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Geriatrics Health

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GERIATRICS HEALTH

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Meet the editor

Hülya Çakmur graduated from the School of Medicine, Atatürk University, Turkey. She completed her residency training in Family Medicine from the Trakya University and graduated with a PhD degree in Public Health from the Dokuz Eylül University. She has 20 years of practical experience as a specialist in Family Medicine, including 8 years of experience in Public Health as a PhD-prepared professional. She studied sleep medicine at the University of Pittsburgh Medical Center in the USA and attended narrative medicine education at the Saint Thomas University in Canada. She studied geriatrics voluntarily and published several studies in this field. She is an active member of the Turkish Medical Association and European Academy of Teachers in General Practice/Family Medicine. She has 6 years of teaching experience as an associate professor at the University of Kafkas and is the director at the Department of Family Medicine. She has published more than 25 papers in reputed journals.

Contents

Preface

"Man will never be contented until he conquers death." Bernard Strehler, 1977.

Aging and death are thought of as a natural part of life. As a result, the greatest dream and goal of humanity in every era are to live eternal life and to stay forever young. Although never-ending life is still far from consideration because of a growing understanding of the aging mechanism, the idea of ever-lasting youthfulness is increasingly possible. Healthy longevity has already significantly increased in today's world. Incessant innovation in medicine, wide sanitation in the environment, and growing personal awareness about a healthy livestyle were dramatically increased the lifespan. To provide the long-lasting youthfulness is not only an utopia of humanity but also a necessity in an aging world. The growing elderly population naturally deals with many of its health problems, which leads to a rise in health expenditure and labor loss. Besides, decreasing young population in the world requires to maintain the long-time productivity of existing human power. Like many health problems, the prevention, early intervention, and proper treatment have significant outcomes in geriatrics. Improving the health outcomes of elderly people mainly depends on health professionals. By creating a healthy elderly generation and promoting health in old age, healthcare providers and policymakers have a great role and responsibility. As our ancestors once said, "every death is early." The purpose of medicine is to ensure that people live healthily for as long as possible. Therefore, we prospect that the aging process will be handled by future generations and even human aging will be eradicated on earth. This book focuses on the health problems of geriatrics and intends to educate the reader in this respect and to form a new perspective on aging. Our motivation in writing this book is to increase the lifespan and inspire the results of the medical research in aging. Readers will encounter the actual health problems of elderly people and their possible solutions in this volume. Many thanks go to the authors for their precious contributions.

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Introduction

Chapter 1

Introductory Chapter: Aging is a Preventable Disorder

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Additional information is available at the end of the chapter

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1. Introduction

People all over the world live longer anymore. Therefore, by improving living and health conditions, the elderly population is rapidly increasing worldwide. Life expectancy is increasing both in developed and developing countries. It is expected that 20% of the world population will be over 65 years of age by 2030 [1]. However, the increased life expectancy does not mean the healthy life expectancy. Continuously aging population consequently augmented the burden of chronic diseases to themself and society. The dependencies in prolonged late life are real threats for personally low quality of life and socially burden on health care systems [1, 2]. For this reason the future medicine need to be focused on productive healthy aging and thus it's provide prolonged healthy life.

2. What is aging?

According to the World Health Organization (WHO), aging is the decline ability to adapt the environmental factors [1]. Aging could be defined as accumulated damages in body as time goes. Molecular and cellular damages gradually increase over the years and lead to decrease in physical and mental capacity of the human body [3, 4]. Aging is characterized by functional decline in every organ due to several cellular, biological, and physiological changes over time. The cumulative effects of the years cause to overall deterioration of the body. As an accumulated result of various diseases in old age, the functional impairment cause to decrease of capabilty one's own needs [3–7]. A humorist writer defined aging as "hardening of soft tissues and softening of hard tissues in human body" [8]. The mechanism of aging generally expresses with the molecular and cellular damages [4–7]. Free radical accumulation in mitochondria in consequence of oxidative stress finally results on dysfunctional senescent cells [6]. The senescent cells can affect their microenvironment and lead to

intracellular alterations. An accumulation of dysfunctional cells disrupts tissue homeostasis and thus rises functional decline in organ system [9, 11–14]. Strehler stated that "my simple view is that aging is those things that go wrong when cells lose their ability to divide, if we could replace our cells as rapidly as they deteriorate, we could probably live very long, if not indefinitely" [10]. Several factors from telomere attrition, loss of proteostasis, mitochondrial dysfunction, cellular senescence to stem cell exhaustion have been identified in the mechanism of aging [4–7, 9, 11]. However, the causal mechanisms of aging are still substantially unknown.

3. How human aging healthy?

It is clearly known that aging and biological age were different conceptions. Despite the age-related changes are based on biological mechanisms, every person has different aging processes. It is well-defined that the negative environmental factors such as sedentary life, unhealthy eating, and stress accelerate aging process, supportive lifestyle, and healthy environment delay this period [1–3]. It has been shown that the simple interventions to lifestyle such as smoking cessation, moderate alcohol consumption, daily physical activity, healthy diet, quality sleep, intermittent fasting, and sustain of an optimal body mass index (BMI) (18.5–24.9 kg/m^2) can increase lifespan more than a decade in both gender (14 years in women and 12.2 years in men) [15]. In the last years, antiaging medical checkups to prevent functional aging and rejuvenate the functional age was widely popular [16]. Unveiling of the human genome and grip better the genetic code has been provided for intervene in biological systems. The genetic engineering and antiaging scientific research such as DNA methylation, calorie restriction, and geroprotectors (rapamycin, metformin, resveratrol, and pterostilbene) have been studied for intervene in biological systems [12–16]. To achieve healthy lifespan in elderly people, we need to comprehend responsible molecular and cellular mechanism in aging process. Understanding the role of cellular processes will provide us a valuable insight into the fundamental biology of aging, and an insight into the global regulatory processes that control the cell's health will lead to a greater comprehension of aging. This comprehension not only provides us to better treat and prevent aging-related degenerative diseases but also provides improving quality of life with age [17]. The clinical trials in gene therapy almost reached to stop and/or reverse human aging. The regenerative medicine could repair and reverse aging in all body cells. Thus, the body's own repair mechanisms can struggle aging and age-related diseases from metabolic and autoimmune disorders to cancer [3, 4, 6, 11–18].

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Geriatrics

Chapter 2

Diplopia Developed in Later Life, An Ophthalmologic Approach

Elfriede Stangler-Zuschrott

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Abstract

Patients suffering from double vision first are commonly suspected to have acquired a neurological disorder. Over many years, we have observed numerous elderly patients complaining of double pictures for distant objects but lacking any other neurologic symptom. For this condition, no other causality was found than aging; therefore, the name "Age-related Distance Esotropia" has internationally been accepted. These days we know that the onset of comitant strabismus may occur, not only in childhood but even in the late years of life. Physicians are generally unaware of this fact; thus, these patients fail to find timely help for their double vision. Other geriatric eye disorders, such as cataract and maculopathy, often lead to a loss of binocularity without causing diplopia, the only signs being blurred vision or the habitual closing of one eye. The treatment of this so-called "masked diplopia" by prismatic correction of the squint will restore clear binocular vision and improve the reading ability. To avoid expensive neurological examinations for ocular-caused symptoms, simple diagnostic methods have been described in this article to help distinguish between ocular and neurologic disorders.

Keywords: diplopia, esotropia, prism correction, masked diplopia, geriatric eye diseases, squint

1. Introduction

For 40 years so far, the author has studied certain problems of vision, such as eye deviations with or without diplopia, not only in young but preferably in elderly patients. Although these symptoms are not infrequent, they are badly neglected. A typical case example may explain the matter concerned:

Case 1: A 70-year-old woman was suffering from double vision but could not remember the time of onset. Her family doctor sent her to a neurologist, supposing some kind of palsy, but the neurologic state was normal. After this she consulted an ophthalmologist who prescribed new glasses, which did not correct the double pictures. Several other ophthalmologists stated correspondingly, her troubles were due to her age and there was no help. Finally, she was seen at the orthoptic department of the First University Eye Clinic of Vienna; the opinion of our colleagues proved to be correct, our diagnosis was "Convergent squint of presbyopic age" [1], which was the first denomination we allocated to this condition in 1976 and, of course, treatment was possible and not difficult.

In the following years I paid more attention to other age-related diseases of the eyes, such as cataract, glaucoma and maculopathy, in order to find out their influence on binocularity and reading ability. Out of 15,000 index cards from my private office for general ophthalmology, 901 were selected. All the patients older than 40 and were suffering from severe binocular problems; 526 patients of this cohort had double pictures as a consequence of an acquired squint position but not every eye deviation was connected with the emergence of subjective diplopia; because of visual field defects, the patient is not aware of the second picture. We have called this condition "masked diplopia" [2].

In the following sections the reader mainly finds pathologic alterations of the eyes and their symptoms to be the cause of double vision. In addition to these ophthalmologic findings, we have recognized many interactions with nervous functions and even systemic diseases of the body; the eyes are not an isolated functional system. Unfortunately, many physicians treat the symptom of diplopia with mental reservation because of their lack of knowledge. Therefore, this chapter should help to survey this difficult matter and enable colleagues to discern important details to differentiate between eye-related and/or neurologic disorders. The targeted groups of readers may be: ophthalmologists without training in the subspecialty of orthoptics, neurologists, general practitioners and orthoptists.

2. Diplopia and ophthalmopathology

2.1. Double vision: monocular or binocular or both?

By covering each eye alternately, it is easy to decide which eye perhaps sees two objects in the proximity, or a shadow-like double contour or even three objects (triplopia). These symptoms may be caused by opacities in the optic system of the eyes, such as cataract, corneal scars and so on. But most commonly, we found the cause to be a high degree of astigmatism, uncorrected or with faulty correction.

2.2. The role of refraction anomalies

Even elderly people do not like to wear glasses. As we know, uncorrected ametropia may lead to a latent misalignment of the eyes, for example, myopia to exophoria and hyperopia to esophoria. Thus, the development of a convergent squint in childhood is caused by an overactive accommodation to overcome the hyperopia. Although the accommodative power

is highly diminished with age, the first step to evaluating the degree of an eye deviation is, independent of the patient's age, the exact correction of their refractive error.

2.3. Extraordinary symptoms equivalent to diplopia

2.3.1. Peripheral double pictures

Usually double vision arises from a squint deviation of the eyes and is checked with a torch and a red glass before one eye to separate the pictures. Some patients report double pictures, but when checked with the torch, only one light is seen. Yet, the patients' complaint is credible. An accurate description could typically be "When watching TV I see only one speaker, but the screen seems to be double, shifted to one side". Such statements may occur in cases of age-related maculopathy or atrophy of the optic nerve, caused by an extended central scotoma. But both peripheral retinas are still in function and indicate the malposition of the eyes, provided that the fixed object exceeds the size of the scotoma.

2.3.2. Masked diplopia

Despite an acquired squint deviation of the eyes the patient is not aware of a second picture because the visual field of one or both eyes has become defective and causes a lack of perception in the central and peripheral parts. Even while wearing corrective glasses, the subjective symptoms are described as blurred vision, seeing of "clouds" and, most noticeable, the irresistible impulse to close one eye. These complaints by a patient cause suspicion of the unknown presence of binocular difficulties. After correction of the squint angle by prisms, the binocularity will be restored again and the patient will have clear vision from one moment to the other, an impressive effect for the patient and the treating physician. The symptoms mentioned are most common in cases of age-related maculopathy.

2.3.3. Vague statements of patients with binocular defects

Without mentioning double vision or squint the patients let the observer assume some kind of anomaly of binocular vision, saying sentences like these: "One eye feels to be stuck", "I am not able to estimate distances" and "The picture seem to tremble when I look with both eyes".

2.4. Physiological aging processes and binocularity

The aging of the eye muscles, starting from the age of 30, is connected with an increase of their ring bands, which leads to a disruption of the myofibrils, and hence the weakening of muscle power (Mühlendyk) [3]. Sachsenweger [4] describes a thickening of the elastic fibers and an augmentation of the collagen tissues in the eye muscles. The result is an increased rigidity, combined with a reduction of their exact and fine functions. A step-wise decline of the ocular ductions between 20 and 80–95 years of age was measured: Supraduction was diminished by 35%, abduction by 21% and adduction and infraduction by 25% [5]. A reduction of the fusion amplitude and a weakening of the accommodative convergence were found to be signs of senile involution. Additionally, the impairment of neurological functions with age was noted:

The reduction of visual field sensitivity, slower but sometimes hyperkinetic motor reactions, changes in alertness and attention as well as early fatigue [6].

2.5. Age-related distance esotropia

This *designation*, created by Mittelman in 2006 [7], will probably be internationally accepted to define a certain disorder of binocularity, acquired in the late years of life. Previously, this condition (see page 1) carried different terms: "Strabismus convergens des Presbyopenalters" (Esotropia of presbyopic age) in Austria; "Konvergenzschielen im Senium" in Germany [8] and "Divergence insufficiency esotropia" in the USA. Although the clinical symptoms are similar to those of Bielschofskys' distance esotropia of highly myopic patients [9], there is a difference to be pointed out: High myopia causes anatomical alterations of the connective tissues in the orbit; age per se only exceptionally produces severe degenerative orbital changes like, for example, the "sagging eye syndrome" [10].

2.5.1. The patients

A total of 125 relevant patients were registered in my office, 74 female and 51 male, aged between 45 and 93 years with a maximum between 71 and 85, the peak being at 71–75. The distribution of the refraction errors of 250 eyes was emmetropia 33 (mostly pseudophakic eyes), 114 hyperopia and 103 slight-to-medium myopia. Many patients showed organic lesions corresponding to their age: Pseudophakia (26), incipient cataract (26), age-related macular degenerations (24), glaucoma (7), lesion of the optic nerve (4), synchisis scintillans (2), heavy eye syndrome (7) and enophthalmus after loss of weight (1). Of course frequent internal diseases must be considered to influence the patients' general condition as well as their eyes.

2.5.2. Anamnesis

For an example, see patient 1.

Some typical statements given by the patients may be mentioned:

a. Once two distant cars were observed coming down the street, and when it passed nearby it proved to be only one car.

b. The patient sees the actor on stage in a theatre as two actors.

c. When driving a car the median line of the street seems to divide at a certain distance.

Almost all patients have no difficulties and good reading ability in near distances. But they cannot date the onset of their symptoms, which will set in gradually and therefore cannot be realized immediately. As a consequence, an ophthalmologist is consulted with a delay of months or even years.

2.5.3. Pathophysiology

Both visual axes of a test person without a squint are in a parallel position when looking at far distances, but the visual lines intersect at a near object to match the degree of convergence

necessary for binocular fixation. In our aged patients, the visual axes are crossed at some distance nearer than about 20 m, according to the degree of convergent squint, the result being uncrossed double vision of distant objects. Fixing a near object the patient needs less convergence power to gain binocular perception; in relaxing the convergence the patient gains a normal eye position for near distances. Other patients cannot correct their eye deviation in this way; they maintain a convergent position even in near spaces; on the contrary, a convergence insufficiency may lead to a latent divergence at reading distance, that is, exophoria.

2.5.4. Clinical state

The first point is, of course, the complete inspection of the eyes and measuring the refractive error.

Visual acuity (VA): Almost all patients had 0.5 or better in both eyes. Only 11 had one eye worse between 0.4 and 0.01, and three of them did not complain about double pictures but habitually would close one eye. The corrected VA for reading was sufficient in all cases, in some only monocular.

Motility of the eyes: The ductions into all directions of gaze are free without restrictions, the near point of convergence being commonly between 15 and 25 cm. Everything seems to be in order unless you check the position of the eyes for *different* fixation *distances*. A fixation light installed *at a distance of 5–6 m* reveals diplopia, and by cover test (CT) or using a red-glass before one eye you can diagnose uncrossed double vision—that means esotropia. A Maddox-Cross at the same distance could indicate the degree of eye deviation; using the cover test you can measure the angle of squint by a prism bar, both in primary position. To differentiate, whether the deviation is due to an eye muscle palsy or not, you have to check the squint angle in different directions of gaze by turning the head of the patient while fixing the light. An increase of the eye deviation into a certain direction means incomitant squint and mostly indicates a neurogenic palsy. Our cases of age-related distance esotropia showed no indication of a palsy even if there was a very slight bilateral abduction deficit, not more than 2–3°. The range of squint angle while fixing into the distance varied between 2 and 20°, the average being 5°.

The binocular state at a *reading distance*, measured with the Maddox-Wing test, varied; many cases had an angle around zero, others had exo- or esophoria, ranging between −4 and +15°, on an average + 1°. The average difference between the angle that was far/near was 4.5° (**Table 1**).

Far distance: Uncrossed double pictures, comitant in all directions of gaze	Near distance: Eso - ortho - exophoria
Onset gradually and unnoticed	No reading problems
Peak age: 70–75 years	Independent of refraction error

Table 1. Age-related distance esotropia: main symptoms.

2.5.5. Prognosis without an operation

36 patients were observed over 2–19 (average 7.2) years. The squint angle did not change in 23 cases, increased in 9 (+4°) and decreased (−3.5°) in 4 patients.

2.5.6. Treatment

2.5.6.1. Prismatic glasses

The fitting of prismatic glasses is not quite easy and must be done by a highly qualified and experienced ophthalmologist or optician. Here only some principles are discussed. One main factor in assessing the strength of the prism is the patients' fusion power, that is, the ability to overcome the eye deviation, either totally or partly. A total interruption of the fusion ability while measuring the angle of deviation is to be avoided, as done, for example, with Maddox-Rods or by covering with an additional prism bar. The examination should take place under visual conditions as natural as possible, and only slight dissociation of fusion should be used, such as that possible with the Bagolini striated glasses or a light-coloured red glass. Thus, the habitually compensated part of squint will remain and only the manifest part, which causes diplopia, would be corrected; the patient probably will tolerate well the prismatic glasses.

Another problem is the prismatic difference far/near. The glasses for distant vision should correct the diplopia, and for this purpose ground-in prismatic glasses are recommended; press-on prisms are blurring, tend to promote suppression and will not be well tolerated. But these distant-glasses are not suitable for reading. Depending on the near position of the eyes, the patient may need no prism at all or a different prismatic strength. The possibilities are two separate spectacles or only one frame with progressive glasses and ground-in prismatic correction, suited for distance viewing. As the progressive glasses have the same prismatic power in both distances, an exophoria for near fixation will be produced, but most patients are able to correct this deviation by forced convergence. If the difference far/near does not exceed eight prism diopters, progressive glasses are well tolerated and sufficient for daily life; reading of books for a longer time will require separate reading glasses.

2.5.6.2. Motility exercises

Motility exercises at home, especially to the lateral side, in my experience, can prevent or slow down the progression of muscular degeneration.

2.5.6.3. Eye muscle operations

This topic is frequently discussed; operations are always of higher interest than conservative therapy; every operator is convinced of his method as the best. In general, aged patients will refuse operations and prefer prismatic glasses, but there is a technical limit for prismatic glasses. If the eye deviation exceeds 25 prism diopters (Δ), the only possibility is an operation. Difficulties after surgery arise from the age-related loss of elasticity in the eye muscles and the reduced fusion strength; both are needed to accomplish the fine adaptation of the eye position which takes more time with increasing age.

In my last active years I operated 14 relevant cases, on average 71 years old and squint angle on average as 25Δ. I performed recession-resection of the non-dominant eye in 10 cases and bilateral resection of the external rectus in 4 cases in order to avoid a weakening of internal rectus muscles. The results after 1–16 (average 6.7) years were the following: 11 cases had orthotropia and 3 cases showed a small residual angle without diplopia. The results are much more stable than in childhood—a short-term repeated increase of the squint angle, very common in children, never occurs in elderly patients.

2.5.7. Discussion concerning the pathogenesis

As usual, there are multiple determinant factors to be considered.

- Divergence insufficiency or palsy:

  Neurologists point out correspondingly that divergence palsy exists only within the scope of neurological diseases. Indeed, I checked 17 of my age-related convergent patients at the synoptophore and all patients showed a fusion range into divergence of 4–5 degrees.

- Abducens nerve palsy—bilateral or unilateral:

  The onset of palsy is always a shocking event which arises suddenly. One patient, I remember, was wearing prismatic correction for distance esotropia; some months later, a unilateral abducens palsy had occurred additionally; the neurologic findings in MRI were vascular encephalopathy with multiple lesions, especially in the pons region. Curran [11] was of the opinion that simulated divergence palsy could be a phase in the evolution of real abducens palsy.

- Decompensated esophoria:

  Two of my patients showed the transition from distance orthophoria to convergent squint because of forced accommodative convergence to overcome near exophoria, a spasm of convergence which cannot be relaxed in a short time. One of the patients was a dentist aged 55; 10 years later after retiring from his profession, the distant deviation regressed to orthophoria. A similar mechanism can be supposed for hyperopic patients refusing to wear glasses. We do not observe such binocular reactions exclusively in the elderly but also in younger patients.

- Connective tissue degeneration in elderly patients [10]:

  A degeneration of the connective band between the lateral and superior rectus muscle causes the lateral muscle to slip downwards, followed by esotropia and hypotropia of the bulb. This clinical entity was called “sagging eye syndrome” and resembles the “heavy eye syndrome” of high myopia, the first additionally being connected to ptosis and loss of orbital fat.

- Age-related myopathy of the eye muscles:

  In my opinion, the high-grade loss of elasticity is an essential factor explaining the disparity between the positions far/near. Performing surgery on patients in their 80s, I could notice the extreme density of their external rectus muscle, described [12] as senile fibrosis.

2.6. Cataract, aphakia, pseudophakia and binocularity

Everyone has to expect the acquisition of cataract, if the life is long enough; commonly, the cataract will develop bilaterally but not to the same degree. These days, we can operate every stage of cataract, be it binocular or monocular, by intraocular lens implantation. Yet, problems occur and disappointed patients will complain of diplopia.

2.6.1. Cataract per se causes diplopia

Cortical opacities of the lens, such as a central spindle, generally cause monocular double contours or even triplopia. Cloudiness of the lens nucleus causes myopia and, if decentered, may additionally have a prismatic effect, evoking binocular diplopia.

2.6.2. Diplopia after long-standing unilateral cataract or aphakia

The most difficult cases were those we saw 20–30 years ago, after the new technique of intraocular lens implantation (IOL) had entered into practice everywhere. A lot of patients with long-standing unilateral cataract or aphakia hoped to gain binocularity again, but instead of binocular depth perception they acquired intractable diplopia. Medical science had to learn some new facts [13]: Interruption of fusion over some years caused by a unilateral visual defect, effectively approaching blindness, represents visual deprivation in adults, which results in a total loss of fusion ability, reversible only in few exceptional cases. Unlike the visual deprivation of newborn children, which almost always causes irreversible amblyopia, the visual acuity of adults is hardly impaired. Through own binocular infrared oculography (IROG) studies [14] we were able to find out that the excursions of the interfixation movements (normally less than 30′ = arc minutes) of the deprived eyes were enlarged by up to 4°30′; that is an absolute obstacle for fusion.

Finally, a recommendation for the daily work of ophthalmologists: A patient having unilateral cataract and VA less than 0.3 should not hesitate longer than 1 year to be operated to avoid the postoperative risk of double vision.

2.6.3. Unexpected diplopia after cataract operations with IOL implant

Even patients who have never had binocular troubles may acquire double vision after cataract surgery. Studying such cases we found that most of them had a pre-existing compensated imbalance of their eye muscles, for example, a slight horizontal or vertical deviation.

During the period of progressive lens opacity not only will the VA be slowly reduced but so will the fusion power and thereby misalignments of the eyes are manifest, and even a distance esophoria may develop.

2.6.4. Prismatic glasses before and after cataract surgery

A group of 25 patients wearing prismatic glasses because of asthenopic complaints or diplopia returned to my office after receiving cataract surgery and wanted the prescription of new glasses. The results are shown in **Table 2**. An improvement (by up to 12Δ) was remarkable,

6 patients	Prisms unchanged
11 patients	Improvement 2–12Δ included: 8 distance esotropia, 2 exotropia and 1 hypertropia
8 patients	Deterioration 1–4Δ included: 6 hypertropia, 2 esotropia

Table 2. Change of prisms after cataract surgery.

especially in cases having convergent deviations based on high astigmatic anisometropia which could be eliminated by the operation. Vertical deviations are severe obstacles for fusion and mostly remain unchanged after cataract surgery.

2.7. Glaucoma and binocularity

In early stages, glaucoma does not impair binocular functions. Difficulties arise with the slowly progressive defects of the visual field, mainly in the nasal areas, causing loss of fusion power and stereo vision. Subjective complaints of glaucoma patients are rare; the event of seeing double pictures only occurs exceptionally because there is no perception in damaged areas of the visual field. Yet, there are some consequences to be mentioned.

2.7.1. Divergent squint for reading distance and diplopia

Bilateral total defects of the nasal visual field as far as the fixation point are equivalent to the total loss of fusion and of convergence. The consequences are a divergent eye position for near distances, inability of reading, lack of stereo vision and crossed diplopia or unilateral suppression, although the VA of both eyes may be 1.0. Imagine the difficulties such a patient has with reading: The left eye is able to perceive the beginning of a line but the following words have vanished and can only be seen by the right eye, which cannot join them to the word seen by the left eye because of the squint position. The prismatic correction of the squint angle could enable both eyes to read the continuous chain of words alternatingly.

2.7.2. Diplopia evoked by an almost blind eye

Case 2: A woman aged 75, whose glaucoma I had treated years ago, called me in despair because the newly consulted ophthalmologist did not believe her complaints: Her left blind eye caused her to perceive double pictures. Indeed, she had a total atrophy of the optic nerve with only peripheral remnants of the visual field and the left bulb had drifted into a divergent position. The trial to correct the squint angle by a press-on prism 15 Δ base attached to the left glass was successful, and the patient was content.

2.7.3. Masked diplopia and glaucoma

Case 3: A chemist, aged 76, treated for glaucoma elsewhere, called me, saying "My vision is very bad, can you help me?" His eye tension was well adapted, the visual field showed intermediate defects and his corrected VA was RE: 0.8–1.0 and LE: 0.7–0.8. While testing his vision we noticed that the binocular vision was worse than the monocular, and the test objects seemed to be blurred; a state like this is a clue to binocular problems. In fact there was a

manifest distant deviation of +6° and a latent near angle of +2°. Prisms of 6 Δ added to the distance glasses immediately produced "clear" binocular distant vision.

2.8. Age-related maculopathy and binocularity

Although modern treatments are able to prevent wet maculopathies with neovascularization from developing into tumor-like fibrotic scars, enough problems remain to be discussed such as the influence of binocularity on reading ability and hence the quality of life; such considerations seem to be neglected in ophthalmology.

2.8.1. Correction of the refraction error even for eyes with impaired vision

Subjective vision testing of visually disabled old patients is fraught with difficulties: The patient cannot decide which glass is the better one, wants magnification and prefers plus glasses too much; the duochrome test is not predicative due to the color vision defect of a damaged retina. And last, the refractometer measuring is not exact for eyes which cannot fix centrally. To get exact data of the refractive error we have to perform retinoscopy in mydriasis and some days later do a subjective test once more.

In our experience the refraction error changes with aging: Myopia increases just as astigmatism against the rule.

Case 4: An intelligent woman, aged 79, maculopathy LE > RE, could read only using a magnifying lens; the left eye had no reading ability at all, no squint position. The patient complained that her ophthalmologist had not given her a new glass for the left eye, but this eye supported the right eye and she needed it. The left glass was strengthened with +2,25sph +1,0x180°; with the new glasses the patient could read 0.4 text without magnification.

There exist some more examples to teach us that the refractive correction of an almost blind eye is highly beneficial for the master eye provided that the eyes are in a parallel position.

2.8.2. Correction of divergent eye positions for reading distance

In spite of fitting glasses, the next complaint of a patient may be: "I can only read the newspaper when closing the worse eye". This is a typical statement indicating the presence of a divergent squint when looking at near objects. These patients never complain of diplopia but show the symptoms of masked diplopia. For cases with one highly impaired eye we use Fresnel prisms, added to the glass of the worse eye; this procedure will be well tolerated and the prism can be changed easily as soon as the squint angle varies. With restored binocularity, the patient has a sudden experience of regained clear vision and no longer feels compelled to close the worse eye. Unfortunately, maculopathy is progressive and the initial success may be lost quickly.

2.8.3. Squint position and maculopathy

The onset of a squint position depends on the size and the distance to the foveola of the central scotoma and whether it is sieve like or dense. No squint will develop if both eyes are deteriorating to the same degree.

Binocularity supports the reading ability most effectively if the damage is bilateral but with a large difference in vision, for example, 0.5 and 0.05. The peripheral fusion of the damaged eye is conductive to the macular orientation of the better eye and causes an increase of reading speed, provided an existing squint position is corrected by prisms.

2.8.4. Central retinal defects and binocular problems

The use of optical coherence tomography (OCT) allows seeing the pathology of the retina, swellings, cysts, distortions of the retinal layers and many more. The visual acuity of such eyes often may be almost normal but the optical pictures of both eyes don't fit one to the other; the central fusion will be disrupted, the reading speed will be slower binocularly than monocularly and the patient will close one eye. If the affected eye is the non-dominant one, central suppression will develop. The confusing quality of the vision of a dominant eye can be reduced temporarily by hazy foils (**Figure 1**).

2.9. Strabismus since childhood

Although patients in general have been accustomed to their visual defects since their youth, situations evoking diplopia may occur even in later life.

2.9.1. Spontaneous change of the squint angle of amblyopic eyes

Amblyopic eyes have fewer zones of suppression than alternating eyes. With aging, strabismic eyes have the tendency to drift into divergence, causing double pictures. The treatment consists of bringing back the deviating eye into the original position, either by prisms or by an operation.

2.9.2. Postoperative muscular insufficiency simulating palsy

Case 4: A middle-aged woman once noticed double pictures when looking to the right side; a neurologist diagnosed a palsy of the right abducens nerve. This diagnosis would have been correct in the presence of a convergent eye position while looking to the right, but, in fact, the eyes were divergent. The patient told us that a recession of the internal rectus of the left eye had been performed many years ago. With aging, the power of a weakened muscle will decrease even more; thus, an incomitant squint is produced without being caused by the palsy of a nerve.

2.9.3. Intractable diplopia after squint surgery

Squint surgery in childhood previous to the age of 3–4 years is a precondition for the establishment of certain imperfect cooperation between both eyes, a sort of anomalous fusion. Such

Figure 1. This is to imagine how a patient, having macular pathology, sees.

patients commonly do not develop diplopia in later life. But this danger is high for patients squinting since early childhood and operated with a delay of 10–20 years. In my office I have seen a lot of patients having had diplopia all their lives. When asked if they were suffering from their immanent double pictures the patients stated in agreement that these unreal shadows were only a problem when they paid attention to them.

2.10. Heavy eye syndrome

This name is derived from the anatomical position of an eye, more myopic than the fellow eye, and hence larger and weightier, which causes a slight, unnoticeable displacement downwards. Our fusion ability to overcome vertical deviations is only 2°, and deviations more than this result in diplopia.

Case 5: A lawyer, aged 60, consulted me in despair. Since a few months, reading had become extremely difficult; the letters appeared double in the vertical direction, and he was hardly able to practice his profession. Some ophthalmologists he had consulted could not help. His glasses were RE −4.5 s + 1.0x15°, LE −6.0 s +0.5x90° and +2.5 s addition for near distances. VA was 1.0 for both eyes. The vertical deviation for near fixation in primary position was +VD 4° (=8Δ); for measuring we used the Lees-Screen, producing full dissociation of fusion.

Prescription of glasses: For his myopic correction ground-in prisms were added—RE 2.5 Δ base down, LE 2.5 Δ base up. With these glasses the patient was highly content and could work again without difficulties. As explained in Section 5.6.1, we gave prisms with just the strength necessary to overcome the deviation.

Patients having such problems are often middle aged and always myopic. In my experience, myopia may increase gradually from youth until the age of 60–65 and afterwards decrease again, due to the influence of presbyopia. These changes in refraction are not always developing symmetrically in both eyes, with the consequence of anisometropia and heavy eye syndrome.

3. Diplopia and general diseases without age limit

3.1. Parkinson's disease

When dealing with this disease, neurologic symptoms will, of course, have priority. Patients consulting an ophthalmologist will usually not declare themselves spontaneously to suffer from "Parkinson". An experienced medical practitioner, however, can easily recognize those patients, observing their stiff movements and the blank, expressionless stare. The diagnose makes us consider a number of ocular symptoms connected with this disease (**Table 3**).

The complaints of 17 patients at my office were diplopia at all distances (4), only at reading distance (12) and unilateral blindness due to glaucoma (1).

The most important problem is the convergence insufficiency with a consequent divergent eye position for near distances, causing reading inability. The first step to helping these patients is to measure the most comfortable reading distance between the eyes and the book, which

Convergence insufficiency
Loss of stable fixation
Dry eyes due to a decreased blink rate
Hypometric saccades
Decreased excursions of up-gaze

Table 3. Ophthalmologic symptoms of Parkinson's disease.

should be seen binocularly. Many patients use a reading stand because of their hands' tremors. For this specific distance we determine not only the strength of the reading glasses but also the prisms necessary to compensate the divergent position. Press-on prisms are not advisable to be put on the patients' own reading glasses for trial; they would be rejected for blurring.

Additionally, a squint position for distance may be present. Two of our patients had a convergent and three a slightly vertical deviation. Those patients needed separate prismatic glasses for each distance.

Another problem is the instability of fixation, resembling a tremor of the eyes. Using IROG we found an anomalously high number of square-wave jerks in both eyes when fixing an object [2]. This fact, combined with inexact movements, may evoke an impression of double vision, perceptible only by the patient and only for a split second.

Finally, a prescription for wetting eye drops must not be forgotten.

3.2. Endocrine ophthalmopathy: Graefe's disease

This disease commonly affects middle-aged patients; the onset may be acute with swelling of the eyes and exophthalmos or insidious with asthenopic complaints and slowly developing diplopia. The first sign may be a restriction of elevation and convergence, unilateral or bilaterally asymmetric, caused by the swelling of the eye muscles. The treatment of the acute stage requires the cooperation of several medical disciplines.

The treatment of late stages is the task of the ophthalmologists. Owing to the inflammation, the muscle fibers are replaced by fibrotic tissues and lose their elasticity; consequently, the excursion of the bulb to the opposite side of the affected muscle is restricted, a condition proved by *the forced duction test.* First, the elevating muscles are afflicted, rectus inferior and oblique inferior, and then a neurogenic palsy of superior rectus and oblique is simulated. The treatment of choice is an operation, which is possible once the deviation has stabilized.

3.3. Myasthenia gravis

This disease is based on a defective neuromuscular junction, a lack of acetylcholine and it is interesting for ophthalmologists because the first symptoms often are a uni- or bilateral ptosis and diplopia. In the course of a day the symptoms will deteriorate. The double pictures cannot be related to a certain eye muscle, like in a neurogenic palsy, and they are highly changeable;

therefore, they cannot be corrected by prisms. Blood tests and stress tests will confirm the diagnosis. In general, neurologists will take charge of the treatment.

Yet, we recommend the colleagues of ophthalmology to consider the possible presence of myasthenia in cases of unsettled asthenopic complaints or unstable heterophoria.

4. Diagnostics

This chapter is aimed at ophthalmologists without orthoptic equipment and at colleagues of other disciplines, such as neurology and geriatrics. With simple methods and a minimum of instruments, it is possible to find out whether double vision is due to an ophthalmologic or a neurologic disorder.

What we need:

1. A non-blinding penlight for the inspection of the eyes, for fixation in a near distance and to check the motility of the eyes.
2. A Maddox-Cross, mounted at a 5-m distance, serving as a fixation light for measuring the angle of squint in various directions of gaze.
3. Two red glasses, one bright and the other dark, for different degrees of fusion dissociation, while measuring the eye deviation.
4. Bagolini glasses for examinations under near physiological conditions.
5. A Maddox-Wing test for measuring deviations in near distances.
6. Occluder.

Partially, diagnostic instructions have already been given on the previous pages. A few most important items are to be further explained: The cover test, the motility of the eyes and their muscles and the Bagolini glasses.

4.1. Cover tests

Cover tests (CTs) are the most important diagnostic tools for the comitant and the incomitant squint. To estimate the existence of muscle palsy, the alternating CT is useful, especially for patients who are not able to speak (**Tables 4** and **5**).

4.2. The movements of the eyes and their muscles

To check the eye motility, a torch is moved in the main directions of gaze, monocular and, what is more important, binocular, while the head is fixed. For the main action of each muscle, see **Figure 2**. In the presence of double pictures the examiner has to ask in which direction the lights have the largest space between them; a red glass before the right eye enables to differentiate the eye which each light belongs to; the light in the most outward position indicates the palsied muscle.

The patient fixes an object	a. in the distance b. in the proximity
Alternate covering of both eyes, every second, without interruption	
No movement = Orthophoria,	
but exceptionally strabismus + amblyopia + eccentric fixation	
(corneal reflexes to be noticed!)	
Movement from nasal side = Esotropia or esophoria	
Movement from temporal side = Exotropia or exophoria	
-tropia = manifest squint	
-phoria = latent squint, decompensation by fusion interruption	
both can be differentiated by the unilateral cover-uncover test	

Table 4. The alternate cover test.

Both eyes must be checked for distance and near fixation, and an interval to regain the original position is necessary.
Observation of the **free eye**
1. While **covering** the fellow eye:
a. No fixation movement = Heterophoria
b. Fixation movement = Heterotropia
2. While **uncovering** the fellow eye:
a. Fixation maintained = alternating squint
b. Fixation lost = unilateral squint

Table 5. The unilateral cover-uncover test.

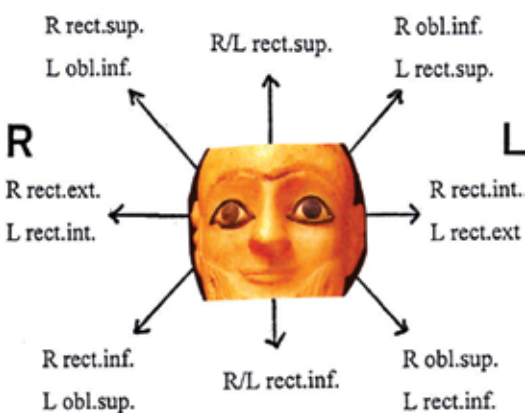

Figure 2. The action of the eye muscles. The face is a photo of an antique statue.

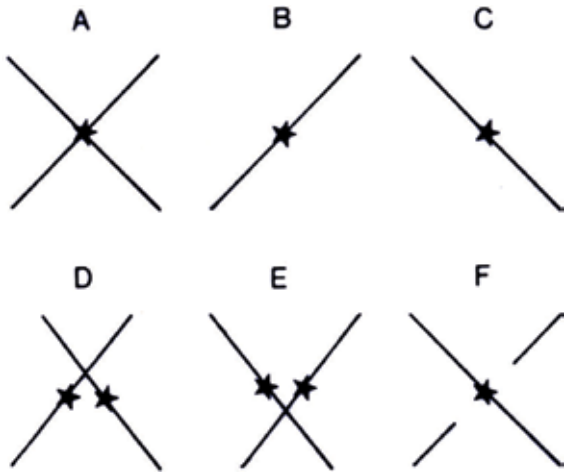

Figure 3. Some results using Bagolini glasses: (A) orthophoria (or microtropia), (B) suppression of RE, (C) suppression of LE, (D) uncrossed diplopia (esotropia), (E) crossed diplopia (exotropia), and (F) central scotoma without squint.

4.3. The Bagolini glasses

The Bagolini glasses, always used binocularly, give information about the eye position, fusion ability or suppression. They should only be used in addition to the best correcting glasses of the refraction error. The possible results are shown in **Figure 3**.

5. Conclusion: differential diagnosis of double vision in the elderly

Ocular diplopia:

- anamnesis most important
- onset slowly, unnoticed
- concomitant motility pattern
- loss of binocularity without diplopia = “masked diplopia”
- intractable diplopia in the adulthood of infantile squinters or after the operation of a long-standing cataract

Neurogenic diplopia

- onset sudden, flash-like
- incomitant motility pattern
- intractable diplopia after severe craniocerebral trauma

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Other declarations

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Chapter 3

Empowering the Elderly by Giving Dignity

Irudaya Rajan Sebastian and Sunitha Syamala

Additional information is available at the end of the chapter

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Abstract

Elder care is the most pivotal topic in any society today. Indian culture of living with parents is a common thing, living arrangement and care is a part of it. However, living with partner and living alone is increasing among the elderly, especially the elderly in Kerala. This paper analyzed the data of Kerala Aging Survey 2013 of Centre for Development Studies, Kerala. This paper analyses whether the elderly living with their family are empowered by giving dignity to them. For this, it analyses the living arrangement of the elderly living in Kerala with their need for special care. It also analyses with their ADL, depression and chronic diseases. The result shows that elderly who live with children need special care and have more than two chronic diseases compared to elderly who live with their partner. Among the elderly who live alone or are living with other non-relatives, the depression scale shows a high value compared to the elderly who live with their partner or with their children. Thus, though the elderly need special care or are suffering from chronic diseases, they are living with the attention of their family, especially with the attention of their children or their partner.

Keywords: living arrangement, care, depression

1. Introduction

The word empowerment has been articulated in many ways according to the state of affairs. When we talk about the empowerment of the elderly, it is different from the other types of empowerment such as women empowerment, youth empowerment, financial empowerment and so on. The ways to empower the elderly are different from that of other means of empowerment, though they are a bit similar. The main thing is to give dignity to the elderly which will automatically enable them to get empowered. The joint family system in India gave a notable status to the older persons in the family as the decision maker. But, the restructuring

of the family system from joint to nuclear have put the situation of the elderly at risk. The focus of the family shifted to the children and the status of the elderly, who once ruled the family got degraded. Thus, they became a liability to the family and caring for the elderly became a challenge to the family as well as the society. There is an increase among the elderly living alone or living with partner only as the children left the family in search of employment or a better livelihood. No one no longer cares to accompany the elderly to the hospital when they need to go. It is time to talk about familial bonding rather than economic stability. Thus, elderly care is one of the most challenging topics in any society today. If someone got care at the right time, that represents giving dignity to them. The aging population, irrespective of its composition, requires care and shelter as it is one of the basic needs of life with dignity [1].

Dignity was found to have two attributes: self-dignity, which is the individual's sense of self-worth; and interpersonal dignity, that is given to the elderly by others and manifested by the respect they received [2]. Concerns about the standard of care for an important number of elderly people abound, despite global aging being a challenging phenomenon. One among these concerns is regarding how to ensure that the elderly will be able to live out their days with dignity [3]. Dignity is an inherent characteristic of being human, it can be subjectively felt as an attribute of the self, and is made evident through the behavior that demonstrates respect for oneself and others. Dignity must be learned, and an individual's dignity is affected by the treatment received from others [4]. Dignity violation in health care occurs through processes of rudeness, indifference, condescension, dismissal, disregard, dependence, intrusion, objectification, restriction, labeling, contempt, discrimination, revulsion, deprivation, assault, and abjection. The conditions that promote these processes reside in the positions of the actors involved; in the asymmetrical relationships between the actors; in the health care setting itself, which is characterized by multiple tensions—including those between needs and resources, crisis and routine, experience and expertise, and rhetoric and reality; and in the embeddedness of health care in a broader social order of inequality [5]. Dignity may be defined as a concept that relates to basic humanity. Dignity consists of inherent and external dimensions, which are common for all humans and at the same time are unique for each person, relating to social and cultural aspects. The attributes of preserving dignity are individualized care, control restored, respect, advocacy and sensitive listening [6]. Several care actions were identified relating to all themes contained within the Dignity Model, except aftermath concerns. Examples include: controlling symptoms; listening to the elderly patient and taking them seriously; providing advice concerning how to cope on a daily basis; treating them as equals and with respect, and; encouraging the family members' presence [7]. Dignity is a complex phenomenon, which differs according to the people's perspectives and cultural variations by region. It is also well-known that elderly people belong to an age group, which demands not only financial support but also emotional and physical assistance to help them lead a dignified life [8]. The proportion of life expectancy free of disability decreases with age and the proportion of life expectancy spent in a disabled state increases with age [9]. The most crucial aspect of living arrangements for the elderly is co-residence with adult children in extended families or multi-generational households where kin provide income, personal care and emotional support to the elderly [10]. This chapter explains the dignity of the elderly as the care and love given to them. According to Census of India 2011, Kerala has 4.2 million elderly,

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which accounts for 4 per cent of India's total elderly. Economic progress and human development have improved the quality of lives and thus increased the longevity of the people. The senior citizens should be able to enjoy these additional years [11]. However, In India, as many studies indicate, the abuse and neglect of the elderly mostly by the relatives and care givers, people the elderly know and trust, and which affects their quality of life as well as is a violation of their rights to a life of dignity and respect is emerging as a serious concern [12]. The research question is whether the elderly living with their family are empowered by giving dignity to them, especially if they need special care.

2. Data and methodology

In order to highlight the plight of the elderly in Kerala, the Centre for Development Studies, Kerala, conducted a survey entitled "Kerala Aging Survey (KAS), 2013," which covered 14 districts of Kerala. The 2011 Census data on aged population in Kerala was used for sampling purposes. The samples of KAS 2013 were obtained from Kerala Migration Survey (KMS), 2011. Those households which have people above 60 years of age and those which had people who would attain 60 years within the next 2 years were taken from KMS 2011 to form samples of KAS, 2013. There were 15,000 households in the Kerala Migration Survey 2011 out of which 5713 households had elderly people. KAS 2013 covered 7768 elderly people. Though there were 7768 samples, 2301 elderly who need special care that they have some disability or limitation were selected for the analysis. These elderly are being analyzed with respect to their living arrangements. The variables selected for the analysis are age, education, financial status, standard of living, perception of health, cognition level, depression level and overall life satisfaction. To identify the effect of each independent variable over the dependent variable according to their living arrangement, a multinomial logistic regression has been carried out.

3. Analysis

Most of the elderly who need special care are living with their children. Educated elderly prefer to stay with their partner or to live alone. If they are illiterate or have less than primary education they would stay with their children. They need assistance to manage their routines including health checkup. Elderly who have more than two chronic diseases live with their children. On the other hand, those who have no diseases live alone or with other relatives. This has an effect on the perception of caring. The elderly living with children are vulnerable to more than two chronic diseases, which means that these elderly need more attention and care from their beloved ones (**Table 1**). But those who are living alone or with others should take care of their own health; otherwise they will face a thick condition of caring imbalance. In urban areas, most of the elderly live with their partners, while in rural areas most of them live with their children.

It is obvious that someone will take care of the elderly if they get financial benefit. Here, the elderly who are fully independent live with others or live alone than living with children.

		Others/Alone	Partner	Children
Age group	80+	24.4	11.9	27.5
	70–79	39.6	32.6	36.8
	60–69	36.0	55.4	35.6
Education	Illiterate	20.9	10.6	19.5
	Less than primary	18.7	14.6	21.0
	Primary but less than secondary	40.4	47.5	47.0
	Secondary and above	20.0	27.3	12.6
Financial status	Fully dependent on others/spouse	52.9	61.0	64.6
	Partially dependent	20.4	14.1	20.8
	Fully independent	26.7	24.9	14.7
SLI	Low	61.3	57.6	58.0
	Medium	23.6	25.7	26.3
	High	15.1	16.7	15.7
Perception of health	Poor	71.1	70.0	66.7
	Fair	15.6	19.4	21.1
	Good	13.3	10.6	12.2
Chronic disease	2 or more diseases	44.9	41.9	46.3
	One disease	32.0	37.1	32.8
	No disease	23.1	21.0	20.8
Cognition	Severe cognition impairment	28.0	14.6	22.4
	Mild cognition impairment	25.8	18.8	30.7
	No cognition impairment	46.2	66.6	47.0
Depression index	High depression	41.3	32.4	29.5
	Medium	50.2	60.5	64.9
	No depression	8.4	7.2	5.6
Life satisfaction	Low	64.4	38.2	25.0
	Medium	21.8	26.3	29.6
	High	13.8	35.5	45.4

Table 1. Profile of the elderly who need special care according to their living arrangement, 2013.

But the standard of living of households is low for those elderly who live with others or live alone. Elderly who live with others or alone have severe cognition impairment compared to

the elderly who live with their partner or children. Most who have no cognitive impairment live with their partners. Most of the elderly have some sort of depression irrespective of their living arrangement. But high depression can be seen more among the elderly who live with others or alone. It is quite natural that they get depressed at their later ages when they are alone or when they are not living with their blood relatives. Overall, life satisfaction is very low when they are living with others or alone. Among the elderly living with children, 75% have a high or medium life satisfaction.

4. Multinomial logistic regression analysis

The dependent variable selected for the analysis is the living arrangement of the elderly who need special care in which three categories of living arrangement such as with children, with partner and with others or alone have been selected. The regression is applied by taking the elderly living with children as the reference category. Is the life satisfaction more among the elderly who are living with children or living with partner or with others or living alone? Here the analysis estimates the degree of effect of independent variables on the dependent variable (**Table 2**).

The reference group considered here is the highest coded categories of each variable. The parameter estimates focus on the role of each independent variable in differentiating between the group specified by the dependent variable [13]. The likelihood ratio test explains the overall relationship between dependent and independent variables based on statistical significance. That is, independent variables such as age, education, financial status, standard of living, life satisfaction, depression and cognition are statistically significant. The coefficient under log (P1/P3) represents the effect of predictor variables on living with others/alone (P1) over living with children (P3), log (P2/P3) represents the effect of predictor variables on living with partner (P2) over (P3).

The elderly who live with others or alone and need special care have a lower chance to have an education level of less than secondary compared to secondary or above level. Also, these elderly have a higher chance of having a low standard of living, but have a lower chance to depend on others. Also, they are less likely to become depressed but more likely to have low or medium level of life satisfaction. The elderly with older ages are less likely to be living with their spouse as widowhood would occur at some point compared to the elderly living with their children.

The elderly who live with their partner have a lower chance of having an education level of less than secondary than secondary or above level. So, we can conclude from the analysis that elderly at their later age have a higher chance to stay with their children and also with no cognitive impairment, high life satisfaction and better standard of living than to live with their partner or others or live alone. Thus, the elderly living with their children are empowered with a dignity and care that they have achieved over their life. Elderly living with others or living alone are less likely to get dignity and family care.

Variables	Categories	Reference category	Others/Alone		Partner	
			B	Exp(B)	B	Exp(B)
		Intercept	−1.819		−0.524	
Three age group	80+	60–69	0.008	1.008	−1.124	0.325**
	70–79		0.198	1.219	−0.482	0.618**
Education	Illiterate	Secondary and above	−0.378	0.685	−1.220	0.295**
	Less than primary		−0.587	0.556*	−1.039	0.354**
	Primary but less than secondary		−0.467	0.627*	−0.597	0.551**
Financial status	Fully dependent on others/spouse	Fully independent	−0.749	0.473**	−0.191	0.826
	Partially dependent		−0.427	0.653	−0.586	0.556*
Std. of living	Low	Best	0.847	2.334**	0.723	2.060**
	Average		0.427	1.533	0.033	1.034
	Better		0.249	1.283	0.025	1.025
Health perception	Poor	Good	−0.019	0.981	0.427	1.533*
	Fair		−0.355	0.701	0.148	1.159
Depression index	High depression	No depression	−0.778	0.459*	−0.253	0.777
	Medium		−1.014	0.363**	−0.312	0.732
Chronic diseases	2 or more diseases	No disease	−0.155	0.857	−0.247	0.781
	One disease		−0.172	0.842	0.105	1.111
Cognition	Severe cognition impairment	No cognition impairment	0.270	1.309	−0.342	0.711
	Mild cognition impairment		−0.079	0.924	−0.524	0.592**
Life satisfaction	Low	High	2.206	9.079**	0.682	1.977**
	Medium		0.878	2.405**	0.147	1.158

* < 0.05 and ** < 0.001 - significant levels.

Table 2. Multinomial logistic regression coefficient: Living arrangement of elderly who need special care (P3 = living with children, P1 = living with other/alone and P2 = living with partner).

5. Conclusion

Living arrangement of the elderly plays a vital role in empowering elderly by giving dignity. Unlike the earlier traditional family system where the elderly were the key decision makers in the household, today's family system has changed with change in the role of each individual; the elderly has an unimportant role. However, it is indirectly understood that elderly who experienced life satisfaction have dignity when they are living with their family. One can enjoy their life at the later stages of life if they would get proper care and love. This chapter explored how dignity is different among elderly when they are living with children and living with others/alone.

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Chapter 4

Life Span Management

Adewale James Alegbeleye

Additional information is available at the end of the chapter

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Abstract

One of the challenges plaguing the health of people is the effect of chronic diseases. Life expectancy of people has continued to be at stake due to the emergence of chronic diseases. The centers for public health in various countries have raised concern that there is a need for urgent intervention to address this challenge. Self-management is the key to a healthy life and healthy aging. According to the World Health Organization (WHO), lifespan management could play an important role in preventative measures of hereditary diseases, reduce mortality rates, and act as motivating factors to human beings in general. Life span is the duration of existence of an individual or the amount of time that a person or animal lives according to Cambridge dictionary and this could be improved. There are various measures that have been scientifically proven to improve lifespan management such as calorie reduction, good nutrition, regular exercise, weight reduction, and healthy relationship. In conclusion, healthcare givers, doctors, and nurses should be able to learn that treatment is not the only medical process that can heal a patient. Lifespan management is an all-round process aimed at improving the health of a patient and if possible, a total restoration.

Keywords: life, lifespan, lifestyle, management, life expectancy, elderly, services

1. Introduction

Lifespan is the average length of life of an organism or of a material object especially in an environment or under specified circumstances. When it comes to human life, it is imperative to note that the period and the number of years possible for a human being to live on this earth are well known. For instance, in the history of mankind, people living above 120 years with all the body organs functioning properly have been recorded. At some point in life, one can think of good health, and for the people who care about their health, the existence of mankind

relies on the knowledge and skills of preventative measures available for the most preventable diseases that they are able to prevent at all costs. When normal life is compromised by a condition, lifespan management (LSM) comes in to supplement one's life to continue living.

Lifespan management (LSM) is a very new health sustaining innovation and is aimed at improving individual more especially for those aging persons who have need of personal assistants with life activities and poor account of adequate interaction with the healthcare industry at length. Many have been asking questions in regard to the need and the importance of the process and the programs. It is one of the most important programs for all humanity because it gives humanity the dignity that it deserves at all times.

Lifespan management can be done at home or through health expert's advice; we are all optimistic and have the perception that we may live a life that will not be attacked by an uncontrollable condition. One thing that we must understand as humans is that the body is prone to morbidity. Many medical scientists and doctors are aware that people can be prone to deleterious and fatal impact of sickness at any time; for this reason it is important to know that life can go on well. However, it is well seen among health practitioners that if a certain disease comes and compromises our lifespan, the treatment, and the other care, can be addressed through the new concept of this innovative approach to lifespan called lifespan management. Apart from expert care for patients in their own community environment, increasing ease and efficient access to healthcare, most of the cases, are done on patients who are victims of world-known epidemics and pandemics [1].

Lifespan management encompasses the kind of care after drug prescription that is accompanied by nutrition recommendation, diet, and change of lifestyle. In general, it is meant for the continuity of life after a certain treatment to the recommended levels. The importance of lifespan management does include the enhancement of lifespan in humanity through methods other than medicine which could be incorporated into diet, exercise, and sports nutrition. In the long run, it is a way of reducing the mortality rates through constant checkup and advisory services to patients on how to avoid death from a condition. Once someone or a patient goes through lifespan management, it will include both medication and other procedures, and this will boost the patient's immunity; hence, lifespan management objective is achieved, where the patient will not be lost for the reasons related to their illness before their time. In other words, premature death will be a mile of years away. It also motivates the patients to be strong and accept their conditions and learn to live by it and reduce the side effects of some of the longtime drugs.

About those elderly patients who require frequent medical attention, lifespan management would be an effective and easy approach to meeting their health needs and ensuring longevity. It is crucial for making patients continue with their lives, and there are those conditions that are known to be fatal; however, it is assumed that when drugs are administered to such patients they may still die. It is a clear assumption that holds a critical view by the fact that the process of lifespan management after drug administration will help the patient to be able to control the condition and make it possible for the patients to live longer than expected with the same complications by easy access to healthcare through lifespan management. For instance, for a patient with diabetes, yes it is important to make sure that they visit a health facility, but after that, they will be engaged in diet recommendation, nutrition, and mental stability; in this regard the patient cannot die prematurely but live with the disease [1].

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According to the Association of American Psychologists (AAP), people are not conscious about living for a long period of time, but they do understand that they can live on earth peacefully and happily. It is observable that they have never concentrated so much on the strategies on how to live according to the maximum years possible for human. It is crucial that people are educated on how to work on the number of days that they must live and make sure that they are aware that they should be responsible for each action that inhibits the lifespan. On the other hand, lifespan management is the health and social techniques that can be adhered to so that one can live according to the lifespan expected of a human.

Lifespan management also includes the medical therapy offered when the person who is under the program is being supported by medical equipment and drugs so that they can be able to continue with their lives normally. A good example is the people living with HIV; they are constantly on antiretroviral drugs as a life support. Off course, drug therapy alone may not be adequate for certain diseases. Therefore, there would be a need for other lifestyles such as the counseling, the diet watch, and other physical needs that are categorized as lifespan management techniques. Apart from the normal drug and health facility care regarding medicine, there is a part of treatment that includes counseling and recommendation from the health experts like nutritionists and dieticians; they play an important role in the health recovery process of the patients, and in the long run, it is regarded as part and parcel of lifespan management in general.

2. Objectives of lifespan management

According to the World Health Organization (WHO), lifespan management has played and could lay an important role in preventative measures of hereditary diseases, reduce mortality rates, and also act as a motivating factor to human beings in general, and it is estimated that the people who try to live their lives in accordance with the tenets of a specific program for lifespan management tend to live longer than those who do not understand their lifespan. In general, lifespan management is the process that is adopted at a personal level and institutional level, mainly for the purpose of reducing deaths and making people live for long or even live comfortably with the health challenges that they go through.

It is the process where one seeks help to increase his or her stay on earth through medication, counseling, and support from health experts and healthcare institutions. Every human being would love to stay long on earth, but the question on how best to acquire a long lifespan is what has been in people's mind for a long time.

3. Theories of lifespan

There are several theories that have been put across to explain the issue surrounding lifespan in general. According to science, it reiterates that lifespan is a dependent variable on the genetic makeup of a living organism, whereas in contemporary society is dependent on environmental factors and lifestyle. It is imperative at this stage to explain what exactly

"lifespan" is [2]. In a normal thinking of a person, they will think of how to elongate life or how to live longer on earth without much consideration to the determinants of a life on earth in humans.

In this paper, we are going to see and discuss the topic on both sides, that is, a long lifespan and a short lifespan in humans, the factors that lead to both and how to manage both but much will be on lifespan management. Sometimes, people ask how long they can live on earth and for how many years, and even in some case, they attach their lifespan to some materials that they believe they can help them manage their lifespan.

Lifespan in this context can only be determined by several factors. But one thing that humanity needs to understand is that the process of lifespan management begins right from conception and at birth. The process takes a break after birth and thereafter begins again when a person begins to be independent and during old age when care is paramount. Therefore, lifespan depends largely on self-care and external care by healthcare professionals or by an agency of human life. As mentioned, it is a process that needs constant care, and scrutiny of one state of health and well-being either during his or her young hood and old age.

There is no specific theory that explains how lifespan management can be approached, but in the long run, it is all about what we feed our bodies with both mentally and physically, where one is alert for any contraindications on the usage of any product that they are used to. Most of the lifespan management programs do depend so much on the health historical records of a society and a person, as they form the foundations for healthcare management at a personal level so that aspects of care in terms of lifespan management will be based upon.

Though, there is the theory of the scientific and the cell physiology in general, where cell division is more attached to the nature of lifespan of a living species. Scientifically, the number of times the cells replicate and divide determines a species' span of life, but in real sense, there are other factors that do determine the lifespan of a living thing. In this regard, this is applicable to all living things including humans; in fact, humans and animals are categorized as one, but the distinction is the way of thinking and the consciousness [1].

In the previous narrations, it has been concluded that lifespan management is triggered by one or two factors, and one of the reasons for the need of lifespan management for both an individual and the society at large is the health status of a person; if the people are known to die of a certain condition, it is of great importance to make sure that they are given the correct medication, supplies, and any other support so as to assist in their wellness, and all this entails lifespan management [3].

The human nutrition, that is, the food intake, is an independent factor that determines the quality of homeostasis and the normal functioning of our bodies. Maintenance of how our lifestyle is designed is generally the foundation of a good lifespan management. That is based on a health condition, but when it comes to the perfection of the health status of a person who is healthy, the preventative measures act as a remote lifespan management program. Motivation is also a component for lifespan management; the aspect of informing the patient to be strong, such that you tend to prove and assure them that the condition is manageable and he or she is not the only one with the same condition, is a component of lifespan management.

There are several theories that have been raised concerning the determinants of our lifespan. Some of these questions span around the main factors that control our lives. Some of these factors span from lifestyle factors and genetic, cellular, epigenetic, or perhaps spiritual factor which is emerging under spirituality of life. Scientific knowledge is yet to provide satisfactory answers to such mystery of our existence. However, it has been concluded that there are factors that do have a great influence in the lifespan of a human in general. As earlier mentioned, the life of an individual on earth is determined by several factors right from birth all the way to death. The main goal in the process of "lifespan" management is to extend the time of death of an individual.

It should be clear that there is no record on a way or a technology that helps people to increase their days on earth, but there are social and economic factors that do determine a well-managed lifespan [4].

Lifespan management is a process that can take different directions and originate from different reasons; for instance, there is a need for lifespan management advisory services if someone has a medical condition that compromises his or her life, and such medical conditions and complications are either inborn or were acquired in the middle of life. In this case, lifespan management will be compulsory and of the essence for the survival of an individual.

Lifespan management is a kind of program that has medical and social attribute in nature. Love and compassion are central parts of a successful goal accomplishment. It is imperative that people around the person must show love and compassion so that the patient will feel loved and encouraged and forget the fact that they are going through a problem and learn to live with it. By so doing, the person gets to hope that they will see tomorrow and the other days. It is an important part of lifespan management on a social perspective; on the other hand, if the need for lifespan management originates from a medical condition and demands medical attention, then health professionals play an important role in making the person or patient live for long and get hope through medical help.

This was just an overview of how lifespan management process is introduced to humans or patients. In normal academic terms, lifespan management is also the same as longevity increases the process where its main purpose is to reduce mortality rates in the world and sustain it to an age like 90 to 120 years. As of today, the mortality rates globally for certain chronic diseases in the older population are high. Apart from the nature of illness, there is a variation in mortality among various nations and are influenced by several factors ranging from environmental to socioeconomic factors. In the end, the main objective at a personal level for the process of lifespan management is to increase the life of an individual and to enable the person to live a happy life. It is necessary to have a look at the factors that do influence lifespan in humans for a better understanding of what lifespan management is in details.

4. Factors that influence considerations for lifespan management

Lifespan is influenced by many things that human beings undergo during his or her life, and what people do most of the time determines how long and how short someone will stay alive. Lifespan management is not a process that one can apply some given parameters and give

a measure or equate it to a given period of time; for instance, if one sticks a diet free from cholesterol for a year, it is not practical to measure the number of years added ahead in life equivalent to cholesterol-free period. It is conclusive to confirm that lifespan management has no specific factors that give results to the positive side and the negative side, but it is important to understand that lifespan management is triggered by both positive and negative factors; if one is going through hard times, and this goes for a long time, then there is a need for an introduction of a process of lifespan management.

The environmental factors do play a vital role for the need of lifespan management. There are some environments that are not fit for human habitation, and they are known to pose a risk to the lives of humans. They can be either artificial or natural, and they are not necessarily risky, but depending on the adaptive nature of a person to the environment, it will result into either positive or negative in either way. Environmental factors can be adverse climatic conditions, and the quality of water that is found in the region if the water, for instance, in the region is known to contain fluorine in high quantities, then the implication is that people are likely to lose teeth early in their lives and as young as 35 years [5].

Nutritional support for the elderly patients is an indication for the need of lifespan management services because people will not be able to access some of the nutrients through chewing, during old age. They will require care support to make them live to the maximum age recommended. On the other hand, the environment can be very conducive where the bodies of humans can be comfortable and make the people in the area to live long. In a nutshell, environmental conditions do play a role in either shortening life or elongating life in humans. But, the question that is very critical in this case is whether lifespan management is a need for a normal human being.

The answer to the case of a normal person can be challenging; in normal life situation, lifespan management is perceived as a process for the needy, for the sick people, and for the old, physically challenged people and patients undergoing a certain permanent condition in life. It is a fact that management of life is intended to elongate someone's life that could be in danger majorly, but this has been extended to those people who are also healthy; they also take care of themselves, not only because they are doubtful or hopeless for the future, but also they want to make things easier for them once they are old. Indeed, whatever we do today has an implication for the future, what we eat, wear, and do daily may determine how we are going to live in the future and even sometimes affects our children.

For instance, if a person smokes tobacco, it influences his or her life at that time, in the future, and possibilities are high to affect their offspring. Lifespan management is a process that can take directions as mentioned before for the needy and for those people who want to live a better life in the future; it is not necessary for a specific people, but the need is for those with complications majorly. The factors that do influence the lifespan of human beings either for a long life or a short life, in general, are diverse.

Elaborating more on the environmental issues, that is, the human activities that do take place in our surrounding, a good example are the industries that are located in close proximity to the residential areas and the mining sites, and the industrial waste that is emitted in the form

of carbon to the air is later on taken into the living things' respiratory systems; this has been reported by several human rights organizations that the chemicals that are emitted in the form of carbon and other industrial wastes do cause grievous harms to humans.

If this is to continue for the next century, it will basically increase mortality rates and hence affect the lifespan of humans drastically. For this reason, there is a need to get into lifespan management at an early stage, so that the environmental conditions do not have a greater negative effect on the human life. This is an important part of lifespan management, more especially if the authorities want to increase the health and happiness of human beings. The understanding of influence of our clean environment to enhance longevity and a life free of adverse environmental and climatic conditions should continue to be a priority of all governments, climatologists, and environmentalists in the world.

5. Would most people need lifespan management?

Our lifestyle plays a crucial role in determining how far we can live as humans; we have these people who do or engage in manual activities as their main activity and income-generating activity for themselves. This can be good for them from a perspective of exercise, but it has a negative effect that causes harm to the body organs leading to diseases like asthma and other specific chest complications, so the kind of job that we engage in should be limited to a certain period in our lifetime.

As an illustration, a professional who deals with machine operations, like the compactors and drills, may tend to be affected as they shake the body for a long time, and this affects the bones and the muscles; in this regard, the body will disintegrate, and when old age comes, you will find that the past lifestyle activities will lead to complications associated with it. It is imperative that people engage in some activities with caution bear in mind the fact that they have an implication in the future. From the foregoing, lifespan management will be triggered by the previous activities that we did during our youthful stage.

It is a wider aspect of what we engage in that will prompt us to get into the perspective lifespan management. If one wants to make it a simple process, it must start from the days when you are a youth; this is because it will be much easier if we do not have problems that can be originating from our young hood. For instance, for a person who has been alcoholic for a long period of time, this person may have a difficult time in the process of lifespan management, because the organs in the body will not be as original as they were. They will need an extra cost through medication and alcohol cessation program. In this regard, lifespan management will involve healthcare, and at the same time diet, this is when one is old, but a good process of lifespan management begins from the mind, making sure that every part of the body is working optimally.

Yes, the life of a human being does not depend on one thing, like food only; it entails other processes that include healthcare, economic, and social process that will bring satisfaction. The straining of the body too is a dangerous affair especially the mental part of the body. If

one undergoes a life that is known to be stressful, his or her life will be shorter, and death may come soon, and if this will be detected early enough, the issue of counseling and giving hope to this kind of person will amount to lifespan management because you already know that it can lead to death. On a social ground, you have and every person has to embrace the aspect of getting contented with what they have and living within their means altogether.

Lifespan management is not a process that you must wait for a certain age to click or when faced with a health condition so that you begin it; it is something that should be part of every conscious adult. In fact, in every action that we take for the good of ourselves, it should be referred to as lifespan management because every living thing does its best to make sure that they see tomorrow. However, according to the objectives of lifespan management of the American Academy of Pain Medicine, it is assumed that it is meant to elongate life, as much that it could be one of the reasons it is not a major reason for the process of lifespan management. The main idea is to make life comfortable and make it possible to have our body organs operate as required [4].

On the other hand, lifespan management should not be handled by the health professionals only. In fact, they are to give advice to the people and do it by themselves. For instance, people born with epilepsy, cerebral palsy, and others are people who may need the process because they are at risk at all times and their death could be known to their parents and relatives, and the health professionals would advise on how to take care of them so that they can live longer and a comfortable life in general. This is a type of lifespan management that demands an expert's advice together with the caregivers. In this context, it can be concluded that lifespan management is both for the comfort of humans and at the same time is meant to improve the health and lifespan of a person. Such conditions are also the influencers of the need for lifespan management.

In summary, lifespan management is a process that is given to a person to make his stay long regardless of other factors in life, and this can be administered to a person whom upon observation is concluded that he or she has to live with the condition. It is not actually done from any place but can be made possible from a remote area, and the people go for the feedback checkups. In this regard, the process can be self-driven and undertaken from institutions that offer such services to the sick and the old with the perspective of healthcare. But the main objective of a lifespan management program is to make possible the ability and the life of human beings to live fully within the periods that are scientifically known to be possible for the human to survive having put all the other factors into consideration.

There are other factors that do lead to the need for lifespan management, that are personal, and that are based on how people from the family linage lived with regard to the quality and duration of their lifespan. In medical terms, it is dependent on the genetic makeup, where one observes how people who are not living died prematurely due to preventable diseases. In this instance, one could consider on what age set and the kind of ailments that they faced most of the time in their lifetime. This is an important data for one to base the basics of his or her lifespan management. One will be conscious about it, and in the end, he or she will be able to know when and during which to expect anything at a point in life. Though this has never been proven to be factual, but in some instances, it has worked [5].

For instance, if members of a certain family lived for 100 years, they are most likely to live the same period, but one thing that is impossible to understand is the fact that it is hard to establish the lifestyle that your deceased relatives led when they were alive but is important to work toward lifespan management with anticipation to live beyond their lifespan. This is based on genetic or hereditary determinant of their lifespan. It will involve looking into the diseases that are hereditary and the complications that are genetically transferred from one generation to the other. By so doing the preventative measures can be started early enough so that you may not be like the gone members of your family. This is part of the personal care in relation to lifespan management.

6. Categories of lifespan management

There are no specific categories of lifespan management, but what have been come up in the medical field are the processes that can be of two main considerations. There is the aspect of patient lifespan management which categorically meant to improve the adaptability of the patients to the advancement of the conditions they go through. It is also meant to make the pain and stigma associated with the complications to subside and bring back the patient to optimal health status. In this case, the society and the health professionals have a responsibility to make sure that the patient is at ease and accepts the fact that life has to go on with their condition.

The doctors and the nurses or the caregivers have a duty to offer advice and medical prescriptions for the patients. The society, on the other hand, should be able to understand that there is no single person who can allow or admire an illness, and they should be able to love and show compassion to the less fortunate in the society. The kind of lifespan management that we are talking is health based where a given condition is managed through medical means and life support equipment.

In this case, where a patient has been diagnosed with diabetes, it is both the responsibility of the doctors and the service provider to encourage the patient to work toward avoiding meals known to trigger the blood sugar levels and make it possible for the patients to access medical care and checkup whenever possible. In this context, lifespan management is based on the diets and reduction of disease causative agents and actions. For instance, checking the sugar levels and the blood pressure of the patients is of an essence to the diabetic patients.

The society or the family members are to make sure that the patient is mentally stable and is not stressed in any way possible and make sure that they feed on the right diet to increase his or her lifespan with the disease or the conditions. In this matter, lifespan management is regarded as a process where different techniques are employed to improve the health status of a person in general. It may involve health professionals, relatives, and family members; equipment like the life support machine, ICU (intensive care unit) equipment, and oxygen equipment; and others.

Another instance that will highly demand the lifespan management is the matter of the cancer patients. This is a category of patients who in the end must cope with the harsh conditions of cancer. They must endure pain and mental stress because of the disease. It is well known that cancer is a deadly disease that if not well managed it can lead to death. This type of disease

results in discomfort and life-threatening conditions to the patients. It is imperative for the patients to be treated; there is no equal measure for the cure of cancer, yet the patient has to be encouraged that everything is going to be fine. There is no proper cure for some of the conditions in the world; notwithstanding, the doctors and physicians are required to provide duty of care and support, and give hope where possible. The doctors engage in this process to make it possible for the victims to live by the disease, to reduce its effects, and to make the patient live by the problem which is a process known as lifespan management in relation to healthcare.

The other category is the one that is very rare in the health facilities globally. Lifespan management is precautionary and preventative in nature, where a patient knows that he or she has been living with a certain condition, yet they have not taken any step to protect or reduce the chances of getting a certain disease. The diseases like diabetes that can be hereditary or sporadic in nature can be controlled through preventative measures: like adequate blood sugar control with drugs, checking on the foods that one takes, what someone does daily and adjusting to the climatic conditions. A good move by most of the governments globally is to demonstrate a clear view of the process of lifespan management by the recent introduction of PrEP (pre-exposure prophylaxis). This is meant to reduce the chance of contracting the epidemic virus; this is a good illustration of the process of remote lifespan management.

Generally, the main objective is to protect a person from succumbing to the ailments but learn to live with the outcomes of the disease or prevent the adversities from creating more relapses. It is necessary for strategies to prevent these diseases than to cure them, hence improving the lifespan of an individual. This is mostly concerned with the idea of encouraging the vulnerable adults to scrutinize their eating patterns, activity patterns, and the need for relaxation and sleep. Caregivers must understand that the lifespan of human beings is compromised by the conditions that they go through, and for the reason, it is important to make sure that diagnosis and medical advice are given attention that it deserves. In this case, the levels of impairment are to be analyzed so that they understand how to deal and give care to such cases. For instance, if the conditions of the patients are alarming to the point that it hinders mobility of the person, the caregivers have to understand that the inability to move from one place to another can lead to other complications associated with lack of exercise and hence lead to obesity; this can be on all categories of patients who are in need of care and lifespan management [6].

It must be understood that the process of lifespan management is geared toward reducing the chances of premature deaths that is the main objective of the process. For adults, it is central to incorporate several things to keep them alive and to keep them busy with activities like watching TV, reading, motivational talks, and engaging in mental discussions and medication; by so doing, it will be possible for them to live with the conditions and meet the objective of lifespan management.

In essence what the caregivers should be doing is to make sure that they give the best advice and care to the patients. In fact, lifespan management is not all about medication and care; it is about the aspect of lifestyle because there are many conditions in the world that are different from each other and they demand different attentions, for instance, mental lifespan

management, terminal illness lifespan management, and hereditary condition lifespan management, among others. They need to be handled according to the needs of the patients and the required standards. In the case of mental disorder lifespan management, it is good to understand that what can make the patient face a premature death could be depression, and the most important thing away from medication is the fact that the patients should not be subjected to stressing environments that could lead to depression.

If it is a terminal illness, it should be on the basis of medication and healthcare, where the patients are duly informed positively to make sure that they take medication seriously and they are brought nearer to the people who have managed the illness in the past and came out strong. In general, there are several categories of lifespan management which are known to the experts, but every human being does anything for survival, and lifespan management should not only be left to the caregivers and the healthcare experts. This should be extended to other close people within the family so that the victims can see a reason to live longer. Another objective of lifespan management is to make sure that, as much as human beings who have psychological problems, should not to die prematurely or at an early age. It is meant to improve their emotional wellbeing and increase their body resistance to illness.

7. The tenets of lifespan management

Lifespan management is a process that should be understood as a sustaining procedure. Medicine is part of the process, and the prescription management is necessary is a component of lifespan management. In rare cases we do witness medication to be the central part of a curing process (LSM). There is a distinction between cure and treatment: cure ends when the doctor administers drugs to a patient, and cure begins from the time the symptoms are reduced or eradicated completely. Lifespan management is in a two-way traffic system, where the victim is subjected to a process of adapting to the changes in the body and the psychological stability of the patient.

It is crucial to make sure that as much as the prescriptions are in progress in the process of lifespan management. Cure entails helping the patients avoid the extension of their conditions like in diabetes. It is geared toward its reversal through proper diets and control of insulin. The patient cannot see the reason for the reversal of diabetes if they are not constantly reminded of the need to control and prevent the condition. Medication must be a part of the processes, but the psychological and emotional wellness of the patients should be enhanced through lifespan management process or programs.

It is not confined to a given location or facility; it should be done anywhere wherever the patient feels comfortable. Some of them may not want to remain in a hospital after treatment. They may need to go back home for the cure to continue. In this case, the emotional well-being is guaranteed to the patient and the caregivers. Lifespan management is good and recommended to be done in a place where the patient is comfortable. In fact, the World Health Organization has indicated that what leads to the premature deaths in the twentieth century is not lack of medication or even wrong diagnosis but the lack of facilities to give care and

attention to patients to fully recover from their conditions, and in this case, it recommends that lifespan management should the second process after medicine and diagnosis [7].

Health professionals should be able to give advice and their opinion based on the values and the needs of wellness regarding managing the span of life of their patients either in the hospital or away. But in the recent past, it has proven that most of the health professionals bring the process to an end after medication. Reasons have been cited for this shortcoming based on the number of patients and the number of doctors leading to a health crisis in general. Apart from the normal medical process and diagnosis, counseling must be emphasized by the caregivers. This creates a strong bond and connection with the patients and feel the ability to get stronger day by day, and as a result, lifespan of the patients can generally be enhanced, hence the objective of the process of lifespan management.

Some of the procedures that should be incorporated in the process of lifespan management include exercises in the case where a patient is not able to involve themselves in vigorous activities like stretching and running. There should be equipment for the gym to enhance muscle activity and even chair base for the nerve stretching and testing. In some other developed countries, they have initiated institutions for care, both for the patients and the old. This is important for the reduction of mortality rates especially if it is accompanied by necessary legislation. One good advancement is the emergence of the artificial equipment that are helpful for the weak; in this regard a home care and lifespan management is to have the necessary equipment for the well-being of the patients and clients undergoing a cure and treatment therapies that must accompanied with medication for the purpose helping the patients to take control.

It is also imperative to make sure that during the process of lifespan management, recommendations must be given to the clients based on the improvements. A report has to be made on the reaction of the client's body toward the process, such that it should include what to avoid and what not to avoid; in this case, the span of life will be added after a given period of time. The caregivers are to give feedback on how the conditions of the patients are doing, in regard to prevention and the reversal of the condition. It does matter so much to give positive feedback because this stabilizes the moods and the emotions of the patients. Lifespan management as mentioned earlier is to make sure that every person receives information regarding their health and diagnosis on time so that they can base the information on the prevention.

There are categories of people whose ability to function themselves independently is compromised, like in the case where a patient cannot eat or drink by themselves; in this case, the facilities should be able to provide other means and equipment to enable the patients to function easily. Children must also be informed of their conditions, so that they get the psyche to take food, because if by any chance a patient cannot eat well, this can lead to other complications like malnutrition and hence drop the immune system of the patient, and at that stage, the patients may not be able to achieve the objectives of lifespan management. Proper feeding can be enhanced by the use of tubes or gastronomy where the caregiver includes the services of registered dieticians to bring in professionalism and guarantee continuity of life [8].

In conclusion, health caregivers, physicians, doctors, and nurses should be aware that treatment is not the only medical process that ultimately heal a patient. It is not only in the health facility that a patient can be treated. They must understand that they can contribute to the survival of a patient, and the only way out is to make sure that they encourage and embrace the process of making sure they live their life as it was supposed to be. In fact, the reason as to why emphasis is made on the lifespan management in every part of the world is because no disease should cut short the life of a person because it is manageable. Lifespan management is an all-round process aimed at improving the health of a patient and the weight to manageable levels; if the patients are stable and comfortable, the rest may be achieved.

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Chapter 5

Cognitive Ageing

Dorina Cadar

Additional information is available at the end of the chapter

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Abstract

Cognitive decline is the first outward sign of dementia, which has a major public health impact on individuals and governments around the world. As individuals age, cognitive abilities gradually start to deteriorate for independent or combined genetic and environmental causes. Given that very little can be done regarding our genetic inheritance, the focus of the current research is on modifiable risk factors across the life course. There is a well-established relationship between specific lifestyle behaviours and cognitive decline, but extremely limited research on the role of combined lifestyle factors. This chapter aims to describe the process of cognitive ageing on multiple cognitive domains (fluid and crystallised), highlighting the changes in cognitive performance occurring as a normal process of ageing, as well as the most severe forms of cognitive impairment indicative of probable risk of dementia. Also, the role of modifiable risk factors such as lifestyle behaviours (alcohol, smoking, physical activity and dietary patterns) will be evaluated in relation to healthy cognitive ageing and preventions of cognitive decline. There are many questions to be answered regarding the biological foundations of cognitive ageing across the spectrum, and the potential role of lifestyle behaviours in reverting the accelerated changes in the cognitive ageing process.

Keywords: cognition, dementia, lifestyle, fluid intelligence, crystallised

1. Introduction

Optimal physical and mental health represents a prerequisite to an optimal quality of life. Highly complex mental capabilities such as memory, processing speed, attention, orientation language, reasoning and problem-solving are vital to everyday functioning and activities of daily living. However, these abilities tend to decline as part of normal ageing [1]. The rate of cognitive decline varies considerably depending on genetic influence [2–4], early environment

[5, 6], education [7] and social class in adulthood. A significant decline in cognitive functioning has also been attributed to lifestyle behaviours such as alcohol consumption [8], fruit and vegetables intake [9], cigarette smoking [10] and low exercise (both physical and mental training) [11, 12]. A serious degree of cognitive decline is not inevitable, but remains one of the greatest concerns in the current climate of our ageing populations around the world, given that cognitive impairment and serious levels of cognitive decline represent important predictors for the development of dementia [13, 14]. Developing realistic strategies and interventions to reduce cognitive decline and prevent dementia should be considered a high priority by governments around the world [15].

2. Cognitive ageing

An optimal cognitive function is fundamental to independence, productivity, and quality of life, while the progressive debilitation in cognitive capability associated with cognitive impairment and dementia, makes these conditions the most feared scenarios for approaching the older age. Human brains seem to be under continuous modifications, which are dependent of cardiovascular health, lifestyle or injuries throughout life. Some changes are part of the normal process of ageing, while others are more severe and debilitating with an underlying neuropathology process.

There is no clear consensus in defining healthy or successful cognitive ageing, but it can be described as the maintenance of most cognitive abilities as until older age and a minimum variation in the spectrum of normal cognitive decline with ageing. There is an immense explanatory gap in understanding the biological foundations of cognitive ageing across the whole spectrum or what determines a slowed information processing and multitasking. Moreover, not enough is known about the mechanisms underlying different types of neuropathological changes, and whether individual choices of lifestyle behaviours can enhance these mental capabilities or slow the cognitive ageing process. A recurrent question in cognitive is whether the decrease in cognitive performance is related to healthy or pathological ageing processes. Building upon this, it is also important to understand the critical periods of life when the transition from healthy to pathological ageing does occur [16–19].

Ageing affects cognitive functions, primarily those associated with executive processing and other functions of the frontal lobe. Age-related changes in memory and other cognitive abilities occur at different rates (for example, reasoning skills, visuospatial facility and verbal memory decline more rapidly over the life course, while vocabulary, attention and calculation are more resistant to ageing). Learning, mental processing and visuomotor functions, such as visuomotor coordination, increasingly decline with age [20–23], suggesting that changes in specific skills are nested in a more global trend of decline which varies according to various cognitive functions. However, there is also evidence that the adult brain shows neuroplasticity and neurogenesis [24–26].

A distinction between two categories of cognitive capabilities has been proposed by Raymond Cattell [27] and further developed by John Horn [28]. They proposed a clear distinction between all types of cognitive capabilities in fluid and crystallised intelligence. Fluid cognitive ability is

considered a measure of cognitive capability involved in processing novel information (e.g. working memory and problem solving) efficiently and with increased flexibility. These aspects of cognition are particularly susceptible to ageing [29], see **Figure 1** adapted from [30]. The absolute level of fluid intelligence measured at any point in later life depends both on genetic inheritance, education, the peak level of cognition achieved across life and the rate of decline experienced by that age [30]. On the other hand, crystallised cognitive functions, which rely on over-learned cognitive skills and abilities or accumulated knowledge, remain preserved or even improve during ageing process [31], except for the advanced stages of cognitive impairment or dementia [32].

The subtle decline in fluid cognitive abilities has been thought to begin as early as age 50 [6, 33, 34] and includes subtle deterioration of fluid cognitive abilities such as memory [35], verbal fluency [36, 37], visuospatial and constructional ability [38], attention, speed and concentration [35]. Previous evidence highlighted that cognitive speed decreases by around 20% at age 40 and by 40–60% at age 80 [39, 40].

An important methodological challenge is to understand the diversity and typology of cognitive decline, the time of onset of decline, and the causes of this change.

The next sections will focus on two aspects of cognitive functioning (memory and psychomotor speed) that are particularly sensitive to ageing.

2.1. Memory

The term memory has been used broadly to refer to mental operations that involve encoding, retention and retrieval of information. Memory functions can be classified based on their temporal scale (short-term versus long-term) and the type of memory function (e.g. declarative versus non-declarative, episodic versus semantic) [41, 42]. Some of these aspects are more vulnerable to the effects of ageing than others. For example, Nilsson investigated episodic, semantic and short-term memory, priming, and procedural memory across the lifespan in a large longitudinal study and found a steady age-related decline in episodic memory as measured by free recall, cued recall, source recall, recognition and prospective memory tasks [43]. There was an increase in semantic memory capacity up to age 55–60, and

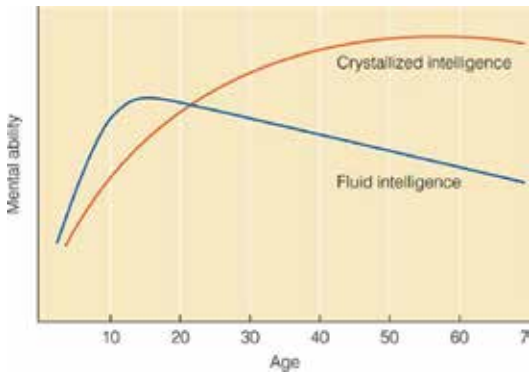

Figure 1. Schematic representation of fluid and crystallised intelligence over the lifespan adapted from [30].

a significant decrease after that. The other types of memory remained unchanged. Episodic memory refers to remembering past experiences, places or times [44], and has been a central focus of research in cognitive ageing.

2.2. Speed of processing

Slower mental processing has often been identified as an underlying factor behind other cognitive deficit such as attention disorders [18, 45]. Methods for assessing mental processing speed are typically either computer-aided reaction-time tasks or paper-and-pencil tests that may to some extent also require psychomotor functioning. Tasks such as the Stroop test (word reading and colour naming) [46] and Trail Making are regarded as general (multidimensional) speed tests that also include the rates of reading, naming, perceptual and visual-motor functions. Stroop task is designed to measure cognitive control and assess the ease with which a person can maintain a goal in mind while suppressing a habitual response in favour of a less familiar one. Trail making measures attention, speed and mental flexibility. Mental speed is considered highly vulnerable to the effects of ageing process. A central hypothesis is that increased age is related to the deterioration of the psychomotor speed, utilised in many cognitive operations [19].

3. The cascade model of cognitive ageing

A life course approach to cognitive ageing and cognitive function was also emphasised by the cascade model of cognitive ageing proposed by Birren and Cunningham [47] (see **Figure 2**). While it is common to conceptualise the chronology of cognitive ageing from birth to later life, the cascade model suggests that it may be more informative to consider a framework of successful cognitive ageing in relation to the time to death rather than a follow-up from the time of birth.

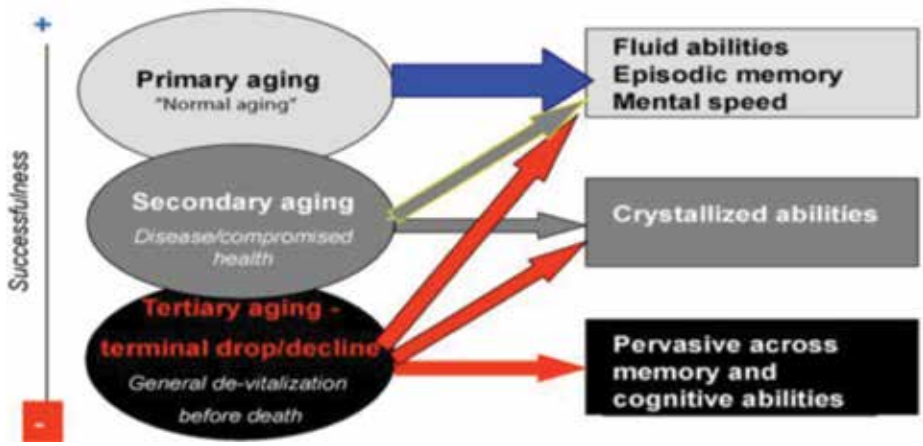

Figure 2. The Cascade model of cognitive ageing, adapted from Birren and Cunningham [47].

The model describes primary ageing as a slow decline in mental progressing, often characterised by difficulties in memory (especially with new learning and retention), information processing, language and other aspects of cognitive functions. Secondary ageing represents a more rapid form of deterioration due to a pathological process such as dementia, and refers to a loss of fluid and crystallised cognitive abilities, while tertiary ageing raises the more complex issue of impairments in cognitive performance arising from overall biological devitalisation of the organism before the end of life. Many older individuals demonstrate no apparent cognitive impairment, while others, perhaps most of the aged population, suffer various degrees of cognitive change.

Another model proposed by Brayne and colleagues, describes the general trend of cognitive decline as a continuum, from "successful" and "normal" ageing to "mild cognitive impairment" and "dementia" [48]. This model presents a general trend of deterioration in all aspects of cognitive abilities, irrelevant of the competing risk of the potential neuropathological changes such as dementia. The authors considered that the "differences in behaviour were associated with environmental causes, genetic causes and individual decision-making processes" (p. 12–13). Despite several conceptualisations of mental ageing across the life course have been developed, it is important to link these models of mental decline to a multidirectional approach that searches for gains and losses across the life course [49].

4. Cognitive performance and the ageing process

Although age-related decline in cognitive performance is undeniable, there are two important caveats to this statement. First, most cognitive deficits that have been observed in non-demented older adults are typically limited to certain types of cognitive tasks. In particular, deficits have usually been seen on tasks that required problem-solving [50, 51], speed response on information processing [52], relied on executive processing [53], assessed a variety of types of memory [54], or assessed the acquisition and retention of novel skills [55]. The variability in cognitive decline that occurs with age has provided insights into the areas of the brain that are implicated in ageing, and this can help identify potential mediators of the relationship. Non-demented older adults are typically able to maintain their long-term memory and the ability to perform tasks that are considered to be less effortful regarding attentional demands [56, 57].

The second caveat regarding age-related declines in cognition is that there has been shown to be substantial variability in the rate of decline with age, and, that this process is extremely heterogeneous given that some older adults never experienced declines in their mental abilities. This achievement could be considered successful cognitive ageing, which has also been described as the evasion of disease and disability, continued engagement in social and productive activities, and sustained cognitive and physical functioning [58, 59]. The question why some people are affected more by ageing process than others remains unclear to date, but it is likely that there are certain genetic variants and clinical conditions that could potentially increase the risk of cognitive impairment. Over the past decade, several risk factors such as the e4 allele of the Apolipoprotein E gene, CVD, stroke, hypertension, diabetes, the metabolic syndrome, hypercholesterolemia, arterial fibrillation, smoking and atherosclerosis have been identified as predictive of increased cognitive decline and a higher risk of dementia [60–66].

Given the increase in the size of the population of older adults and the personal and social consequences of age-related cognitive decline, research related to the maintenance of cognitive functioning is of increasing relevance. From an environmental perspective, promoting healthy adult lifestyle behaviours may attenuate harmful effects of less modifiable risk factors. Therefore, identifying genetic and lifestyle factors which predict successful ageing represents an important direction for researchers in delineating the risk factors for cognitive decline and developing behavioural interventions designed to attenuate cognitive decline.

5. The role of lifestyle behaviours on cognitive ageing

Lifestyle behaviours refer to routine activities (e.g. smoking, alcohol, diet and physical activity) that could influence our health. Because of their impact on various health outcomes, the term "lifestyle behaviours" has also been referred to as "health-related behaviours". Many studies have shown that lifestyle behaviours are associated with type 2 diabetes [67, 68], coronary heart disease [69] and mortality [70]. An example is a recent study that followed a cohort of more than 20,000 people aged 45 to 79 living in the Norfolk area in the United Kingdom between 1993 and 1997, which investigated the association between lifestyle behaviours and mortality [71]. The results of this study showed that people who smoked, drank more than 14 units of alcohol per week, consumed fewer than five servings of fruit and vegetables per day, and were inactive, had a four-times higher mortality risk than those who exhibited none of these lifestyle behaviours. An important aspect that needs further highlighting is that lifestyle behaviours are not always independent of one another, and may also have additive effects on various health outcomes.

Optimal control and management of lifestyle factors demonstrate efficacy in the prevention of cognitive decline and dementia [72–75], highlighting an intertwined link between the risk factors for cardiovascular and cerebrovascular disease and dementia. Accumulating evidence points to the potential risk factors of cardiovascular disorders (e.g. midlife obesity and cigarette smoking) and the potential protective roles of psychosocial and lifestyle factors (e.g. higher education, regular exercise, healthy diet, intellectually challenging leisure activities, and an active socially integrated lifestyle).

Factors showing a considerable influence on decreasing the risk of dementia and cognitive decline are social and cognitive engagement. Other influences such as physical activity, which increases cerebral blood flow and in turn promotes nerve cell growth and enhanced cerebrovascular function, seem to be the most frequently cited lifestyle in the cognitive ageing literature. However, it is highly probable that physical activity may also enhance cognition through other mediator factors such as depression, sleep, appetite (diet), and energy levels by postponing or preventing age-related diseases (e.g. diabetes, hypertension) known to affect cognition. Furthermore, there were also well-known documented benefits of non-smoking [76–78], moderate alcohol consumption [8, 79–82] and healthy dietary choices [78, 83–85] for a healthy and successful cognitive functioning from mid to later life.

In addition to considerable observational data of the independent effects of lifestyle factors, there is now increasing empirical evidence from intervention studies [73], that alterations in

lifestyle factors may lessen an individual's risk of developing cognitive decline. The evidence of a correlation was strongest in the case of an increase in an individual's level of physical activity, followed by cessation of smoking. These interventions carry few risks and have many additional health benefits, so can be recommended for most of the older population. Other factors such as increasing social engagement, cognitive stimulation and homocysteine-lowering vitamin supplements also appear promising, with considerable observational evidence supporting their uptake, although there is still a lack of empirical evidence for these interventions [73]. Similarly, fitness training interventions were found to have robust but selective benefits for cognition, with the largest fitness-induced benefits occurring for executive-control processes [86]. This indicates that cognitive and neural plasticity could be maintained throughout the lifespan. However, the real risk of dementia is probably underestimated, and it is not clear how many people quit smoking between the time of the initial survey and the onset of dementia, but there were clear long-term consequences of mid-life smoking.

Research has also shown that diet can help prevent, better manage or even reverse conditions such as hypertension, hyperlipidemia (high cholesterol), hyperglycemia (high blood sugar) and atherosclerosis that may lead to cardiovascular and cerebrovascular disease. In turn, this affects optimal functioning of organs including the brain due to inefficient transfer of glucose and oxygen necessary for optimal neuronal transfer, with a significant impact on cognitive functioning.

To current date, only limited work has investigated the combined effect of these behaviours in relation to cognitive outcomes, and when this evidence exists, findings are inconsistent. For example, a French study investigating alcohol (wine consumption) and smoking in 833 older adults from the Eugeria longitudinal study of cognitive ageing showed that there was no apparent protection from these combined behaviours against Alzheimer's disease. For instance, smoking was associated with an increased decline in language performance even when adjusted for wine consumption, and the latter was associated with an increased decline in attention and memory while adjusting for smoking [87]. The study cites previous evidence, however, suggesting that only smoking (using a pack-years measure) was significantly related to declining in digit span, while low-to-moderate alcohol consumption was not significantly associated to a subsequent three-year change in performance.

More recent work has highlighted that the number, duration, and the interaction between some unhealthy behaviours were all associated with subsequent cognition in later life. In a study of London civil servants (Whitehall II cohort) the interaction between alcohol and smoking was investigated, and these results highlighted that the combined effects of smoking and alcohol consumption were greater than the individual effects. Participants who were smokers and drank heavily experienced a 36% faster cognitive decline compared to non-smokers who drank in moderation. These associations were maintained after adjusting for age, sex, education and chronic diseases [88].

A previous investigation conducted in the same cohort highlighted that participants with three to four unhealthy behaviours were more likely to have poor executive function and memory, compared to those with no unhealthy behaviours. Also, the odds of lower cognitive function were higher when the number of unhealthy behaviours was repeated over time (across three different waves) [89]. Similar findings from the Suwon Longitudinal Ageing Study (SLAS) showed that a combination of multiple positive lifestyle behaviours (such as non-smoking,

vegetable consumption and social activity) was associated with the higher cognitive ability [90]. However, since these behaviours tend to cluster [91, 92], the extent to which apparent effects of one behaviour were attributable to (i.e. confounded by) another is uncertain.

Furthermore, relatively little is known about the longitudinal effects of these behaviours on the cognitive decline; yet associations among multiple lifestyle behaviours emphasise longitudinal studies since patterns of behaviours tend to develop over decades, with implications for targeted interventions to change the aggregate public health risk [93]. The life course approach to age-related diseases [94, 95] provides an important opportunity to identify the nature and timing of different environmental contributions to neuronal damage and the risk of dementia across life [96].

Risk and protective factors for health can exert their most critical influences at different ages [97]. This was acknowledged by the life course approach and the hypothesis that positive lifestyle behaviours such as non-smoking, being physically active and choosing healthier diets may protect cognitive functioning and a slow cognitive decline in later life. Fratiglioni et al. identified key periods for potential risk and protective factors [97]. Early life seems to be most critical for the development of cognitive reserve (learning and education) [98–100] when distal adverse influences (such as poor childhood social circumstances) contribute to the risk of adult disease or later life risk of dementia. Lifestyle behaviours, including those that influence cardiovascular and metabolic risk, become more influential in midlife, although some, such as diet and physical activity, track back into childhood [101, 102], whereas mental and physical activity patterns may continue to moderate these risks into later life [103, 104] (see **Figure 3**).

Cadar et al. examined the associations between lifestyle behaviours in early midlife (36 and 43 years) independently of each other, and in combination, in relation to cognitive performance at age 43, and cognitive decline over 20 years from 43 to 60–64 using the Medical Research Council 1946 Brtish Birth Cohort [78]. Key findings for the former analyses were

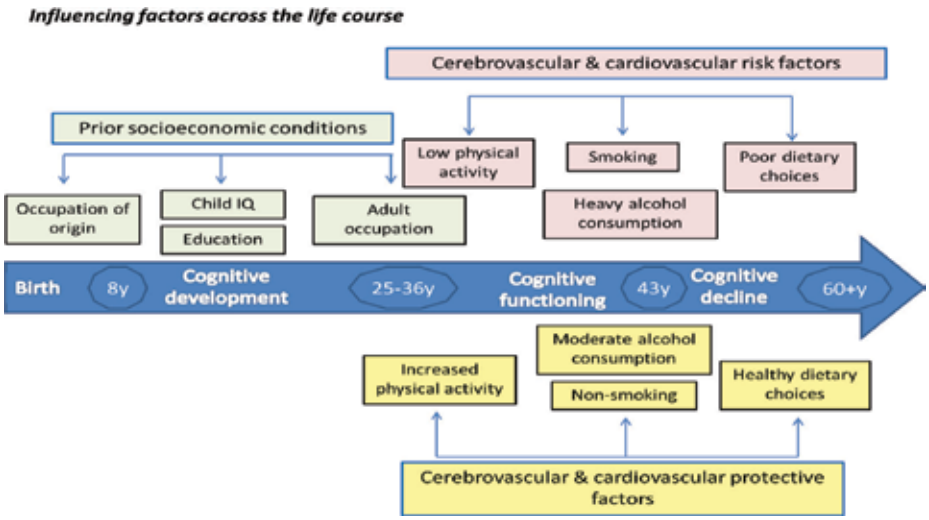

Figure 3. A life course timeline presenting the risk and protective factors across the life course.

that the highest level of midlife physical activity was associated with better memory (but not search speed) at baseline, and a consistently healthy dietary choice was associated with slower memory decline from mid to later life. In addition, the highest level of physical activity at age 43 and across early midlife was associated with slower visual search speed decline, independently of every other lifestyle behaviour and of selected covariates: social class of origin, childhood cognition, educational attainment, adult social class, symptoms of anxiety and depression, and clinical conditions (hypertension, diabetes, cancer, CVD) and frailty. Smoking was not associated with either cognitive outcome, but since the number of heavy smokers was relatively low in this sample, these conclusions should be interpreted with caution. It should also be noted that their findings for dietary choice and physical activity were not always consistent at different ages across midlife, compared to effects of the cumulative scores.

The associations between physical activity and a slower decline in visual search speed in Cadar's study, and between healthy dietary choice and memory, are new findings and were not previously tested on this cohort. In the former case, physical activity was not investigated in relation to search speed in the previous study; in the latter case, midlife cognition has not previously been studied in relation to diet on this cohort. On the other hand, the associations between heavy smoking at age 43 and faster memory decline previously reported between ages 43 and 53 (Richards et al., 2003) were not replicated here with the 20-year period of cognitive change from 43 to 60+ years. The loss of the cumulative midlife heavy smoking-memory decline association may be due to low statistical power resulting from the relatively high odds of morbidity and premature mortality in this sub-group (135 study members smoking more than 20 cigarettes per day at age 43 were represented in the previous study, compared to 22 in the present study).

Evidence from a study of London civil servants found an effect of sex on the association between smoking and cognitive decline in a study of London civil servants. Their results showed that men who smoked showed faster decline than non-smoking men over a 10-year period, after adjusting for the effects of heart disease, stroke and lung function on mental abilities, while for women there were no differences in cognitive scores over the same period. This could be related to the lower number of female participants as compared to males in the Whitehall II study [105]. In relation to physical activity, leisure-time physical activity at least twice a week in midlife was associated with reduced risk of memory decline in the Cardiovascular risk factors, Ageing and Incidence of Dementia (CAIDE) study, after adjustment for age, sex, education, follow-up time, locomotor disorders, APOE genotype, vascular disorders, smoking, and alcohol consumption [106]. Similarly, in The Mayo Clinic Study of Ageing moderate exercise in midlife or late life was associated with reduced odds of Mild Cognitive Impairment (MCI) [107]. In contrast, results from the Chicago Health and Ageing Project reported that physical activity conducted within 2 weeks of the date of baseline cognitive assessment was not associated with risk of cognitive decline in an older population [108].

Given that lifestyle behaviours are modifiable risk factors indicates that encouraging a healthy lifestyle may prevent or ameliorate cognitive decline and underlying cerebrovascular and cardiovascular risk factors [109]. Designing interventions that promote healthy lifestyles should represent key components of any response to the potentially overwhelming problem of dementia prevention.

6. Policy implications

Despite major progress in understanding the neurobiology of cognitive impairment and dementia, there are still no clear determinants and complete causal models available for explaining risks for this condition [110]. As noted, the Department of Health National Dementia Strategy acknowledges that "what is good for the heart is also good for the brain". This implies that limited consumption of alcohol, non-smoking, an active physical lifestyle, and a balanced, low-energy-dense/nutrient-rich diet should all contribute to a healthy brain. Cognitive decline itself is a predictor of dementia. Thus, the implied message is that by changing lifestyle behaviours dementia may be delayed or even prevented.

7. Conclusions

This chapter has presented an overview of the process of cognitive ageing from a life course perspective and discussed the role of lifestyle behaviours on successful cognitive ageing. The evidence presented highlights the important role of lifestyle behaviours (especially physical activity and healthy dietary choices) on maintaining an optimal level in different aspects of cognitive function. Adopting more than one healthy lifestyle behaviour across early midlife seems to be protective against a faster decline in several domains of cognitive functioning, highlighting a dose response with the number of lifestyle behaviours adopted. With an increase in the ageing population, the number of older people affected by cognitive decline and dementia is continually rising, causing a major public health burden on individuals and governments around the world.

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Conflict of interest

The author declares no financial relationships with any organisations that might have an interest in the submitted work; no other relationships or activities that could appear to have influenced the proposed work.

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Aging is characterized by functional decline in every organ due to several cellular, biological, and physiological changes over time. Molecular and cellular damages are gradually decreasing in the physical and mental capacities of the human body. Health results have shown that lifespan has dramatically increased during the twenty-first century. Increasing elderly population naturally deals with many health problems leading to a rise in health expenditure and labor loss. The good news is that the clinical trials in gene therapy have almost stopped and/or reversed human aging. Regenerative medicine can repair and reverse aging in all body cells. Thus, the body's own repair mechanisms may struggle with aging and age-related diseases. Research is promising and suggests that human aging will be eradicated on earth.

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