

# Ecological features of the association between mortality and determinants or salient risk factors of cardiovascular disease

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## ABSTRACT

Globally, cardiovascular disease is a leading cause of mortality. The multifactorial emergence of the association between mortality and salient risk factors of cardiovascular disease is not clearly elucidated. Diverse countries and geographical regions have been monitoring and evaluating these parameters as the levels and trajectories undergo continuous changes with environmental and public health concerns. Understanding the encompassing impacts of these changes is crucial in taking precautionary measures in counteracting and managing cardiovascular disease. Empirical findings strongly indicate that the evolving complexity of these incessant changes is accelerating, particularly in low- and middle-income countries, LMICs exhibiting the limited and inequitable distribution of research resources. This article presents a dynamic overview of the extant features of the ecological analysis of cardiovascular disease.

**KEYWORDS:** Diet and nutrition; Sedentary lifestyle; Environmental indicators; Public health challenges.

## INTRODUCTION

This paper enhances and introduces novel issues, challenges, and opportunities in the ecological presentation of the association between mortality and determinants or risk factors of cardiovascular disease globally. Mortality and risk factor data have been applied expansively for the monitoring and evaluation of cardiovascular disease issues and the spatiotemporal variations across populations. There is an extant inequitable distribution of resources in the disparate regions and communities around the world in the quantification and analysis of the mortality, morbidity, risk factors, or determinants of cardiovascular disease. The diagnosis of the cardiovascular disease tends to be devoid of diagnostic tests of high specificity and sensitivity in certain instances. Poor diet is a leading etiologic factor of suboptimal health in cardiovascular disease. Diet, nutrition, and scientific policy measures have accelerated, resulting in ambiguities, and also creating opportunities to obviate the excruciating health and economic burden in cardiovascular disease

and other cardiometabolic disorders in vulnerable populations. These indicate that expansive spatiotemporal variations in the incidence between populations are attributable to inter alia certain contradictions in the modalities of event ascertainment, culture, and economic burden [1-3].

It is possible and pertinent to monitor and evaluate mortality and risk factors in a uniform and standardized pattern in diverse settings for the prevention and management of a cardiovascular disease. There is a discernible inequitable distribution of research modalities and resources across global populations or regions in the ecological analysis and presentations of the inextricable linkage of deaths and putative risk factors of cardiovascular disease [1-3]. Due to the resultant metamorphosis or alterations detected in risk factors or determinants and mortality attributed to cardiovascular disease, researchers have defined but with no clear elucidation, the paramount factors in cardiovascular disease development, spread, and magnitude in the application of globally acceptable and tenable

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uniform criteria and standards in the disparate world regions [4, 5].

### **Conceptual and contextual epidemiological factors and considerations**

Globally, cardiovascular disease constitutes the leading cause of death [1-3], except for Africa [3]. Since the 1970s, cardiovascular disease rates have been increasing in the developing world, with a decrease in the developed world [4]. Estimates indicate that by 2030, an excess of 23 million Earth's inhabitants is likely to die on a yearly basis from cardiovascular disease [5]. The importance of veritable risk factors or determinants in the assessment of predictive values, inextricable linkage in cardiovascular disease aetiology, prevention, and amelioration cannot be ignored. The low- and middle-income countries (LMICs) have been depleted or devoid of powerful tools to track and manage the scourge of cardiovascular disease. Several but not all ecological research correlates between cardiovascular disease mortality and significant risk factors or determinants, and there are no consistencies in the findings.

Worldwide, the extent of cardiovascular disease has become very rapid and expansive; thus, resulting in grave concern per healthcare systems and resources with excruciating pecuniary encumbrance as well as ill-defined risk factors or determinants. These can be mitigated or ameliorated via full and proper behavioural, socioeconomic, and healthcare interventions as well as non-biased research designs. These become pertinent through individual and population healthcare because the cardiovascular disease has constituted itself into an enigma as well as significant challenge and constraint in disparate regions throughout the world. Cardiovascular disease screening is highly cost-effective but generally not available at the primary healthcare level, especially in LMICs and vulnerable populations. Thus, national cardiovascular disease plans are seldom implemented and domesticated. We must act without undue procrastination now.

### **Ecological Correlates in Disparate Ambientes**

Major risk factors may not adequately clarify the global disparities of mortality associated with cardiovascular disease. LMICs rank among the regions with the poorest cardiovascular disease interventions and control systems at the population level. Cardiovascular disease that was perceived as a farfetched disease is present at the doors of LMICs, causing indefatigable and excruciating misery among numerous families and populations. In high-income countries, cardiovascular diseases usually culminate in about 50% of the mortality of persons aged 35-

64 years [6]. Elevated blood pressure, elevated total serum cholesterol, and smoking has been implicated as principal independent risk factors for cardiovascular disease, as depicted via cohort studies. The ecological analysis deposed that putative cardiovascular mortality risk factors or determinants determined from cross-sectional studies at the population level do not actually replicate spatiotemporal variations in mortality and may not represent mortality disparities. A prominent flaw in the study [6], is the exclusion/non-inclusion of Africa and the Americas.

However, a contemporaneous study at the population level demonstrated that socioeconomic indicators and cardiovascular risk factors correlated with mortality in Oslo, Norway, and depicted expansive variations in morbidity between diverse districts [7]. Another study [8] revealed that an expansive lacuna was extant between eastern and western Europe that continuously increased following the marked fluctuations in mortality during the Soviet era of the 1990s. The recent surge of mortality in eastern Europe among vulnerable groups and lower socioeconomic populations suggests the influence of socioeconomic determinants of mortality within these groups [8]. However, the predominant proximal variables associating the social situations with health are not clearly elucidated, but there has been an inextricable linkage with social, psychological, and behavioural factors, alcohol, and nutrition. With reference to western societies, the linkage between alcohol and cardiovascular mortality depicts a J-shaped curve [9]. Pertinent data must be developed and enhanced for the utilization of veritable robust and contextual determinants to validate social trajectories taking into cognizance spatiotemporal and cultural variations and trends [10]. These should be extrapolated to involve multilevel collaborations, influences, interrelationships between diverse interfaces of inextricably linked socioeconomic status as well as research design and implementation.

Socioeconomic placement is linked with disparities in risk factors for the incidence of cardiovascular disease, resultant impacts, and mortality. Principal cardiovascular events have been found to be more prevalent among populations with low education levels in LMICs. Inasmuch as people with lower education levels in LMICs present a higher incidence of cardiovascular disease and increased mortality, they exhibit better overall profile for risk factors [11]. These populations present significantly inimical health disposition, though. Stringent policies to ameliorate global health inequities ought to involve modalities for easier access to healthcare, particularly those with less educational levels and vulnerable

populations. Perspicuously, among the elderly in Brazil, cardiovascular disease is the leading cause of mortality. There is an extant correlation between the urbanization process, socioeconomic conditions, and lifestyle metamorphosis with ischemic heart disease [12]. The heterogeneous spatial dependence detected in the socioeconomic variables pertains but not for deaths from ischemic heart disease with specific disparities in the districts of Rio de Janeiro.

Africa faces an expansive dilemma in confronting the burden of communicable diseases, augmented disease risk, restricted access to healthcare, disorders related to socioeconomic impediment with the exorbitant social costs inextricably associated with cardiovascular disease epidemic, and mortality which impact deleteriously on development and poverty alleviation. The African predicament tends towards a debilitating trajectory as the determinants, and cardiovascular disease risk factors are extant and accelerating with age. In sub-Saharan Africa that constitutes a vast measure of the LMICs, the trajectory, presentation, extent, and trends in cardiovascular disease mortality remain unclear with resultant restrictions to configure data-propelled national and regional health policies for veritable ecological analysis encompassing the entire continent. Although, throughout sub-Saharan Africa, cardiovascular disease is not perspicuously epidemic and does not constitute the leading cause of mortality, a disproportionate elevation in mortality rates has been linked to inter alia aging, the epidemiologic transition, and population growth. In contrast to other world regions, there has been an absence in the retardation of the age-adjusted mortality rate for cardiovascular disease in sub-Saharan Africa. Furthermore, stroke [13] preponderance as the leading cause of disability and death in comparison to other world regions is extant in sub-Saharan Africa [14]. Interventions to develop and enhance registries and epidemiologic data for quantitation of risk exposure, all-cause mortality certification, and assessment of disease encumbrance become pertinent measures.

An examination [15] of the relatedness between perspicuously modifiable risk factors with cardiovascular disease and all-cause mortality with the quantification of presenting population attributable factors in a cross-section of Tehran inhabitants depicted that modifiable risk factors which are relevant for obesity mediators and other independent variables, such as hypercholesterolemia, low HDL, diabetes, hypertension [16], smoking and educational level constituted over 70% risk for both cardiovascular disease and mortality. In the USA [17], heart failure mortality has presented significant variations

with disproportionate impacts across different States and counties, with a strong correlation to the age-adjusted prevalence of diabetes, obesity, high blood pressure, and sedentary disposition or physical inactivity.

Subjects having high plasma triglyceride levels are usually susceptible to cardiovascular disease. D6PV, a peptide, has been observed to curtail the triglyceride concentration in plasma. It is a mimetic per the functionality of apolipoprotein C-II that produces very-low-density lipoproteins and activates the enzyme that enhances triglyceride hydrolysis. D6PV has been demonstrated to facilitate lipolysis in the plasma of patients having hypertriglyceridemia. It is suggested to be a veritable treatment for hypertriglyceridemia [18]; thus, obviating the risk of cardiovascular disease via D6PV intervention. Also, numerous studies indicate that saturated fatty acid substitution with polyunsaturated fatty acids (PUFAs) could ameliorate cardiovascular disease risk with a pronounced influence of N-3 PUFAs [19]. There are defined variations between N-6 PUFAs and cardiovascular disease risk; therefore, necessitating future studies on N-6 PUFAs, diet habits, and healthcare relationships. In a study [20] to determine the contribution of cardiovascular risk in the development of hypertension and coronary heart disease [1, 2], it was revealed that in a high birth weight/birth mass population, elevated birth mass correlated to higher body mass index in adulthood, and not implicated as a risk factor for adulthood obesity. The inverse relationship between birth weight and truncal fat or adipose tissue in adults is suggestive of functionality in foetal development for the determination of fat/adipose tissue dissemination in adults. The inverse correlation of birth weight to blood pressure is ostensibly not mediated via the same pathway as to truncal adipose tissue [20]. Further studies are pertinent to completely elucidate the disparate pathways in programming disorders in adulthood because

putative risk factors may not fully explicate the global disparities of morbidity and mortality associated with cardiovascular disease.

Events, such as environmental exposures which involve drinking water, trace elements, and other minerals from highly mineralized areas [21, 22] as well as noise [23] pollution, could impact on cardiovascular risk. The resultant impact of aircraft noise on health is of increasing concern to the global population, especially those in the proximity of aerodromes because noise constitutes a psychosocial stressor that triggers the endocrine and sympathetic system with resultant metabolic aberrations and constitutes concomitant risk factors for cardiovascular disorders. An ecological study [23] undergirds

the hypothesis of the correlation between exposure to aircraft noise and myocardial infarction, cardiovascular disease, and coronary heart disease [1, 2] mortality. The probability of ecological bias and the potential relatedness to residual confounding could be implicated.

In retrospect, the cardiovascular disease leads as a significant aetiologic agent of mortality; and in recent years, accounting for millions of deaths (5, 6). Conventionally, cardiovascular disease emanating from unhealthy dietary habits, gene-environment interaction, family history, impaired physical fitness, obesity, and other influences, such as tobacco and alcohol consumption, environmental exposure to lead poisoning [24] and atmospheric pollution has been indicted as cardiovascular disease risks. The burden of cardiovascular disease is not restricted to high-income ambients since a vast majority of cases encompass LMICs.

## DISCUSSION

The devastating effects of cardiovascular disease have continued to accelerate expansively, and have given reasons for concern per healthcare, the excruciating encumbrance, and ostensibly the significant risk factors or determinants. The presenting risks can be mitigated or ameliorated via full and proper behavioural, psychological, socioeconomic, and improved healthcare interventions. These become pertinent measures through individual and population levels because the cardiovascular disease has constituted itself as an important challenge and constraint to the healthcare of disparate world regions. A holistic approach for cardiovascular disease is to understand the critical analysis, identification, and prevalence of its risk factors or determinants in a multidimensional and multidisciplinary management setting and care [25].

There is a convergence of a didactic approach that cardiovascular disease risk with associated mortality is a disease conundrum ostensibly emanating from inter alia tobacco consumption, sedentary lifestyle, elevated serum cholesterol and blood pressure, diet, obesity, family history, gene-environment interaction, atmospheric pollution resulting from heavy metal exposure, especially lead, Pb [24] combined with over-reaching pecuniary encumbrance. Several environmental attributes have presented significant impacts on the risk, severity, progression [26] and prognosis of cardiovascular disease. With the exclusion of genetic alterations, environmental variations resulting from migration to disparate ambients or geographical regions, modifications in choices of lifestyles, cultural dispositions, societal and scientific policies are etiological agents in cardiovascular disease risk or determinants and

mortality. The environmental cumulative [26] or resultant impact on cardiovascular disease has been difficult to assess, evaluate and monitor, and the mechanisms and dynamics of environmental determinants or risk factors governing cardiovascular disease have been almost impossible to elucidate.

Certain of these determinants and risks have decreased substantially due to the improvement of inter alia cardiovascular disease medical intervention, counseling and guidance, better educational background, and reduced exposure to diverse mortality determinants or risk factors [27]. However, cardiovascular disease remains the leading cause of death with a slight edge over the cancer mortality rate.

Several determinants or risk factors have been implicated in the ecological analysis of the linkage between cardiovascular disease and mortality, which present non-congruent criteria for data gathering and situation analysis in different world ambients. Thus, there is an increasing convergence that LMICs are precluded from participation in larger studies or research. Also, there is a general consensus that there are extant disparate complicated mechanisms and inculcated errors or flaws with the exclusion of non-successful trials or unacceptable observations with resultant perspicuous falsifications, diverse misleading outcomes, and misrepresentations, aberrant statistical measurements, and data, contradictions in presentations and findings [28] which must be addressed as postulated in this study for future works. There is the ardent need for novel research, intervention, resources, and collaborative information model that will be shared among the global regions in the elucidation of the association between mortality and indicted risk factors or determinants of cardiovascular disease.

## CONCLUSION

Numerous factors, both natural and anthropogenic activities have contributed to the complexity and spatiotemporal variations in human environments, ecosystem and ecological features as significant determinants or risk factors and mortality in cardiovascular disease. Standardized and veritable tools must be applied for convergence in the control of all risk factors or determinants, albeit minuscule in magnitude for the elucidation of the spatiotemporal variations and the associated morbidity and mortality of cardiovascular disease at the individual and population level in high income and LMICs as well as vulnerable populations. Researchers and all stakeholders in the cardiovascular disease ensemble need to change the ways to collate data

from intervention and ecological analyses which will function as catalysts in the accelerated evolution in converging regions of the world in a uniform pace, rather than in leaps and bounds, to avoid presenting a society of the endowed in the high-income countries and the deprived in LMICs and vulnerable populations.

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