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Evolution, Aging and Primary Elderly Care

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Abstract

Human life span has been and continues to be extended, and technology and scientific works are being mobilized to sustain this extension. Achievements are so far limited to the treatment of diseases which the incidence increases in old age. What needs to be achieved in order for people to live longer and healthier lives is not the creation of a moribund and vulnerable elderly society in need of care, but rather to allow elderly people to live a healthy long life. Thus, re-planning health care for elderly people has become a necessity. The provision of health care services to the elderly is primarily a duty of the bottom level health services (BHS). The purpose of this review is to first inform the BHS care providers about the evolutionary origins of aging, and thus improving the care provider's approach to the elderly patient, and then to develop recommendations defining primary elderly care (PEC) service development for BHS care providers in order to better plan the primary health care (PHC) for elderly.

Keywords: *Evolution, Senesence, Longevity, Selection, Primary Elderly Care, Bottom Level Health Services.*

ABBREVIATIONS

PHC: Primary Health Care

BHS: Bottom level Health care Services

BHT: Bottom level Health care Team

PEC: Primary Elderly Care

INTRODUCTION

Transition theory, defined by Omran in 1971, is well-known for its applications in the disciplines of epidemiology and demography [1]. The fourth stage of epidemiologic transition, in which the age-specific mortality rate declines, is associated with population aging and the 80 years and older population segment continues to grow [2]. As a result, the increasing prevalence of "delayed degenerative diseases" in this growing older age group creates an additional diseases burden [3, 4]. As to demographic transition, it suggests a downward trend of high mortality in the eighteenth [5] and nineteenth centuries [6], owing primarily to a decrease in mortality due to living conditions and poverty [7]. Because of the demographic transition, age-adjusted mortality is decreasing, resulting in increased average life expectancy and population aging [8]. Women tended to have fewer children and postpone their fertility until reproductive senescence this is an important component of the demographic revolution in which fertility declined [9].

All living beings are programmed to have relatively short lifespan. Aging, on the other side, is a long evolutionary process that has been programmed into our genes. Almost all living beings weaken and die as they age [10]. Aging is the product of natural selection, and the power of natural selection diminishes with age [11]. Living organisms prioritize reproduction over body maintenance because living organisms actually function as a means of maintaining their DNA [12]. If this is true, aging is neither avoidable nor preventable feature of life [13]. On the other side, aging is not necessarily unavoidable; some organisms do not seem to age or age very slowly, and some even seem to increase their fecundity and survival probability for at least part of adulthood [14].

Natural selection favors traits that increase reproductive efficiency, whether they benefit the individual or the family members. Understanding the evolution of aging thus necessitates an understanding of the environment-dependent balance between the pros and cons of an extended lifespan in the process of gene dispersal. Different niches and environmental conditions can be very beneficial or destructive to the fitness of an extended lifespan [15].

The key determinants of the health of the elderly are all conceivable biological and physical differences between the young and the old, decline in physiological abilities and functions, changes specific to later stages of life, the impact of the socio-economic structure of society on the elderly and the extent to which this structure can meet the needs of the elderly [16]. The poor selection on aging-related diseases explains why these diseases do not decline as longevity increases, especially after reproductive age. Fitness is acquired through the cumulative reproductive success of all stages of an individual's life history, and reproduction contributes more to fitness in the early stages of life. Fitness components at a younger age, such as fecundity, influence mortality through trade-offs at an older age. High reproductive success in youth

is accounted for by later morbidity, particularly as chronic infections [17].

The term primary health care (PHC) was coined in Alma-ata in 1978 [18]; it is a set of actions, often referred to as bottom level health care services (BHS), but actually encompassing all levels of health care, primarily aimed at addressing the basic health care needs of populations with difficulties in accessing health care services, and largely implemented by non-physician professionals [19].

Elderly care has been defined many times and recommendations for elderly health care services exist [20]; however, the definition of "primary elderly care" (PEC) has not been defined to the best of the author's knowledge. In this manuscript, I use the term "primary elderly care" to describe the main features of this service in accordance with the BHS and propose to coin the term in this way. However, the term PEC, like PHC, concerns all levels of health care rather than just BHS.

This manuscript is divided into two parts with two goals: the first part will attempt to explain aging from an evolutionary perspective, and the second will provide recommendations for planning and improving PEC services at the BHS level from this perspective.

What is Aging?

Aging can be defined in biological, social, economic and chronological terms. In terms of biology which is also the subject of this paper, aging is defined as the intrinsic decline of physiological functioning, resulting in a decrease in fecundity and an increased likelihood of death [21]. It is challenging to change aging. Aging is a detrimental trait with a wide range of diversity. Aging phenotypes differ significantly among individuals [22]. This complexity and variability make the aging process uncontrollable in experimental studies and medical interventions [23]. There is no single aging process; many independent harmful factors accumulate together during aging that are not due to a common cause [24]. Eliminating the effect of a single type of age-related damage, even if this scenario were true, would not affect the remaining majority and would have no effect on overall age-related decline [25]. Therefore, a single environmental intervention or gene mutation should not be expected to have such a large-scale effect [26].

Aging is a side effect of the accumulation of mutations caused by the decline in the power of natural selection at older age, and it is a disadvantageous trait that has evolved to function as a benefit in youth [27]. The power of natural selection for extrinsic causes of mortality, such as disease, accidents and predation, is weakened in the elderly because few people can live to that age and their exposure to these extrinsic risks is reduced [13]. The effect of fecundity-increasing new mutations seen only in young age, are selected for even if they reduce the probability of survival in old age, suggesting that aging may evolve as a side effect [10]. Aging is an unregulated side-effect of natural selection that maintains functionality becoming inadequate at older ages, which few people in nature can reach [10]. Even minor declines in fitness can jeopardize wildlife survival. Senescence puts the animal at risk of death by weakening its ability to defend itself against predators, from which young animals can flee, and by lowering immunity, making it vulnerable to deadly infections. Since nature is highly competitive and almost all animals in the wild die before they get too old, the traits that protect an organism from death in youth should no longer have a selection advantage after reproductive age [17].

There is no known benefit to the deterioration of the body with age; the rate of aging is determined by natural selection. The remarkably harmonious deterioration of many body systems is due to the decline in the power of selection with age, not to a coordination. Even in the absence of senescence, the power of selection would dwindle as the number of people surviving to old age decreased [15]. Different organs such as muscles, brain, kidneys, etc. age at different rates, although they are genetically linked [28]. Alzheimer's disease is characterized by premature aging of the brain relative to the body [29]. The main factor here is not reproductive arrest; postmenopausal women increase the fitness of their genes by assisting their daughters and granddaughters [30]. Understanding the evolutionary origins of menopause will help us learn more about the biological basis of the factors that cause aging women's fertility to end [31].

Aging Genes

Our genes influence our longevity, and it is possible that thousands of genes contribute to human longevity, as evidenced by mutant individuals of other species such as the common fruit fly longer lives [32]. The human species is in a pretty good position in this regard, even our closest relative, the chimp, does not live longer than 40 years; the only other mammals with a longevity comparable to ours are elephants [33]. Humans take twice as long as other higher primates to achieve reproductive capability and live twice as long [34].

When all living organisms are considered, we see an extraordinary diversity in aging rates, which is largely due to genetic variation. Despite this diversity, all species age in a similar course [35]. The biochemistry of mammalian aging is nearly identical. One of the pathways is associated with the insulin signal, which we need to keep as low as possible throughout our lives [36]. Thus we can live longer and healthier by eating less. Restrictions in our diet are a good example of interventions that can affect the aging process and extend lifespan. Free radicals produced by cell energy production are another lifelong threat. These trigger aging and are also linked to our dietary habits [37].

Unlike development in early childhood, there is no genetic regulation to ensure that aging begins in the right tissue and at the right time [38]. More mutations occur in each generation than evolution can cope with, and evolution cannot weed out alleles that are harmful in old age as effectively as those that affect children [39]. There is no known evolved gene that

causes aging. We may never know for certain which sequence of the DNA code is linked to aging because their effects are so minor and coincidence plays significant role in aging [40]. Some may be common variants, others uncommon; some may be prevalent in Africa, while others in Asia; and some may be more harmful to men, others to women. Many may be present in the gene pool but have no effect on longevity [41].

Evolution of Human Longevity

Survival strategies adapted to different environments influence the rate at which organisms age. This is primarily due to genetic variation in lifespan length and differences in life span between species [42]. Some species have gone so far as to die immediately after oviposition or seed dispersal. This trade-off between reproduction and survival has also entered the human equation: Women who have a large number of children at an early age are not guaranteed to live longer [43]. Human beings now live five times longer than they did for a very long part of their history. Fewer than half of children born in the Stone Age lived past the age of 10, and even in the Middle Ages life expectancy at birth was less than 30 years [44]. Our genetic capacity for longevity has clearly evolved dramatically, but at such a rapid pace that we have not yet reached equilibrium. The inability to adapt to living for so long has also left us vulnerable to dementia [45]. The environmental conditions experienced by modern societies are changing dramatically, with major changes occurring within a few generations. In contrast, we can assume that the genetic architecture of the life history of modern humans has changed little since it was under the influence of ancient patterns of selection [46].

We must not overlook the man-made practices that have extended our lives: Human beings are the longest-living mammalian species, and the adoption of a communal lifestyle, as well as the transfer of culturally acquired knowledge, such as tool use and the discovery of fire have contributed to such dramatic human longevity, thus increased the level of intelligence [47]. These advancements resulted in a steady decline in extrinsic mortality, which in turn led to a selection pressure for increased levels of somatic maintenance and repair [48]. Man has the highest capacity for DNA repair and stress resistance among mammals [49]. It is critical to comprehend the evolutionary genetics of human longevity. However, while there is an obvious hereditary component to human longevity, as mentioned at the beginning of the paragraph, non-genetic factors such as diet and lifestyle are also important. Therefore, we should focus our scientific efforts not only on identifying the genes that influence human aging and age-related morbidity, but also on the interactions between genes and environmental factors. Lifestyle and socioeconomic variables have a significant impact on human longevity [50]. For example, we do not yet know what the effects of global warming will be on human longevity on the one hand and on the current elderly population on the other [51], but making a positive prediction is probably too optimistic.

Problems Associated with Old Age

Although osteoporosis is primarily an aging disease, it has its origins in childhood. The body's bone mineral content increases as the skeleton grows during development. However, the increase in bone mineral content and density slows down in the second and third decades of life [52]. Grandmothers helped to feed the tribes' children in a way that increased their chances of survival during the Stone Age. They maintained a high level of physical activity throughout their lives as hunter-gatherers, and even in old age, they engaged in physical activity to feed their children and grandchildren, thus maintaining their skeletal bone strength even in old age [31]. The extension of human longevity, particularly in women, has increased the importance of maintaining physical activity begun in childhood into old age in order to postpone the age of onset of bone fragility [53]. To prevent osteoporosis, especially in women, women should be educated about healthy sexual life, nutrition, exercise, and hormone replacement therapy (HRT) rather than medication [54]. The Paleolithic diet was found to be more beneficial to bone health [55]. Our diet changed dramatically as a result of the agricultural revolution. With the agricultural revolution, new foods that the archaic Homo genome had never seen appeared on our tables [56]. We have increased our chances of breaking our bones by living longer, and we have expanded treatment options thanks to advances in technology, but we have created an environment for osteoporosis [57].

Every organism's goal is to reproduce, and natural selection will favor any trait that increases reproductive fitness more than cancer resistance. Moreover, because cancer is caused by accumulating mutations with age, all organisms that live long enough in adulthood and whose cells divide, are expected to develop the disease [58]. Evolution hypothesizes that the emergence of aging and related diseases is caused by the weakening of the power of natural selection with age [59]. Evolutionary trade-offs are important in understanding the link between aging and cancer: Genes that enhance reproductive success in youth undergo positive selection, even if they cause problems in old age. Understanding how a strong pressure for reproductive success works in tandem with a lack of pressure for cancer resistance in old age may also help to understand the evolutionary cause of rising cancer rates in older animals, including our species [60].

WHAT AND HOW TO DO: PRIMARY ELDERLY CARE (PEC)

The bottom level health care team (BHT) is primarily responsible for the health of a community's older population, as it is for the health of all other age groups. It is the duty of the BHT to assist the older people in leading a healthy and useful life to the extent that their condition allows, to collaborate with upper levels of health services for early diagnosis of common diseases in this age group, definitive diagnosis when necessary, and their treatment planning, and then to monitor and support them to continue their treatment [61]. The availability of this service through BHS

facilities is dependent on when it is planned to be delivered [62]. Planned and quality care entails meeting the patient's needs fully and to the largest extent possible in a single visit. Care that is well- planned and of high quality reduces unnecessary use of healthcare services [63].

The first step that BHT should be taken in the field of elderly health is to identify those over 60 in its region, to categorize them into age classes (e.g. 60-79, 80+) and to determine their population proportion. The BHT should assess how society views older people and understand their place in the society. In addition to social and medical support, families frequently meet the challenges of people becoming self-sufficient in old age [64]. At the same time, it should be determined how many older people have a regular income in the type of pensions, how many are cared for by relatives, and how many live alone. It should be known how many of those living alone have to provide their own food, water and medicine.

If the BHT wants to obtain this data in a more standardized format, it can develop and use simple rapid needs assessment tools that take into account a small number of risk factors, as exemplified in Table 1, Table 2 and Table 3 [65, 66]. For example, by following the checklist in Table 1, the BHS can score the elderly in its region and easily identify the order in which it should deliver services (Table 1). With this checklist, elderly people over the age of 80 who have chronic diseases, live alone and do not have regular income can be placed in the top of the list with higher scores, whereas elderly people in their 60s, at least who appear to be healthy and live with their children and have a pension can be assigned to a lower rank with lower scores. The BHT can also subdivide each group into smaller parts based on the number and severity of illnesses or complaints identified. In this way, it will be able to manage what at first seems like a huge task by dividing the elderly population into high, medium and low risk groups. For this purpose, it is sufficient to simply examine the identified elderly people either by calling them to the BHS unit or by visiting them at home [67].

Table 1. Social support checklist of the elderly

Characteristics	Response	Score
Age	60-69 = 0; 70-79 = 1; 80+ = 2	
Gender	Male = 0; Female = 1	
Regular income (such as pension)	Available = 0; None = 1	
Family/relative support	Available = 0; None = 1	
Number of households	>1 = 0; Alone = 1	
Can s/he supply his/her own medicine?	Yes = 0; No = 1	
Can s/he provide his/her own food?	Yes = 0; No = 1	
Can s/he supply his/her own drinking water?	Yes = 0; No = 1	
Does s/he own the house s/he lives in?	Yes = 0; No = 1	
Total score		

Body appearance changes with age. The first group of changes is related to the skeletal system and is characterized by changes in posture, standing and sitting height, shoulder span and chest depth [68]. Once the BHT member has developed some visual habits, s/he can assess the elderly people s/he sees even on the street with these criteria. However, because the elderly are less likely to leave their homes and require more health care home visits are particularly important in PEC planning [69]. The second group of changes occurs in body fat stores and is determined by weight gain and changes in skin thickness in various areas [70]. Physiological aging is the natural changes that occur gradually with increasing age. The BHT member should understand that these changes are natural and should be able to adopt them to the elderly person s/he is watching enough to affect his/her attitude positively. The physiological changes seen with aging are mainly in body composition, cardiovascular system, kidneys, digestive system, liver, brain, nerves, lungs and endocrine system [71]. Many of these organ and system examinations can be easily performed in the BHS unit or in the home of the older person [72].

Elderly diseases are not actively screened and are under-reported. There are further problems: The presence of one disease may prevent the diagnosis of another. Furthermore, the body's response to disease and symptoms diminishes at old age. A symptom of one disease may coincide with a symptom of another underlying disease. A condition that limits the mobility of elderly, such as stroke, may result in urinary tract or respiratory infections due to bed-boundedness [73]. Treatment for one disease may be contraindicated for another; treatment of patients with chronic liver or kidney failure should be carefully adjusted and monitored. A simple cough or hoarseness may indicate lung cancer, while diarrhea or constipation and anemia may be signs of colon cancer [61].

In fact, contrary to popular belief, the majority of older people is not sick or has disability or impairment. The most effective role of a BHT member in this regard is to distinguish between the sick and the disabled and to make an early diagnosis [74]. For this purpose, the BHT member needs to develop prevention and early diagnosis skills for three major causes of disability. These are chronic diseases, mental and

sensory impairment [75]. The BHT member can group the daily function assessment of the elderly as follows (Table 2) for early disability diagnosis: 1- manual skills (cutting bread, locking the door), 2- locomotor functions (going up and down stairs, going out on the street, taking the subway-bus), 3- mixed functions (bathing, undressing, dressing, going to the toilet) and 4- using assistive devices (for vision, hearing, chewing, walking) [76].

Table 2. Daily function assessment checklist of the elderly

Characteristics	Response	Score
Can s/he cut bread?	Yes = 0; No = 1	
Can s/he lock the door?	Yes = 0; No = 1	
Can s/he be washed up by him/herself?	Yes = 0; No = 1	
Can s/he undress unaided?	Yes = 0; No = 1	
Can s/he dress without assistance?	Yes = 0; No = 1	
Can s/he use the WC unaided?	Yes = 0; No = 1	
Total score		

The health problems that should be avoided and sought out first in the elderly are falls and accidents, osteoporosis, eye and vision problems, hearing problems, mental health problems, dental and nutritional problems, chronic pain and sleep disorders, urinary and fecal incontinence, loss of body temperature and drug dependence, alcohol dependence and iatrogenic health problems [16]. Naturally, death occurs more frequently in the elderly than in any other age group. External causes of death over 65 in industrialized countries include gastrointestinal and lung cancers, cerebrovascular diseases, stroke and ischemic heart diseases, respiratory diseases and accidents [77]. A checklist will make it easier for the BHT member to assess the presence of these conditions and prioritize the elderly person's risk of dying and care needs based on their score.

Table 3. Medical assessment checklist for elderly

Characteristics	Response	Score
The number of general complaints	# =	
Number of prescription drugs used	# =	
Does s/he have all the prescribed medicines at home?	Yes = 0; No = 1	
(Ask) What day of the week is today?	Notified = 0; Didn't know = 1	
How many children does s/he have?	Notified = 0; Didn't know = 1	
Does s/he use glasses?	No = 0; Yes = 1	
Does s/he use a hearing tool?	No = 0; Yes = 1	
Does s/he use dentures?	No = 0; Yes = 1	
Does s/he use a walking ustensil?	No = 0; Yes = 1	
Is s/he a cancer patient?	No = 0; Yes = 1	
Is s/he a ischemic heart patient?	No = 0; Yes = 1	
Does s/he have hypertension?	No = 0; Yes = 1	
Does s/he have diabetes?	No = 0; Yes = 1	
Is s/he a chronic kidney patient?	No = 0; Yes = 1	
Does s/he has Chronic Obs. Lung Disease?	No = 0; Yes = 1	
Does s/he have any joint or back pain?	No = 0; Yes = 1	
Has s/he fallen at all in the last week?	No = 0; Yes = 1	
Other:……..	No = 0; Yes = 1	
Total score		

Over the age of 65, the mortality rate due to accidents rises, and the majority of accidents resulting in death are falls at home and health problems related to falls [78]. Thus, with the demographic transition, falls are becoming increasingly prominent among the causes of hospital admission [79]. Small environmental irregularities such as a sudden, albeit small, slope on the floor of the house, curved paving stones, while easily tolerated by young people, lead to falls more frequently even in healthy elderly people [80].

Knowing what medicines the elderly use, teaching them how to use them and preventing them from keeping unnecessary medicines at home, as well as teaching them to store liquids such as liquid fuel, bleach, and pesticides in a certain place that is difficult to reach will prevent most of the accidents.

Teaching the elderly to dress and cover themselves based on the measured home and body temperatures rather than the temperature they feel, will help to prevent loss of body heat. Solving vision and hearing problems will have significant impacts on preventing accidents outside the home [81].

Balance disorder, swaying, dizziness and, in the worst case scenario, falls are all vague symptoms, subject to patient description, immeasurable and are frequently denied or forgotten. Moreover, almost any disease can cause falls [82]. Simple measures such as indoor arrangements, carpet removal, creating a handhold in the bathroom, installing a device that can easily turn on the light at night, and reducing the number of objects are all effective in preventing falls [83].

CONCLUSION

The aging process of the human population and advancements in individual health have resulted in an increasing number of people reaching advanced ages and complaining of age-related diseases and dysfunctions. Aging implies an increase in life expectancy as well as the differentiation of physical, mental, social and environmental health problems that are specific to older age. The leading causes of death now including cardiovascular disease, cancer and dementia, are all age-related [84].

Human life extension in industrialized societies has been accomplished not by slowing the rate of aging, but by lowering baseline mortality rates. In other words, overall health has improved at all ages, but management of the processes underlying the accumulation of damage in aging has not improved [85]. Aging is a complex process of damage accumulation that cannot be controlled medically or experimentally [3]. The prevailing view of aging in contemporary medicine is that diseases of aging can be medically controlled, but the aging process itself cannot; that is, prevention of aging means prevention of aging-related diseases. On the other hand, the view that aging-related diseases share a common etiology despite their different manifestations is well-established; aging itself is regarded as the primary risk factor for these diseases. The aim is therefore to protect and improve human health in old age rather than simply extent [20].

Geriatrics is predominantly a BHS specialty and basic and other clinical medicine branches should provide feedback to geriatrics [3]. If we summarize the factors that should be taken into account when addressing elderly people in BHS, these are l- daily life functions (mobility, having a place in the community, being able to do their own work), 2- mental health (cognitive status, psychiatric symptoms), 3- social and cultural well-being, 4- physical health (feeling healthy, symptoms and diagnosis, use of health services, self-sufficiency rate), 5- social relationships (support of family, friends and environment and their accessibility when needed), 6- economic level and housing (proximity of housing to transportation, shopping and public services). To be able to take these factors into account, the HCP should at least have knowledge of the promotion of healthy living and disease prevention, first intervention for acute diseases and management of chronic diseases in the elderly population [72].

The main tasks of the BHT should fulfill in elderly health care are primary prevention of disease and disability, prevention of loneliness and isolation, early diagnosis and treatment of disease, psychiatric symptoms and disability [86]. The elderly that the BHT member should primarily consider are the those who are very old, those who live alone, isolated elderly, childless elderly, people or couples with chronic diseases or mobility limitations, and those without social security [3]. The BHT member can also benefit the elderly population by recording the medication used, daily walking time, vision and hearing, and immunization status of the elderly person, even under conditions that negatively affect the service. Even in the most difficult service conditions, it can provide healthy living recommendations and disease prevention, early diagnosis and treatment services through a passive surveillance approach by screening the elderly who come for repeat prescription for specific diseases and monitoring the diseases related to the prescription with the help of Table 3 [67].

The BHT member, like an orchestra conductor, may not play any of the instruments at a virtuoso level, but s/he can do good elderly health management through a holistic approach.

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