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Aging -Population, Microbiology and Bioinformatics

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Research Article

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EDITORIAL

The world population is aging, with increasing proportions of elderly in the total population. Population aging has been a key issue in many developed countries, and is increasingly prominent in developing countries as mortality decreases and fertility declines.

By 2050, about 8.9 billion people will be living on the planet, and some 370 million people will be 80 years of age or older. An important consequence of population aging is its significant burden on the healthcare system, as more people live longer with chronic diseases. Over the years, governments around the world have focused on building up healthcare capacities to meet the growing needs of an increasing greying society. To better address the aging issue, it is important to understand the science of aging. However, much remains unknown about the biology of human aging and age-related conditions, about the biomarkers and pathways associated with healthy and non-healthy aging, and about the microbiological changes that occur in our body at different life stages.

Aging is a biological process that increases the susceptibility of our body to diseases. It is widely believed that aging is caused by the gradual accumulation of molecular damage due to failure of maintenance or repair. As our body systems age, those immune, cardio-vascular, pulmonary, musculoskeletal, and respiratory systems will become increasingly weaken, and with it, there are greater propensities to infections, cancers and their associated complications. The microbiological burden on elderly people's health is likely to become tremendous and by extension the susceptibility to age-related diseases and associated mortality.

So, does infection cause aging? It is evident that aging is a risk factor for infection, and from existing literature, it would seem that the contrary may also be true. Studies have shown that the host immune system and aging process are linked during evolution. Pathogens are known to cause damage to host tissues and cells. Also, while the immune system is generally protective, it may also result in severe damage to tissues at times. Furthermore, inflammation caused by bacteria has also been linked with the aging process.

Some studies have failed to identify biomarkers or pathways for age-related conditions. There are several reasons why this could occur: small cohort size limitations; poor stratification of the population; limited array of biomarkers that have been tested clinically in humans; old or obsolete biomarker detection technologies; or the lack of data analytics and computational modelling capabilities.

More must be done to understand the dynamics of microorganisms in different human life stages, such as integrating genomic, proteomic, epidemiologic and clinical data with systems modelling to understand how these microbial organisms affect immunity, health and the aging process.

Harnessing the power of big data analytics and computational modelling can bring tremendous upside. This should be directly incorporated into gerontological research and practice. Aging is a result of destabilization at the whole system level. Systems biology offers a new perspective to examine this age-old problem. How do microbe-host cell interactions at the cellular level affect homeostasis of the whole human life system? Spatial-temporal modelling and simulation could provide insights into the complex host-pathogen systems and their impact on life functioning.