Art and Science of Successful Aging[1]

Dr Pratap Sanchetee

Sanchetee Neurology Research Institute, 429, Pal Link Road, Jodhpur- 342008, Rajasthan; email ID: pratap.sanchetee@gmail.com

Introduction

"Today adds one day to yesterday and tomorrow will add one day to today." It can also be expressed as that "*yesterday I was one day younger and tomorrow I will be one day older*." It is an eternal truth that we all age. In a sense, we are all aging experts—every day we get older. It is also true that we cannot undo it. Every individual of a species has a lifespan that is high enough to reproduce and to make sure that offspring survive.

Lifespan, the length of life for an organism, differs from species to species. It ranges from about 193 years in Galapagos Land Tortoise to 6 months in ants. The maximum recorded lifespan for humans, reported in 2010, is 122.5 years for females and 116 years for males. Women, on average, live longer than men. Gerontophobia or fear of old age is result of societal attitude for a high regard for youth and productivity. We are constantly bombarded with incentives to remain young and prolong our lives through medical breakthroughs. At present state of knowledge, it is unlikely that we will find a cure for aging or death. Chronological age is not synonym with biological age. Cellular aging begins relentlessly, albeit very slowly, with birth and ends with death. The rate and progression of cellular aging vary greatly within the same species. Current generation of elderly are more educated and understand their right to age well with better quality of life. *Question is that can we challenge and delay process of aging?*

Old age has varied meaning between societies, culture and race. In many traditional societies, elders are respected as the repositories of inherited wisdom. In modern society, however, the situation is different and the elderly tend to have a lower status. Till recently, attitude towards aging was quite negative and common words to describe aged people were slow, senile, ill, disabled, infirm, forgetful, frail, impotent, ugly, mentally declining, mentally ill, useless, isolated, poor and depressed. Fortunately, this negative view is now being challenged. There is a shift in our attention to the positive side of aging with focus on continued productivity, contribution of wisdom and experience to younger generation and quest for new learning. The goal of aging successfully appears increasingly feasible by interventions which can reduce disability and promote better health in later life.

[1] Modified and reproduced with permission[17-19]

Successful aging

Successful aging is a positive connotation. It is characterized by a) freedom from disease and disability, b) high cognitive and physical functioning and c) social and productive engagement. Five broad categories have been recognised to assess impact of spirituality on aging i.e. independence, health, mindset, activity and family.

Aging is a simple term for the act of living longer. Concept of successful aging is more than 60 years old. However, it was popularized by Rowe and Kahn in 1987. They proposed that successful aging focuses on lack of disease and disability, healthy mental well being and active engagement in life. There is little consensus on the optimal definition of successful aging and its measurement. Interest and expectation are more toward active life expectancy (ALE) i.e. the number of years a person can expect to live a meaningful life. It also means a person will have lesser number of years with disability and dependency.

WHO (2002) has considered functional mobility, adequate cognition and active social participation as integral part of successful aging. Even in presence of diseases and disabilities, elderly can age successfully. It is represented by two main factors: longevity and reduction of morbidity. It is a multidimensional construct encompassing physical, functional, psychological and social health and can be viewed as a continuum of achievement.

Due to no consensus on definition, estimates of incidence of successful aging vary widely from 0.4% to 96% with a mean of 35%. On the basis of objective criteria based on physical health, only a small proportion of older adults are aging successfully. However, a high percentage of elderly believe that they are aging successfully and meet various psychosocial criteria. Evidence based means of enhancing successful aging include calorie restriction, physical exercise, cognitive stimulation, social support and optimization of stress.

Cognitive functions are important in aging. The term cognition indicates the totality of information processing including psychomotor skills, executive functions, thought, perception, pattern recognition, attention, learning, memory, language, problem solving, abstract reasoning and higher order intellectual functioning.

Meditation and spirituality

Meditation, yoga and spirituality, though distinct entities, are being used interchangeably without clarity of their meaning. These are ancient healthcare practices and use breathing exercises, posture, stretch and meditation to balance the body's energy centres. They produce sense of calm, limited thought and attention.

Meditation is defined as the "intentional self regulation of attention," a systematic mental focus on particular aspects of inner or outer experience. Most meditation practices have been developed within a religious or spiritual context. It is a physiological state of reduced metabolic activity that elicits physical and

mental relaxation and is reported to enhance psychological balance and emotional stability. There is decreased sympathetic nervous activity and increased parasympathetic activity following meditation. Several studies on meditation have observed increases in blood plasma levels of melatonin' and serotonin. Neuroimaging studies have demonstrated that meditation leads to increased activation in frontal and subcortical brain regions, which are important for sustained attention and emotion regulation.[12]

Yoga (literally means 'add' or 'join') describes the joining of the body, mind and spirit. By performing various postures (asanas) and controlling breathing (pranayama), one can can clean the body and have a self realization.

Spirituality is a lifelong developmental task and related to mental and physical health. It is multifaceted and there is little consensus on definition. Though religion and spirituality have different concepts, they are significantly correlated. Religious interventions are more structured, denominational, external, cognitive, ritualistic and public. In contrast, spiritual interventions are more cross cultural, affective, transcendent and experiential. Spirituality offers to strengthen journey through life and leave a lasting legacy. Personal faith, prayer and family support enhance the ability to keep a positive attitude. Spirituality has positive relationships with life satisfaction, psychosocial wellbeing, physical and mental health.

Spirituality plays an important adaptive role in aging with better quality of life and longevity. Increased longevity has put spiritual needs of older adults at the forefront. Our current health care plan is of little use for mental health in aging population. There is need to change philosophy, attitude and knowledge to create an effective model of care for elderly.

Mechanisms

Aging is determined by the genetic structure with modification by environmental conditions. Although mammal's life spans vary considerably, manifestations of aging (cancer, arthritis, weakness, sensory deficit, etc) are similar in different species suggesting a common deterioration and maintenance mechanisms. Urbanisation, lifestyle changes, loosening of family bonds, domestic violence and changing social values are major detrimental factors to healthy living by elderly.

Place of residence also have relevance to lifespan. As of 2011, the average lifespan for the entire world is 66.6 years. Country with the highest life expectancy is Monaco at 89.73 years and the country with the lowest life expectancy is Angola at 38.76 years. In India it is 66.8 years. There is a good but imperfect correlation between body weight and longevity. In general, larger animals live longer than smaller one. Life span of human is three times greater than expected from his body weight. Some of animals though with heavier body weight e.g. elephant (70 years), camel (50 years), horse (40 years), rhinoceros (40 years), pig (25 years) etc have smaller lifespan than human. With the exception of brain, most organs of the body show a close correlation with total body weight. It has been postulated that brain weight correlate better with life span rather than total body weight.

Historically, age related cognitive decline was thought to be due to massive cell loss and deterioration of dendritic branching. A 10-60% decline in cortical neuron density with a concomitant reduction in cerebral blood flow and levels of chemical neurotransmitters has been observed between late childhood and old age. On the positive side, adult brain is capable of a greater degree of plasticity. Recent observations suggest that neuronal loss does not have a significant role in age related cognitive decline. It is more related to loss of synaptic connections as well as decrease in synaptic plasticity. Neuroimaging techniques have demonstrated major structural and functional changes at medial prefrontal cortex (PFC), entorhinal cortex, medial temporal lobe, anterior cingulated hippocampus, parahippocampal gyrus and white matter tracts.

Role of circadian clock in aging is a subject of recent research. There are several age related changes in gene expression particularly those related to protein synthesis.

Neurogenesis is the process by which new neural cells are formed from a small population of multipotent stem cells in the CNS. It is a lifelong phenomenon and not limited to perinatal period as was believed earlier. However, immature neurons born in adulthood may differ in their functional properties from those born in early age. Another interesting concept is neuroplasticity. Decline in cognitive function can be explained in part by changes in neural plasticity or cellular alterations that directly affect mechanisms of plasticity.

Mild levels of acute stress have beneficial effect on memory and cognition, chronic stress has the opposite effect. Caloric restriction stimulates trophic factors which lead to greater resistance to stress. Stress related biochemical factors (hormones, inflammatory factors and oxidative stress) can promote cellular aging. Chronic stress may contribute to hippocampal atrophy and reduces the ability of neurons to resist insults by challenges or ordinary attrition. Adaptive coping strategies involving hypothalamic-pituitary axis is a subject of major interest now.

The determinants of successful aging include complex interactions of culture, emotion, behaviours and socioeconomic environment with genes. It now appears that the window of opportunity for regulating brain aging is not restricted to early life. It extends into later adulthood as well through synaptogenesis. Functional neuroimaging reveals that high-performing older adults exhibit greater bilateral activation on cognitive tasks. Gerotranscendence defined a transition from a materialistic and rationalistic perspective to a more cosmic and transcendent view of life that accompanies the process of aging. The differential survival hypothesis suggests that people who are more spiritual and religiously committed have reduced mortality. Studies have revealed an inverse relationship between spiritual commitment and hypertension, strokes, ischaemic heart disease and many other illnesses. It encourages healthy lifestyles and better adherence to preventive programs.

Management

Research suggests that good lifestyle choices are important in healthy aging. Factors frequently associated with longevity include low blood pressure, low body mass index, low central adiposity, preserved glucose tolerance and normal lipid profile. Physical risk factors leading to early morbidity in elderly include physical inactivity, obesity, smoking, tobacco consumption, excessive alcohol intake and diseases like diabetes, arthritis, visual impairment, hearing loss, repeated falls, ischemic heart diseases, stroke, white matter lesions in brain imaging, Alzheimer's disease and biological markers of inflammation. Dietary, behavioral and pharmacological interventions have been identified as potential means to slow brain aging.

Secondary aging: Increase in average life span over last century is related to reduce risks of infectious diseases and avoidance of health risk factors such as high calorie diets, smoking, physical inactivity and high blood pressure. However, we are neutralising this gain with poor agrarian culture, preserved food, contaminants and executive life.

Physical activity: Human and non-human animal studies have shown that regular exercise can minimize the physiological, psychological and cognitive change of aging and increase active life expectancy. Exercise prescription for elder should include balance and flexibility exercises, muscle strengthening exercises and aerobic exercises. It is advisable to be physically active by engaging in activities such as walking, bicycling, gardening, yoga and aerobic exercises.

Animals living in protected (domestic) environment live longer than those living in wild environment. However, survivors in wild are healthier than their counterpart. It is well recognized that physically active individuals survive longer than those living sedentary lives. Regular exercise reduces health risk factors e.g. hypertension, obesity, dyslipidemia, osteoporosis, etc. Animals, whatever be the age, do not stop running and climbing. We need to learn from them as many of the adverse effects of aging are related to inactivity.

Diet: Proper nutrition with an emphasis on low fat, rich in antioxidants and vitamin supplements diet has long term benefits. Reducing food intake and decreasing insulin signalling can extend the lifespan in several animal species. High nitrate diet, particularly leafy green vegetables such as spinach, lettuce, broccoli and beetroot juice, may improve regional cerebral blood flow in key areas of the brain.

Caloric restriction is another approach is to retard aging. High metabolic rate is associated with short life span and vice-versa. In experimental settings in rat and other animals, it was demonstrated that a low-calorie diet increases life span. Though caloric restriction has not been standardised so far, it is commonly defined by at least a 30 percent decrease with a balance of protein, fat, vitamins, and minerals. It has been suggested that caloric restriction protects mitochondrial function, preserves activity of the electron transport chain, or blocks the deleterious actions of reactive oxygen species.

Social support: Social support is important for both prevention and treatment in successful aging. It protects an individual against the effects of age and from physical, emotional, financial or social challenges.

Research have supported that non-institutionalised older people staying with family are better adjusted than institutionalised old people.

Psychological support: Emotional health is presence of positive emotional adaptation such as resilience, mastery, self-efficacy and wisdom. Important elements in psychological stress are breakdown of the existing family support systems, position of elderly in the home, shortage of money, fear of neglect by family members, death of the spouse and fear of one's own death. Hobbies like reading, writing, games, puzzle solving, attending plays or lectures, gardening and vocational rehabilitation are quite relevant in counteracting it. School children and youth can be roped in to act as promoters of geriatric health and schemes like "adopt-a-grandparent".

Internet and telemedicine: Use of the Internet is on increase among older adults. Information technology provides opportunity to access health information and receive online support. Technologies such as smart phones and voice over internet protocol software applications (e.g. Skype) can bridge geographic distance. Research should aim at identifying psychosocial and structural barriers that prevent elderly from using the internet and to develop training modules.

Cognition: People with high cognitive reserve can sustain more neuronal loss or cognitive decline. Mentally stimulating activities which are novel, enjoyable and cognitively challenging will result in brain to make new synaptic connections, facilitate neural plasticity and improve cognitive functioning.

Genetic manipulation: The human genome consists of approximately 25,000 genes made up of approximately 3 billion letters (base pairs) of DNA. How these genetic changes influence life span is not clear. It is a common observation that longevity runs in families. Our DNA suffers millions of damaging events each day. However, we do have powerful mechanism for its repair also. Augmenting this maintenance procedure can be one another approach to prolong lifespan.

Potential adverse effects

Unlike pharmacologic trials, with standardized methods to assess side effects, there appear to be no well developed or established tools for assessing adverse events associated with mind based therapies (MBTs). Increased anxiety while practicing relaxation techniques and meditation has been observed in the tune of 17% to 54%. Additional adverse events include unfamiliar feelings and sensations, intrusive thoughts, sense of losing control, floating, dizziness, feelings of vulnerability, sensations of heaviness, muscle cramps, and myoclonic jerks. Fortunately most of adverse events are mild and self limiting. Serious side effects that interferes with normal life is in less than 4%.

Future Research

A host of clinical and research issues must be better addressed if MBTs are to be integrated into conventional medical care. Research into neurobiological mechanisms of spiritual interventions is limited by a small number of interventions and small sample sizes. Most of the studies have been performed in younger

adults or in mixed-age groups. There is lack of valid parameters to measure religiosity and spirituality. Measuring spirituality in clinical practice and research has been a challenge because of the complexity of contributing elements and definitions. There are multiple barriers to the proper assessment of spirituality e.g. shortage of fund, lack of training for healthcare professionals, shortage of time and comfort for healthcare providers etc.

Key points

1. Aging is a complex puzzle involving interplay of genetic, environmental, cultural, emotional, socio-economic environment and lifestyle factors. Myth that decline in mental, physical and social functioning is an invariable accompaniment with aging and individual has got no control over it, has been refuted.

2. The public health significance of spirituality and positive aging is rapidly growing. Integrating an individual's spiritual practice into their healthcare can help shape personalized medical care for older adults and improve health outcomes.

3. Training of healthcare professionals in assessing and integrating spirituality into healthcare should be a priority for interdisciplinary training programs.

4. Increasing use of preventive care, better medical management of morbidity and changing lifestyles in older people may have beneficial effects on health and longevity.

5. Future spiritual interventions must consider spiritual diversity, culturally appropriate interventions and develop targeted programs. To be successful it is important that these steps are taken at an early age.

References

1. Astin JA, Shapiro SL, Eisenberg DM, et al. Mind-body medicine: State of the science, Implications for practice. *J Am Board Fam Med* 2003; 16:131-147

2. Cabeza R, Anderson ND, Locantore JK. Aging gracefully: compensatory brain activity in high-performing older adults. *Neuroimage* 2002; 17:1394–1402.

3. Cahn BR, Polich J. Meditation states and traits: EEG, ERP, and neuroimaging studies. *Psychol Bull 2006;* 132: 180–211.

4. CIA, *World Factbook.* Life Expectancy for Countries — Infoplease.com http://www.infoplease.com/world/statistics/life-expectancy-country.html#ixzz24K81bmPy

5. Crowther MR, Parker MW, Achenbaum WA, et al. Rowe and Kahn's model of successful aging revisited: positive spirituality – the forgotten factor. *Gerontologist* 2002; 42: 613–620.

6. Dalby P. Is there a process of spiritual change or development associated with aging? A critical review of research. *Aging Ment. Health* 2006; 10, 4–12.

7. Garfinkel M. Yoga as a complementary therapy. *Geriatrics Aging* 2006; 9:190-194.

8. Holloszy J. The biology of aging. Mayo Clin Proc 2000; 75(Suppl):3-8.

9. Jeste DV, Depp CA, Vahia IV. Successful cognitive and emotional aging. *World Psychiatry* 2010; 9: 78–84.

10. Lavretsky H. Spirituality and aging. Aging Health. 2010; 6:749-769.

11. Lowry KA, Vallejo AN, Studenski SA. Successful aging as a continuum of functional independence: Lessons from physical disability models of aging. Aging Disease 2012; 3:5- 15

12. Martin B, Mattson MP, Maudsley S. Caloric restriction and intermittent fasting: two potential diets for successful brain aging. Aging Res Rev 2006; 5:332–353.

13. Phelan EA, Anderson LA, LaCroix AZ, Larson EB. Older adults' views of "successful aging". How do they compare with researchers' definitions? J Am Geriatr Soc 2004; 52:211-216.

14. Puchalski CM. Spirituality and medicine: curricula in medical education. *J Cancer Educ 2006;* 21: 14–18

15. Rowe JW, Kahn RL. Human aging: usual and successful. Science 1987;237:143–149

16. Sacher GA. Relation of lifespan to brain weight and body weight in mammals. In Ciba Foundation Symposium - The Lifespan of Animals (Colloquia on Aging). eds GEW Wolstenholme, M O'Conner, John Wiley and Sons, Ltd, Chichester, UK. 2008:5

17. Sanchetee P. Art and science of healthy aging. J Ind Acad Geriatr 2012; 8: 51-54.

18. Sanchetee P. Spirituality and aging: Fact or fiction. J Ind Acad Geriatr 2011; 7: 47-49.

19. Sanchetee PC, Chaityapragya. Can we challenge aging? J Ind Acad Geriatr 2012; 8: 99-100.

20. Welberg L. Learning and memory: Aging without forgetting. Nature Reviews Neuroscience 2010; 11: 456-457.