healthy lifestyle habits to build resistance to communicable and non-communicable diseases. It was noticed that humans tend to acquire various biomechanical dysfunctions (Gravitational Torque Deficiency Syndrome) leading to unhealthy ageing, perhaps at an early age itself, due to inadequate exposure to gravitational force [32].

Through physical exercise and training, especially resistance training, it may be possible to prevent sarcopenia and the remarkable array of associated abnormalities, such as type II diabetes, coronary artery disease, hypertension, osteoporosis and obesity and there is no pharmacological intervention that holds a greater promise of improving health and promoting independence in the elderly than does exercise [33]. For a period, at least, health saving must take precedence over lifesaving and we will not move forward in enhancing health until we make the prevention of nonfatal chronic illness our top research priority [34]. 'Compression of morbidity' looks like the only promising way to successful ageing and positively impact Human Development Index, and also to reduce the health care burden at any time. The Compression of Morbidity hypothesis—positing that the age of onset of chronic illness may be postponed more than the age at death and squeezing most of the morbidity in life into a shorter period with less lifetime disability [35]. But at present we are far behind in even understanding the importance of 'Compression of morbidity', hence intolerant to the COVID-19 crisis and its 'Global Medical Stampede' effect.

Conclusion: COVID-19 has revealed the ignorant, negligent and unprepared state of the humans to resist or overcome a pandemic. Immediate revisiting and revamping of the basics of all the domains of the medical field is crucial to refine public health paradigms, without fail incorporating the expertise of Exercise professionals and Dietitians, to align with 'Compression of Morbidity' and successful ageing. We can envisage far superior health care systems and policies if the Government dexterously gathers fundamental health-related data of every citizen once in a year (Height, Weight, Somatotype, Blood pressure, Heart rate, Respiratory rate, Blood glucose, Blood cholesterol, Existing morbidities, Medicines being consumed) to understand the disease trends in the country and keep the health departments in competent state to manage any health crises. Importantly, COVID-19 has also proved that the unidirectional epidemiological transitions cannot be trusted anymore because at any time mortality rates could rapidly surge globally if the communicable and non-communicable diseases meet and strongly interact perfectly at one point as 'Epidemiological Intersection'.

References

- [1]. R.Vinodh Rajkumar. Endomorphy dominance among non-athlete population in all the ranges of body mass index. *International Journal of Physiotherapy and Research*. 2015;3 (3):1068-1074.
- [2]. Last JM, editor. *A dictionary of epidemiology*, 4th edition. New York: Oxford University Press; 2001.
- [3]. M.H.Wahdan, The Epidemiological Transition, *Eastern Mediterranean Health Journal*. 1996; Vol.2, No.1.
- [4]. Yang J, Zheng Y, Gou X, Pu K, Chen Z, Guo Q, Ji R, Wang H, Wang Y, Zhou Y. Prevalence of comorbidities in the novel Wuhan coronavirus (COVID-19) infection: a systematic review and meta-analysis. *Int J Infect Dis*. 2020; Mar 12. pii: S1201-9712(20)30136-3. doi: 10.1016/j.ijid.2020.03.017. [Epub ahead of print]
- [5]. Vardavas CI, Nikitara K. COVID-19 and smoking: A systematic review of the evidence. *Tobacco Induced Diseases*. 2020;18(March):20. doi:10.18332/tid/119324.
- [6]. Kurt Riezler, *The Social Psychology of Fear*. *American Journal of Sociology*. 1944; Vol. 49, No. 6, pp. 489-498.
- [7]. Weiss MG, Ramakrishna J. Stigma interventions and research for international health. *Stigma and Global Health: Developing a Research Agenda*; 2001. September 5–7; Bethesda, Maryland. [cited 2003 Aug 1].
- [8]. Das V. Stigma, contagion, defect: issues in the anthropology of public health. *Stigma and Global Health: Developing a Research Agenda*; 2001. September 5–7; Bethesda, Maryland. [cited 2003 Aug 8].
- [9]. Person B, Sy F, Holton K, Govert B, Liang A; National Center for Infectious Diseases/SARS Community Outreach Team. Fear and stigma: the epidemic within the SARS outbreak. *Emerg Infect Dis*. 2004;10(2):358–363. doi:10.3201/eid1002.030750
- [10]. Goldstein DS. Stress-induced activation of the sympathetic nervous system. *Baillieres Clin Endocrinol Metab*. 1987;1(2):253-78.
- [11]. Yaribeygi H, Panahi Y, Sahraei H, Johnston TP, Sahebkar A. The impact of stress on body function: A review. *EXCLI J*. 2017; 16:1057–1072. Published 2017 Jul 21. doi:10.17179/excli2017-480.
- [12]. Pike BL, Saylor KE, Fair JN, et al. The origin and prevention of pandemics. *Clin Infect Dis*. 2010;50(12):1636–1640. doi:10.1086/652860
- [13]. Yi-Chi Wua, Ching-Sung Chena, Yu-Jiun Chan. The outbreak of COVID-19: An overview. *J Chin Med Assoc*. (2020) 83: 217-220).
- [14]. Munster VJ, Koopmans M, Doremalen NV, Riel DV, Wit ED. A novel coronavirus emerging in China – Key Questions for Impact Assessment. *N Engl J Med* 2020. DOI: 10.1056/NEJMp2000929.
- [15]. Pengfei Sun, Xiaosheng Lu, Chao Xu, Wenjuan Sun, Bo Pan. Understanding of COVID 19 based on current evidence. *J Med Virol*. 2020;1-4.
- [16]. Li B, Yang J, Zhao F, Zhi L, Wang X, Liu L, Bi Z, Zhao Y. Prevalence and impact of cardiovascular metabolic diseases on COVID-19 in China. *Clin Res Cardiol*. 2020 Mar 11 [Online ahead of print]
- [17]. Linjakumpu T, Hartikainen S, Klaukka T, Veijola J, Kivelä SL, Isoaho R. Use of medications and polypharmacy are increasing among the elderly. *J Clin Epidemiol*. 2002 Aug;55(8):809-17.
- [18]. Golchin N, Frank SH, Vince A, Isham L, Meropol SB. Polypharmacy in the elderly. *J Res Pharm Pract*. 2015;4(2):85–88. doi:10.4103/2279-042X.155755.
- [19]. Maher RL, Hanlon J, Hajjar ER. Clinical consequences of polypharmacy in elderly. *Expert Opin Drug Saf*. 2014 Jan;13(1):57-65. doi: 10.1517/14740338.2013.827660. Epub 2013 Sep 27.
- [20]. Zhou ZW, Chen XW, Sneed KB, Yang YX, Zhang X, He ZX, Chow K, Yang T, Duan W, Zhou SF. Clinical association between pharmacogenomics and adverse drug reactions. *Drugs*. 2015 Apr;75(6):589-631. doi: 10.1007/s40265-015-0375-0.
- [21]. Roses AD. Pharmacogenetics and the practice of medicine. *Nature*. 2000 Jun 15;405(6788):857-65.
- [22]. Relling MV, Evans WE. Pharmacogenomics in the clinic. *Nature*. 2015;526(7573):343–350. doi:10.1038/nature15817.
- [23]. Cacabelos R, Cacabelos N, Carril JC. The role of pharmacogenomics in adverse drug reactions. *Expert Rev Clin Pharmacol*. 2019 May;12(5):407-442. doi: 10.1080/17512433.2019.1597706. Epub 2019 Apr 24.

- [24]. Cascorbi I, Schwab M. Epigenetics in Drug Response. *Clin Pharmacol Ther.* 2016 May;99(5):468-70. doi: 10.1002/cpt.349.
- [25]. W. Tan and J. Aboulhosn, The cardiovascular burden of coronavirus disease 2019 (COVID-19) with a focus on congenital heart disease. *International Journal of Cardiology*, <https://doi.org/10.1016/j.ijcard.2020.03.063>
- [26]. Diastolic blood pressure or actually it is baseline systolic blood pressure? R.Vinodh Rajkumar. *Int J Physiother Res* 2015;3(4):1126-1132.
- [27]. Michelle A Cretikos, Rinaldo Bellomo, Ken Hillman, Jack Chen, Simon Finfer, Arthas Flabouris. Respiratory rate: the neglected vital sign. *Med J Aust.* 2008; 188 (11):657 – 659.
- [28]. https://www.researchgate.net/post/Who_first_discovered_120_80_mmHg_as_normal_BP_What_was_the_basis_to_define_120_80_mmHg_as_normal_BP.
- [29]. Hickey T, Dean K, Holstein BE. Emerging trends in gerontology and geriatrics: implications for the self-care of the elderly. *Soc Sci Med.* 1986;23(12):1363-9.
- [30]. Continuing Medical Education, Anthropometry to improve public health. *Indian Journal of Community Medicine.* 1993; 18 (4): 166-167.
- [31]. Bhavani Shankar. Trivialization of Health Care Scenario in Rural India: A Sociological Concern. *International Journal of Humanities & Social Science Studies (IJHSSS)*, 2016; 2 (6):89-97.
- [32]. R.Vinodh Rajkumar. Gravitational Torque Deficiency Syndrome – a prospective clinical terminology- part 1, *Int J Physiother Res* 2016, Vol 4(5):1668-78.
- [33]. Evans WJ, Campbell WW. Sarcopenia and age-related changes in body composition and functional capacity. *J Nutr.* 1993 Feb;123(2 Suppl):465-8.
- [34]. Gruenberg EM. The failures of success. 1977. *Milbank Q.* 2005;83(4):779–800.
- [35]. Fries JF, Bruce B, Chakravarty E. Compression of morbidity 1980-2011: a focused review of paradigms and progress. *J Aging Res.* 2011.

