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ΔΙΑΤΡΟΦΙΚΕΣ ΣΥΝΗΘΕΙΕΣ ΚΑΙ ΣΥΜΠΕΡΙΦΟΡΕΣ, ΣΕ ΣΧΕΣΗ ΜΕ ΤΗΝ ΥΓΙΗ ΓΗΡΑΝΣΗ ΣΕ ΕΛΛΗΝΕΣ ΤΗΣ ΔΙΑΣΠΟΡΑΣ: ΕΠΙΔΗΜΙΟΛΟΓΙΚΗ ΜΕΛΕΤΗ MEDIS

Κωνσταντίνα Κούκη

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DIETARY HABITS AND BEHAVIORS IN RELATION TO HEALTHY AGING IN GREEKS OF THE DIASPORA: EPIDEMIOLOGICAL STUDY MEDIS

Konstantina Kouki

ATHENS, 2020

Τριμελής Εξεταστική Επιτροπή

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Η Κωνσταντίνα Κούκη δηλώνω υπεύθυνα ότι:

1) Είμαι ο κάτοχος των πνευματικών δικαιωμάτων της πρωτότυπης αυτής εργασίας και από όσο γνωρίζω η εργασία μου δε συκοφαντεί πρόσωπα, ούτε προσβάλει τα πνευματικά δικαιώματα τρίτων.

2) Αποδέχομαι ότι η ΒΚΠ μπορεί, χωρίς να αλλάξει το περιεχόμενο της εργασίας μου, να τη διαθέσει σε ηλεκτρονική μορφή μέσα από τη ψηφιακή Βιβλιοθήκη της, να την αντιγράψει σε οποιοδήποτε μέσο ή/και σε οποιοδήποτε μορφότυπο καθώς και να κρατά περισσότερα από ένα αντίγραφα για λόγους συντήρησης και ασφάλειας.

Dedicated to my grandparents and the grandparents of society that gave as a village of support during our life. Even if they are not here with us anymore, they will be always in our heart

Αφιερωμένο στους παππούδες μου και στους παππούδες της κοινωνίας που μας στήριξαν όλα τα χρόνια της ζωής μας. Ακόμα και αν δεν είναι πλέον κοντά μας, θα τους έχουμε για πάντα στις καρδίες μας.

"Aging is not lost youth but a new stage of opportunity and strength."

In this quote, Betty Friedan (1921-2006) captures the concept of successful aging. Let's redefine later life as a time of growth instead of inevitable decline.

«Α! τα χρόνια τα παλιά

βαριά φορτία φεύγαν για την Αμέρικα.

Α! στην Αμερική,

Ελλάδα σαν αγριόχορτο φύτρωσες και κει.»

[πηγή: δίσκος Διάφανος, μουσική: Θανάσης Παπακωνσταντίνου, ερμηνεία: Σωκράτης Μάλαμας, LYRA 2006]

ΠΡΟΛΟΓΟΣ

Η παρούσα διπλωματική εργασία έλαβε χώρα το ακαδημαϊκό Μέτος 2019-2020 στο Χαροκόπειο Πανεπιστήμιο, στο πλαίσιο της πολυεθνικής μελέτης MEDIS (Mediterranean Islands Study) και είχε ως θέμα την μελέτη της «Υγιούς Γήρανσης» στους Έλληνες της Διασποράς. Επιστημονικός υπεύθυνος της παρούσας εργασίας καθώς και της έρευνας είναι ο Καθηγητής Βιοστατιστικής και Επιδημιολογίας της Διατροφής Δημοσθένης Παναγιωτάκος, τον οποίο θα ήθελα να ευχαριστήσω θερμά για την εμπιστοσύνη του και την στήριξη του το διάστημα της εκπόνησης της διατριβής μου αλλά και για όλα τα χρόνια των σπουδών μου. Επίσης θα ήθελα να ευχαριστήσω τους καθηγητές μου κα Μαίρη Γιαννακούλια και Αντωνία-Λήδα Ματάλα για την συνεπίβλεψη τους στην εργασία μου και την υποψήφια διδάκτωρ του Χαροκοπείου Πανεπιστημίου Αλεξάνδρα Φωσκόλου για την πολύτιμη στήριξη της που συντέλεσε σε μεγάλο βαθμό στην ολοκλήρωση της παρούσας διατριβής. Ένα μεγάλο ευχαριστώ θα ήταν παράλειψη να μην δοθεί στους δεκάδες συνεργάτες για την συμμετοχή τους κατά την συλλογή δεδομένων της έρευνας.

Κωνσταντίνα Κούκη
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PREFACE

The present thesis was conducted in the academic year 2019-2020 at the Harokopio University of Athens as a part of the multinational study MEDIS (Mediterranean Islands Study) and focused on the study of "Healthy Aging" in the Greek Diaspora. Scientific supervisor of this work, as well as research is Professor of Biostatistics and Nutrition Epidemiology Dimosthenis Panagiotakos, whom I would like to thank for his trust and support during the preparation of my thesis and for all the years of my studies. I would also like to thank my professors Mary Yannakoulia and Antonia-Leda Matala for their supervision of my work and PhD candidate Alexandra Foskolou for her valuable support as she has greatly contributed to its completion. Finally, I would like to thank all the contributors involved in collecting the survey data.

Konstantina Kouki

Dietitian Nutritionist

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Περίληψη

Εισαγωγή Διανύοντας τον 21ο αιώνα, όλες οι χώρες αντιμετωπίζουν το παγκόσμιο φαινόμενο των αυξημένων ποσοστών της γήρανσης. Ωστόσο, το γεγονός ότι οι άνθρωποι ζουν περισσότερο δεν σημαίνει ότι ικανοποιείται η ποιότητα της ζωής τους κατά τη γήρανση, καθώς η αύξηση του προσδόκιμου ζωής τα τελευταία χρόνια συνδυάζεται με την αύξηση των χρόνων που ζουν με ασθένειες και αναπηρίες. Αυτός είναι ο λόγος για τον οποίο τα τελευταία χρόνια παρατηρείται μια ευρέως διαδεδομένη χρήση ποικίλων όρων, όπως η «Υγιής Γήρανση», η οποία ορίζεται από τον Παγκόσμιο Οργανισμό Υγείας (ΠΟΥ) ως η κατάσταση της απόκτησης και διατήρησης της λειτουργικής ικανότητας που επιτρέπει ευημερία σε μεγαλύτερη ηλικία . Καθώς αυτή η κατάσταση είναι πολυπαραγοντική, υπάρχουν διάφοροι καθοριστικοί παράγοντες όπως αυτοί του τρόπου ζωής και οι διατροφικές συνήθειες που επηρεάζουν την «Υγιή γήρανση» . Το παγκόσμιο φαινόμενο της μετανάστευσης που επηρεάζει διάφορες πτυχές της ανθρώπινης ζωής μπορεί επίσης να επιδρά στην κατάσταση της υγείας και την «Υγιή γήρανση» των ηλικιωμένων.

Σκοπός Η αξιολόγηση του ρόλου των διατροφικών συνηθειών και συμπεριφορών στην «Υγιή γήρανση» μεταξύ των γηγενών Ελλήνων και των Ελλήνων της Διασποράς (Καναδάς και Μασσαλία - Γαλλία)

Υλικό και Μέθοδος Η παρούσα εργασία αποτελεί μέρος της μελέτης MEDIS και περιλαμβάνει μόνο τους συμμετέχοντες από τα ελληνικά νησιά καθώς και τους Έλληνες που ζουν στη Μασσαλία της Γαλλίας και στον Καναδά (ΗΠΑ). Κατά τη διάρκεια της περιόδου 2005-2019, 2.221 άτομα από 16 ελληνικά νησιά και 142 Έλληνες με μόνιμη κατοικία στη Μασσαλία της Γαλλίας και 71 Έλληνες της διασποράς στον Καναδά συμμετείχαν εθελοντικά στη μελέτη. Μια ομάδα επιστημόνων υγείας με ερευνητική εμπειρία συγκέντρωσε όλες τις απαιτούμενες πληροφορίες, όπως κοινωνικοδημογραφικά, κλινικά συμπεριφορικά χαρακτηριστικά, χρησιμοποιώντας ποσοτικό ερωτηματολόγιο και τυποποιημένες διαδικασίες και ο δείκτης SAI (υγιούς γήρανσης)

Αποτελέσματα Οι Έλληνες του Καναδά έχουν το υψηλότερο ποσοστό των συνταξιούχων (p <0.001), καθώς περίπου μόνο το 9% αυτών δεν έχουν συνταξιοδοτηθεί. Επίσης, το 71% δήλωσε ότι βρίσκεται σε καλή οικονομική κατάσταση, η οποία ήταν η υψηλότερη μεταξύ των 3 ομάδων

(p <0,001). Το ποσοστό των φυσικά δραστήριων συμμετεχόντων ήταν το υψηλότερο στην ομάδα των Ελλήνων στη Γαλλία (91%) (p <0,001). Οι Έλληνες της Γαλλίας έχουν τη μικρότερη

 πιθανότητα ιστορικού συχνών καρδιομεταβολικών παραγόντων (υπέρταση (p <0,001), διαβήτης ρ = 0,006) και υπερχοληστερολαιμία (ρ <0,001)). Ο ΔΜΣ (δείκτης μάζας σώματος) το MeddDietScore και το GDS δεν έχουν διαφορές μεταξύ των τριών ομάδων (p> 0.005). Επιπλέον, οι Έλληνες του Καναδά έχουν το χαμηλότερο ποσοστό των σημερινών καπνιστών (μόνο 1,5%), ακολουθούμενοι τους Έλληνες της Γαλλίας και αυτούς της Ελλάδας που είναι σε διπλάσιο ποσοστό (18%). Τέλος, ο δείκτης SAI (υγιούς γήρανσης) ακολουθεί μια πτωτική τάση από τους Έλληνες της Γαλλίας και τους Έλληνες του Καναδά, οι οποίοι έχουν παρόμοια υψηλότερα επίπεδα από ό,τι οι γηγενείς Έλληνες.

Συμπέρασμα Οι Έλληνες κάτοικοι της Γαλλίας και του Καναδά, σε αντίθεση με τους γηγενείς Έλληνες, έχουν υψηλότερα ποσοστά στο SAI (υγιούς γήρανσης). Αυτό οφείλεται κυρίως στις διαφορές στον τρόπο ζωής, κυρίως στη σωματική δραστηριότητα, στο κάπνισμα και στην οικονομική κατάσταση.

Λέξεις κλειδιά: υγιής γήρανση, Έλληνες της Διασποράς, διατροφικές συνήθειες, συμπεριφορές, ηλικιωμένοι

Abstract

Introduction As we are going through the 21st century, all countries deal with the worldwide phenomenon of increasing ageing. However, the fact that people live longer does not mean that the quality of their life during aging is satisfied, as the increase of life expectancy the last years is combined with the increase of years lived with diseases and disabilities. That is why, in recent years, we have observed an expanded use of many terms such as "Healthy Aging" which is defined by the WHO (World Health Organization) as the state of gaining and preserving the functional ability that enables wellbeing in older age. As this state is multidimensional, there are various determinants like lifestyle factors and dietary habits that affect "Healthy Aging". The global phenomenon of immigration that influences different aspects of human life may also affect the health status and "Healthy Aging" of them.

Aim The evaluation of the role of dietary habits and behaviors on healthy aging between native Greeks and Greeks of Diaspora (Canada and Marseille-France)

Material and Method The present work is part of Mediterranean Islands (MEDIS) study that includes only participants of Greek islands and also Greeks that live in Marseille of France and in Canada (U.S.A) During 2005-2019, 2,221 people from 16 Greek islands and 142 Greeks with their permanent residence in Marseille of France and 71 Greeks of Diaspora in Canada were enrolled voluntarily in the study. A group of health scientists with experience in field investigation collected all the required information such as socio-demographic, clinical, behavioral characteristics using a quantitative questionnaire and standard procedures and the SAI (Successful Aging Index) was calculated for every participant.

Results Greeks of Canada have the highest percentage of retired people ($p<0.001$) as approximately only 9% of them are not retired. Also, the 71% of them reported to be at a good financial state which was the higher among the 3 groups ($p<0.001$). The proportion of physical active participants was the highest in the group of Greeks in France (91%) ($p<0.001$).Greeks in France have the lowest possibility of having history of common cardiometabolic factors (hypertension ($p<0.001$), diabetes ($p=0.006$) and hypercholesterolemia ($p<0.001$)). BMI, MedDietScore and GDS (Geriatric Depression Scale) have no differences between three groups

(p>0.005). Furthermore, Greeks of Canada have the lowest proportion of current smokers (only 1,5%), followed by Greeks in France and finally them in Greece where the percent of smokers is almost twice (18%). Finally, the Successful Aging Index follows a decreasing tend from Greeks in France and Greeks in Canada which have similarly higher levels than their counterparts in Greece.

Conclusion Greek residents of France and Canada, unlike their counterparts of Greece, are of higher rates in SAI. This was mainly attributed to lifestyle differences, mainly physically activity, smoking and financial status.

Key words: healthy aging, Greeks of Diaspora, eating behavior, lifestyle factors, older people

Chapter 1: INTRODUCTION

1.1 Definition and physiology of aging

Many philosophers and scientists have expressed their interest in the topic of aging through human history. Plato (428–347 BC), the pivotal figure in the history of Ancient Greek and Western philosophy had referred many times to aging: " He who is of calm and happy nature will hardly feel the pressure of age, but to him who is of an opposite disposition youth and age are equally a burden". Many definitions of "aging" have been used from scientific community. Human aging is the state that has been associated with a loss of complexity in various physiological processes and anatomic structures (Goldberger, Peng, & Lipsitz, 2002) or aging may be defined as the breakdown of self-organizing systems and reduced ability to adapt to the environment (Vasto et al., 2010).

There is no 'typical' older person. Some people over 70 year-old have physical and mental health similar to many 20 year-olds. Other people face significant declines in physical and mental abilities at younger ages such as 60 years. The process of aging is based on multiple, complex biological paths. Nowadays, advanced technological methods give us the opportunity to identify all age-related changes that take place at a cellular and molecular level but also on a tissues and organ systems (Yin & Chen, 2005). Current research shows that there are nine hallmarks of aging, genomic instability; telomere attrition, epigenetic alterations, loss of proteostasis, deregulated nutrient-sensing, mitochondrial dysfunction; cellular senescence; stem cell exhaustion; and altered intercellular communication (Figure 1) (López-Otín, Blasco, Partridge, Serrano, & Kroemer, 2013) The proposed nine hallmarks of aging are grouped into three categories. The first three hallmarks considered to be the primary causes of cellular damage. The next three are compensatory or antagonistic responses to the damage. These responses initially mitigate the damage, but eventually, if chronic or exacerbated, they become deleterious themselves. The last three are integrative hallmarks that are the result of the previous two groups of hallmarks and are ultimately responsible for the functional decline associated with aging. Various exogenous factors such as chemical or infrared radiation and endogenous like oxidative stress with the reactive oxygen species (ROS) and radiative errors can lead to DNA damage or insufficient DNA repair and telomere attrition that contributes to aging. Furthermore, epigenetic

mechanisms like DNA methylation, histone modifications and coding and noncoding RNA profiles cause alterations in chromatin but not in DNA sequences, influencing gene expression (Brunet, Berger, & Sciences, 2014).

Aging and some aging-related diseases such as Alzheimer's disease, Parkinson's disease and cataracts are linked to impaired protein homeostasis or proteostasis. Proteostasis involves mechanisms for the stabilization of correctly folded proteins, restoration of the structure of misfolded polypeptides and complete degradation of some of them in order to avoid the accumulation of damaged components (Powers, Morimoto, Dillin, Kelly, & Balch, 2009)New evidence suggest that anabolic signaling accelerates aging, and decreased nutrient signaling extends longevity (Fontana, Partridge, & Longo, 2010). The intracellular nutrient signaling pathway of IGF-1 (insulin-like growth factor) and insulin have the role of informing cells of the presence of glucose and the combination of them is known as the 'insulin and IGF-1 signaling' (IIS) pathway. A decreased IIS pathway is linked with longevity because it leads to lower rates of cell growth and metabolism and results in lower rates of cellular damage. In addition to the IIS pathway three more nutrient signaling systems are: mTOR, for the sensing of high amino acid concentrations, AMPK, which senses low energy states by detecting high AMP levels; and sirtuins, which sense low energy states by detecting high NAD+ levels (Houtkooper, Williams, & Auwerx, 2010) .Generally increase in activity of mTOR but down-regulation of AMPK and sirtuins are combined with decreased lifespan and a no- healthy aging profile (Johnson, Rabinovitch, & Kaeberlein, 2013). Mitochondria have a crucial impact on the aging process as their dysfunction, causing by accumulation of mutations and deletions in mtDNA, oxidation of mitochondrial proteins, destabilization of the macromolecular organization of respiratory chain complexes, changes in the lipid composition of their membranes, changes in their dynamics, can accelerate aging in mammals (Kujoth & Science, 2005) .In young organisms, cellular senescence limits the proliferation of damaged cells, protecting from cancer and involving in tissue homeostasis. However, in old organisms, the damage and the insufficient clearance of senescent cells have detrimental effects on tissue homeostasis that favor aging (Collado, Blasco, & Serrano, 2007). As organism is getting older, tissues begin to lose their ability of regeneration. Stem cell exhaustion is responsible for plenty of aging-associated damages and is likely considered as one of the ultimate culprits of tissue and organismal aging (Sharpless & DePinho, 2007).
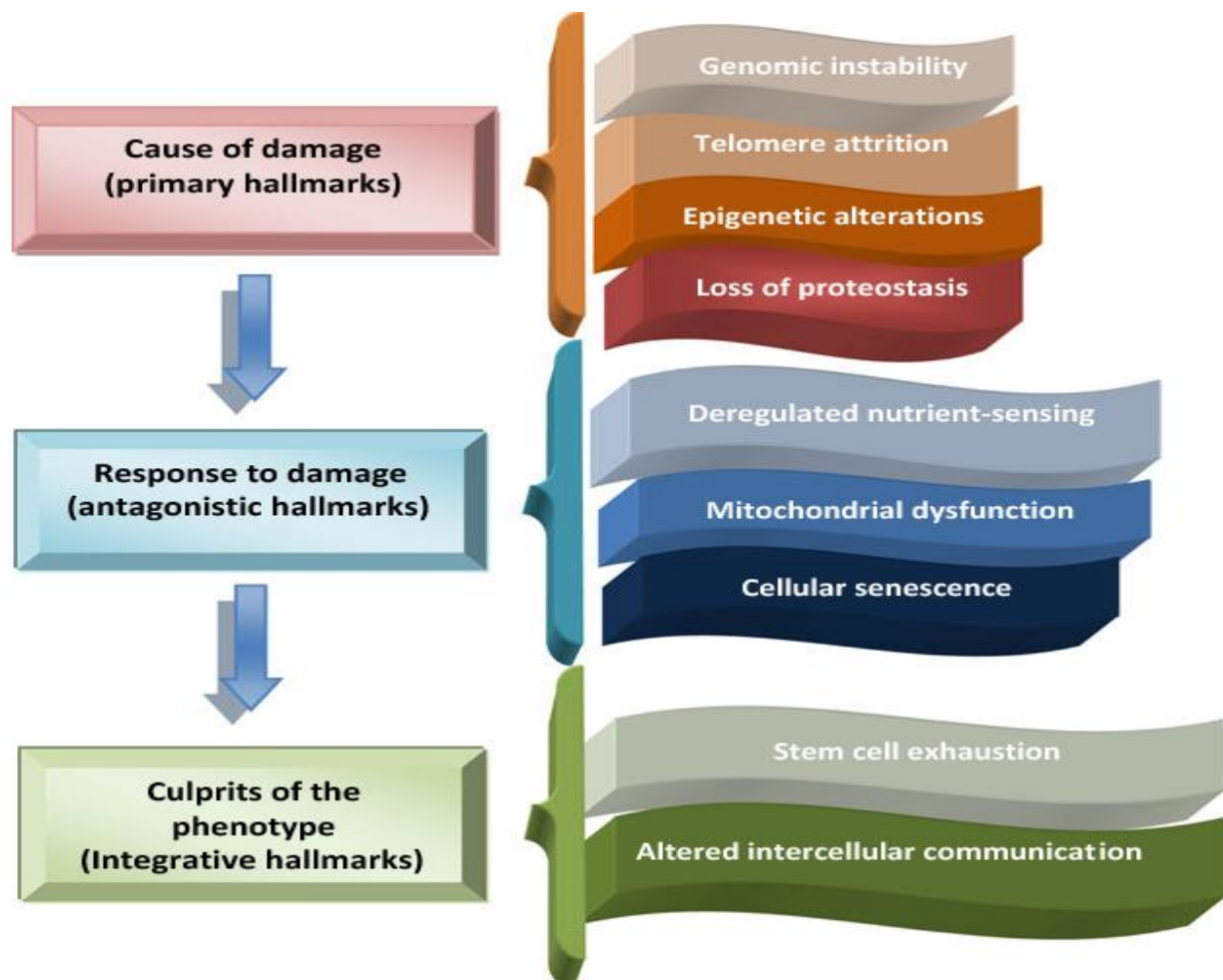
Figure 1 Nine hallmarks of aging categorized according to the point at which they act and create cellular damage (primary causes, compensatory responses and the end result). Adapted with permission from Lopez-Otin et al, 2013.

1.2 Demographic data of aging

In this part of diploma thesis demographic data of aging will be mentioned in order to manage a quantitative description of universal phenomenon of aging which concerns all people across the world. As we can realize in Figure 2 the world's population is getting older. The European population over the age of 65 in 2005 was 15.9% and it is estimated that it would raised at 27.6%

in 2050. A rapid increase will be occurred in every continent in both developed and developing world. (United Nations Population Division, 2006).
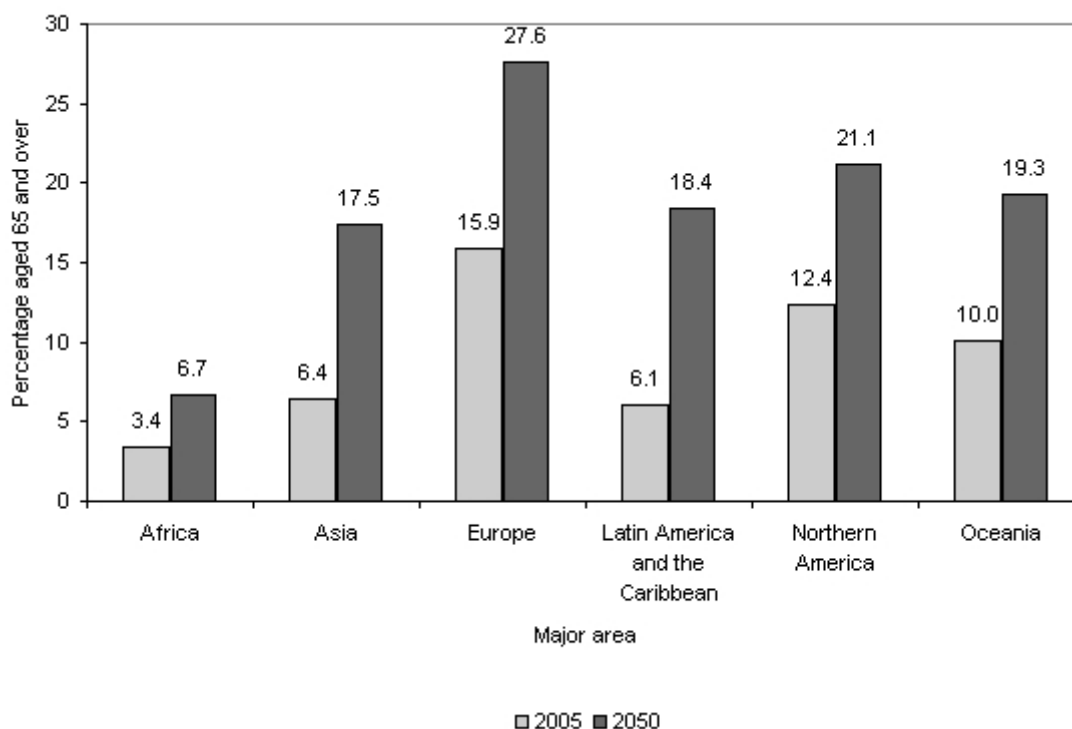
Figure 2: 2005 and predicted 2050 population figures for people aged 65+ (United Nations Programme on Ageing, 2006

Life expectancy at birth rose rapidly during the last century due to a number of factors, including reductions in infant mortality, rising living standards, improved lifestyles and better education, as well as advances in healthcare and medicine as it is mentioned by Eurostat, the statistical office of the European Union. According to the data of WHO (World Health Organization) that are published every year, 72.0 years was the average life expectancy at birth of the global population in 2016 opposed with 2000 which was 66.5. Life expectancy at birth is defined as the average number of years that a newborn could expect to live, if he or she were to pass through life exposed to the sex- and age-specific death rates prevailing at the time of his or her birth, for a specific year, in a given country, territory, or geographic area. In addition, life expectancy at 60 years is defined as the average number of years that a person of 60 years old could expect to live, if he or she were to pass through life exposed to the sex- and age-specific death rates

prevailing at the time of his or her 60 years, for a specific year, in a given country, territory, or geographic area. Globally this index for both men and women for 2016 was 20.5 years. Furthermore, WHO uses two more terms of life expectancy. Firstly, Healthy life expectancy (HALE) at birth (years) and then Healthy life expectancy (HALE) at age 60 (years) which are the average number of years that a person can expect to live in "full health" by taking into account years lived in less than full health due to disease and/or injury. The data for these four terms globally, in Europe, in Eastern Mediterranean region and in America are presented in Table 1. The statistics in life expectancy at birth for men and female show that in Greece is at 79 and 84 years, in France is at 80 and 86 years and in Canada is at 81 and 85 years (WHO,2016). Life expectancy in Greece has been increasing since the late 1990s and in 2015 was slightly above the EU average (81.1 and 80.6 years, respectively).

REGION	Life expectancy at birth(years)			Life expectancy at age 60 (years)			Healthy life expectancy (HALE) at birth (years)			Healthy life expectancy (HALE) at age 60 (years)		
	BOTH SEXES	MALE	FEMALE	BOTH SEXES	MALE	FEMALE	BOTH SEXES	MALE	FEMALE	BOTH SEXES	MALE	FEMALE
Globally	72.0	69.8	74.2	20.5	19.0	21.9	63.3	62.0	64.8	15.8	14.8	16.8
Europe	77.5	74.2	80.8	22.3	20.2	24.1	68.4	66.1	70.7	17.4	15.9	18.7
Eastern Mediterranean	69.1	67.7	70.7	18.2	17.5	19.0	59.7	59.1	60.4	13.3	13.0	13.6
Americas	76.8	73.8	79.8	22.7	21.1	24.3	67.5	65.5	69.6	17.6	16.4	18.7

Table 1 Life expectancy and Healthy life expectancy Data by WHO region

As we are going through the 21st century, all countries deal with the worldwide phenomenon of increasing ageing which is one of the greatest challenges that leads to social and economic demands. Nowadays population aging is characterized by a decline in the number of children and young people in combination with an increase of people age 60 and over. Also decreasing fertility rates contribute to the continuous "greying" of the world's population. As a result the triangular population pyramid of 2002 will turn to present a total different structure in 2025 (Figure 2) According to the international organization of United Nations the global population

of older adults, over the age of 60 years , is estimated to reach at 2.1 billion in 2050, in relation with 901 million in 2015 (United Nations 2015). Although population aging is more common in developed countries, it seems that until 2020 people aged 60 and over in developing countries will have reached 840 million (70% of all older people worldwide) in relation with 2002 when was 400 million (Figure 3).
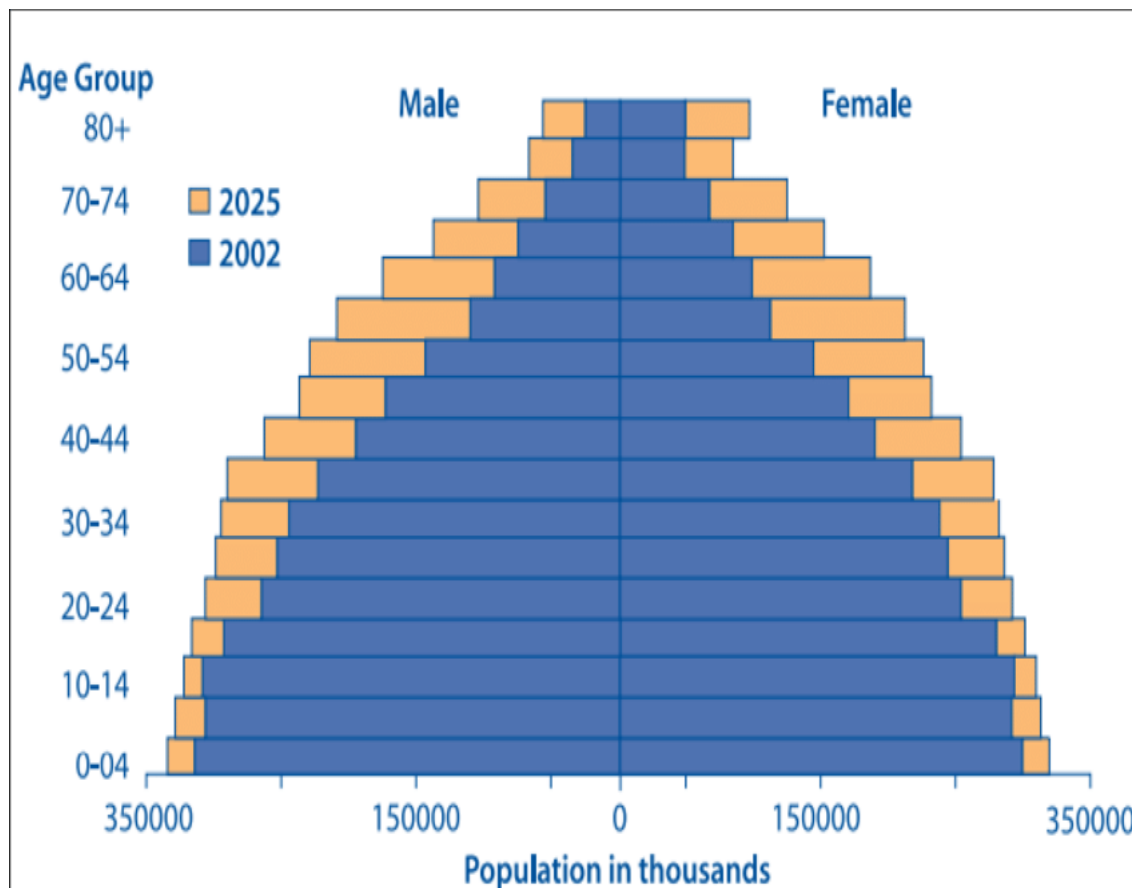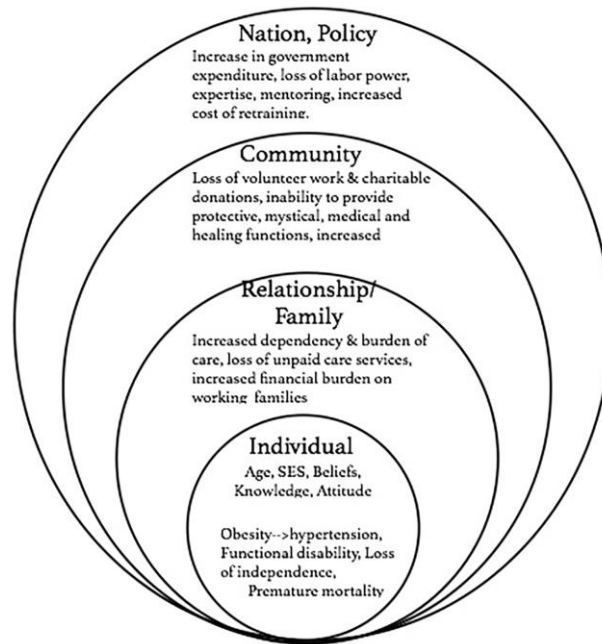

Figure 3 Global population pyramid in 2002 and 2025
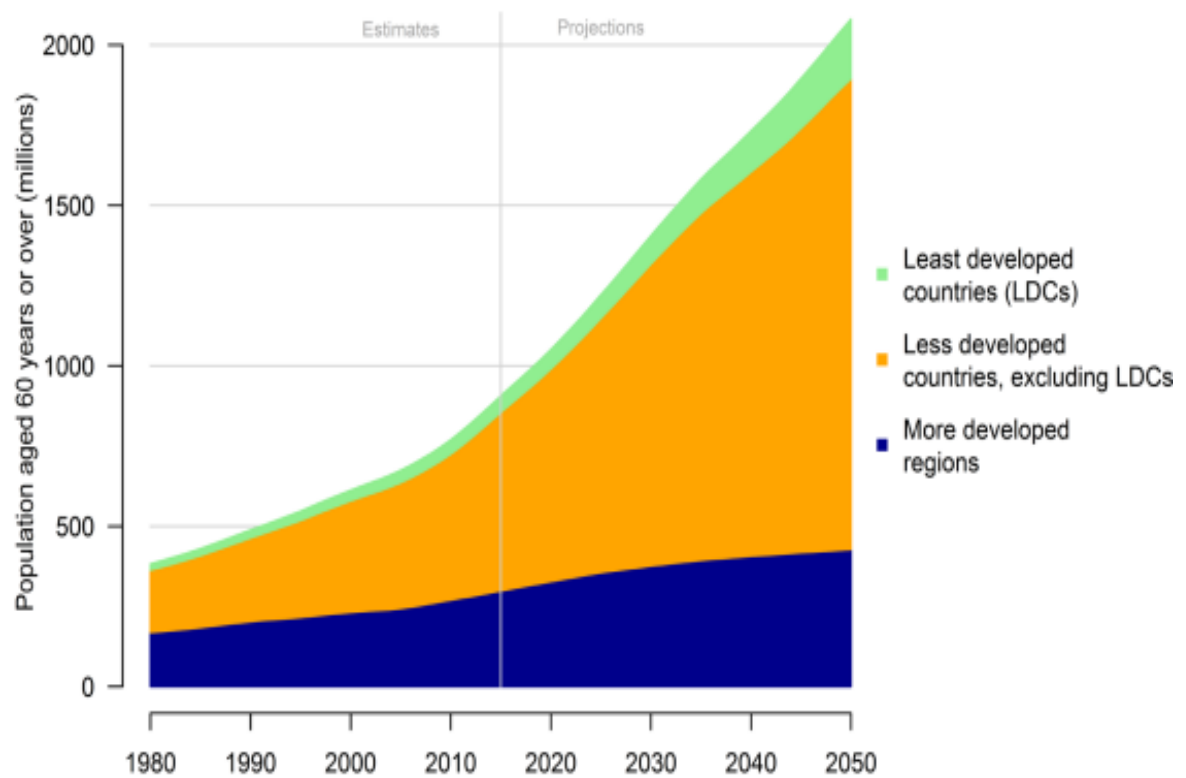
Figure 4 Number of persons aged 60 years or over by development group, from 1980 to 2050

1.3 Implications of aging

Aging is a natural process that have many health risks and implications in individual and society. The major implications of aging and the connections between them are presented in Figure 4.

Figure 5 The ecological model: A framework for understanding the effects of health risks among the elderly (based on WHO database on Global AGEing and adult health)

Older people are at higher risk of health challenges with various functions of the body starting to degrade and all the organism systems being negatively affected such as the cardiovascular, digestive, excretory, nervous, reproductive, and urinary. Many disabilities that difficult older peoples' life are hearing loss, decrease in body muscle mass and strength, reduction in body water, decline in the functionality of kidney and liver, decline in bone density and strength, and decrease in visual ability. Alzheimer's, arthritis, cancer, diabetes, depression, and heart diseases have been identified as the most common illnesses of ageing. Mortality is related to all these diseases. The greatest use of health services as well as most deaths occur in the older period of lifespan.

However, there are some additional challenges that people of advanced aged may face except physical or biological changes. Those are related to how society treat and behave to older people. Stereotypes for elderly people are commonly used such as the fact that they are considered less valuable or unable to contribute in various and beneficial ways for general welfare. This fact drives to social exclusion and isolation of older people and a representative example is that are not chosen in jobs or they are replaced by younger employees even if they are not in the age of retirement yet. On the contrary, the reality is that many older adults are able to convey a wealth of knowledge, qualifications, and experience in the workplace, and are often active member of societies (Cannon, 2015). Aging is also followed by many difficulties to psychological well-being. There are plenty of life changes during these years of individual   including losing job and retirement, relocation and deaths of family and friends, impaired health issues and loss of independence. All these may easily burden mental health of older adults along with the fact that ageing is saturated by feelings of loneliness and dependence on others (Ziolkowski, Blachnio, Pachalska, & Medicine, 2015) .

Population aging has implications not for the individual but for societies and economies. It is notable that this phenomenon has negative effects on economic growth and employment. Specifically, when the proportion of older dependents is increased, related to the proportion of productive young people, the productive capacity of the whole society is declined. This decline in the global workforce will lead to an increase in the age dependency ratio which is the ratio of working-age to old-age individuals. Globally, the dependency ratio in 1970 was 10 workers for each individual over age 64, but the expected ratio in 2050 is four workers for each person over 64 As people get older and reach their retired age, they restrict their spending and they consume only necessary goods and services. It is also concerning that the capacity of older people to adopt new and innovative technology is poor and this may limit total productivity of an economy especially when rapid technical progress is taken place globally. In addition, high requirements for health care service and old age pensions and shrinking of tax revenue from young tax payers are obviously implication of population aging (Harper, 2014; Smith, Newhouse, & Freeland, 2009).

It is clear that with an increase in the proportion of people over the age of 65, there will be a decreased proportion of people of workforce age. This means that there will be more people

claiming benefits such as state pensions and less people working and paying income taxes, causing an increase in dependency ratio. The forecast for dependency ratios represents predictions for dependency ratios by country (Figure4). It shows that USA, among other European countries, will experience almost a double in ratio over the next 50 years, which will have severe impacts on the working force as they will experience increases in income tax in order to support the increased proportion of older population. When those in work may have to pay higher taxes, this could create disincentives to work and discourage firms to invest, therefore there could be a fall in productivity and growth (Economics Help 2008).
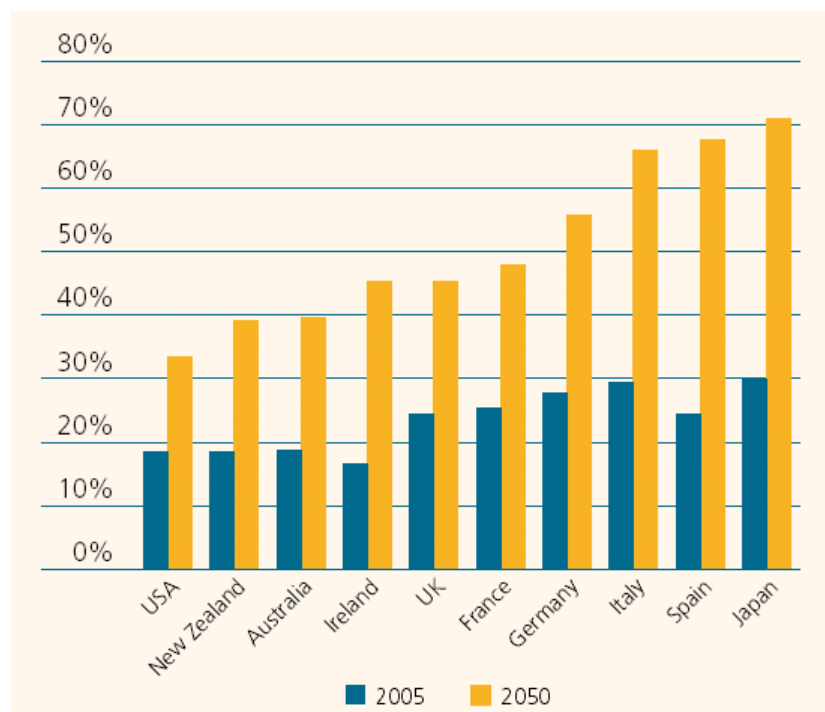
Figure 6 Forecast for dependency ratio in different countries

The European Union's Economic Policy Committee had announced in 2010 the danger of population aging: "The ageing of the population is becoming a growing challenge to the sustainability of public finances in the EU Member States. The increase of the ratio between the number of retirees and the number of workers will amplify expenditure on public pensions and health and long-term care and thus puts a burden on maintaining a sound balance between future public expenditure and tax revenues." As society continues to improve life expectancy, the

proportion of people with disease and disability will increase. This fact is known as chronic disease burden which force allocation and restructure of health care system and its expenditures (Cao, 2015). Data based on a macroeconomic model (EPIC) highlight that sizeable costs are combined with non-communicable diseases (NCDs), which prevail in older adults (Bloom et al., 2012). Furthermore, reduction in the number of younger members of family, that would be available in order to offer family care to older members, is combined with the need of formal care service like nursing homes.

1.4 Definition of "Healthy Aging"

However, the fact that people live longer does not mean that the quality of their life during aging is satisfied, as the increase of life expectancy the last years is combined with the increase of years lived with diseases and disabilities (Salomon et al., 2012) . It is considered that 80% of older adults have age-related disorders such as obesity, diabetes, hypertension, or heart disease, and 50% have at least two of the previously mentioned (Economou, Kaitelidou, Karanikolos, & Maresso, 2017). Globally, mortality rates due to communicable diseases have decreased as the medical and pharmaceutical science are rapidly developed but non-communicable diseases like chronic ones continue to expand. This may obviously mean that health and social care costs would be raised (McKee, 2016). For older people, the 15 most burdensome disorders are ischemic heart disease (77.7 million),stroke (66.4 million),chronic obstructive pulmonary disease (COPD, 43,3 million), diabetes (22.6 million),low back pain (19.1 million),cancer of the trachea, bronchus, or lung (18,6 million); falls (12,4 million), visual impairment (10,4 million), dementia (10 million), tuberculosis (9,2 million), hypertensive heart disease (9,5 million),stomach cancer (8,6 million), hearing loss (7,5 million),osteoarthritis (7,5 million) and major depressive disorder (7,5 million) (Prince et al., 2015). As longevity has become a predominant state, the pursuit of good health is an urgent necessity. That is why, in recent years, we have observed an expanded use of many terms such as successful aging, active aging, healthy aging, which are efforts in order to approach the meaning of a "good" life in the aging years. These terms have differences between them as the state that they try to describe is multidimensional Professionals from different scientific fields have been engaged with these terms and it is not irrelevant that 6,705 and 24,228 published articles are found in the PubMed the year of 2020, using key words as

successful aging and healthy aging respectively after setting as the only filter publication years for the last decade.

Scientist from different backgrounds especially from social, physical and medical fields have referred to various existing models of constituents of successful aging. Three main categories depending the kind of approach that is used for explaining successful aging are biomedical theories, psychosocial theories and the combination of these two (Bowling & Dieppe, 2005). Biomedical theories based on the leveraging of life expectancy and the absence of chronic disease and disability to define successful aging. Cognitive and physical functioning characterize the state of successful aging. The most well-known published studies are these of MacArthur for elderly people in US, back in 1988 (Bowling & Dieppe, 2005) .Another influential model of successful aging, that is involved in models of biomedical theories, was suggested by Rowe and Kahn (Rowe & Kahn, 1987). They mentioned to two terms as they were totally different, "usual aging," which is the aging with increased risk of disease and disability, and "successful aging" which is referred to the aging with less or no physiological loss. Later, they completed their model and defined successful aging as the compound of three elements:

(1) Absence of disease and disability,

(2) High cognitive and physical function and

(3) Active engagement with life.

The model is partially in accordance with the definition of World Health Organization as "a state of complete physical, mental, and social well-being, and not merely the absence of disease or infirmity" (WHO., 2007). It is true that the Rowe and Kahn model have received criticism because total absence of disease in older life is quite impossible and other factors of supporting health such as socio-economic were not concluded in this one. However, the Rowe and Kahn model has stimulated a lot of research and is the most widely spread model as far as the area of Successful Aging (Bowling & Dieppe, 2005). The model also offers a great range of health status data among elderly (McLaughlin, Connell, Heeringa, Li, Roberts, et al., 2010) .On the other hand psychosocial theories have focused their interest on different aspects of human life in order to define successful aging. Specifically, they emphasis life satisfaction, social participation,

and psychological aspects of individual as keys of successful aging. Satisfaction for all the previous, present and future years is achieved by older adults when happiness, morale, self-concept and generally wellbeing are main characteristics of lifespan (R. J. J. P. o. a. S. Havighurst & perspectives, 1963) .

Also, social participation which means developing healthy relationships with others and interacting with society for both individual and social welfare is a proposed determinant of successful aging (R. J. Havighurst, Neugarten, & Tobin, 1968). Psychological aspects that contribute to the examined state are positive and optimistic outlook, autonomy, sense of control over life, independence, self-respect, the feeling of a person that worth and the ability of adjusting in different changing conditions during lifetime (Baltes & Baltes, 1993; Ryff, 1989)

Healthy aging is defined by the WHO (World Health Organization) as the state of gaining and preserving the functional ability that enables wellbeing in older age. Functional ability is explained as a person's ability to:

1. Serve their basic needs,

2. To acquire knowledge, grow and make decisions,

3. To be able to move,

4. To create and maintain relationships and

5. To interact with society.

Healthy aging is referred also with other terms but with the same meaning as "optimal" or "successful" or "active". The term "active aging" was firstly created by WHO in the late 1990s and is referred as the extended healthy life expectancy but in accordance with quality of life and the human right of involving in social, economic, cultural, spiritual affairs. It is not only the potential for physical, social and mental well-being but the providing of protection, security and care when it is necessary. Quality of life is also determined by autonomy and independence of older people. Last but not least, it is worth mentioning that culture has been regarded as crucial to defining understanding Successful Ageing. For instance, Asian cultures typically respect and honor elderly people but the American culture generally 'seeks to defy or deny aging'. As a result, cultural differences may be worth (Phelan, Anderson, Lacroix, & Larson, 2004) . North

American caregivers believe that successful ageing is the ability to stay independent for as long as possible, while their Japanese counterparts were more accepting of the notion of frailty in old age (Harris & Long, 1999) .

1.5 Determinant factors of Healthy Aging and Successful Aging

Healthy aging is a multidimensional state which is affected from numerous factors. Figure 7 shows a summary of the most important determinants which would be analyzed below in detail (Fuchs et al., 2013)
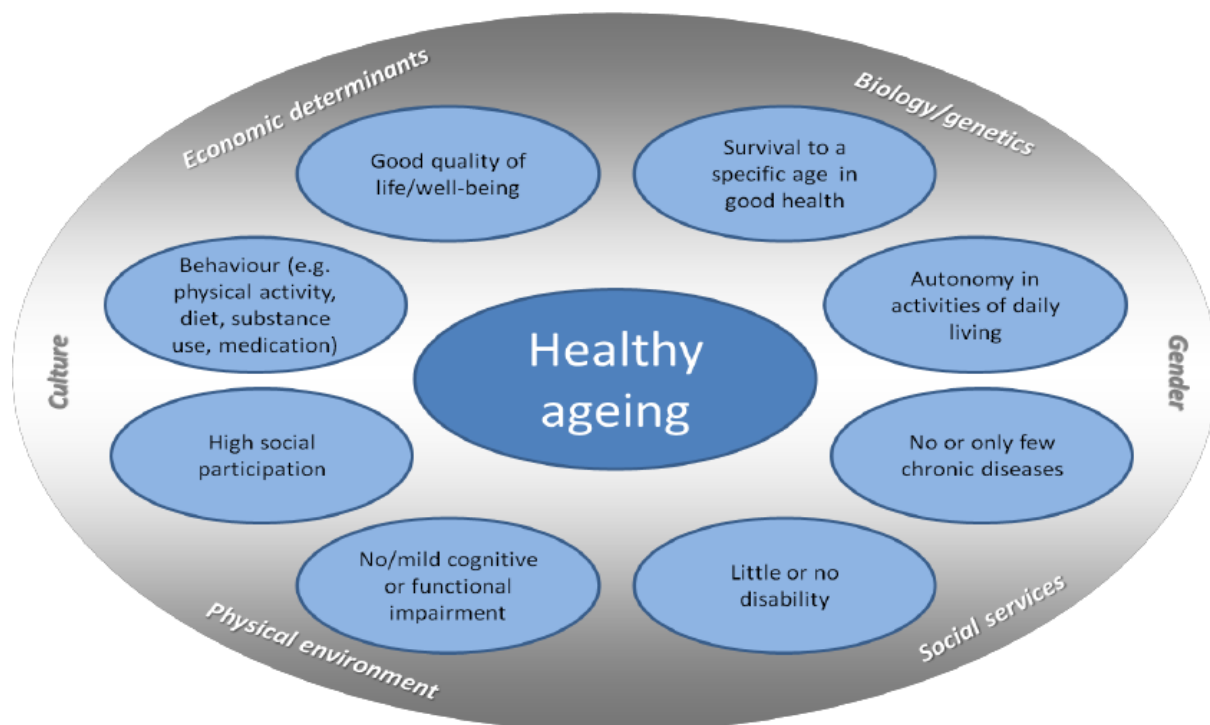
Figure 7 Components of Healthy Aging

1.5.1 Genetic Factors

Partial evidence suggests that health and longevity likely have biological and genetic roots. Scientists have found that genetics contribute substantially to successful aging which seems to be inherited by later generations. Age at death is a heritable characteristic at approximately 25 % (Murabito, Yuan, Lunetta, & Sciences, 2012). The siblings of Okinawan centenarians show

increased adult survival capacity and absence of many age-related diseases and scientific data supports that these individuals have genetic factors which increase the likelihood of reaching exceptional old age (Bernstein et al., 2004; Evert, Lawler, Bogan, Perls, & Sciences, 2003). They also have mentioned that a number of specific genes are likely involved (Glatt, Chayavichitsilp, Depp, Schork, & Jeste, 2007). There are several prospective studies and GWAS (Genome Wide Association Studies) that refer to which genetic polymorphisms affect aging. It seems that more than 55.000 SNPs (Single nucleotide polymorphisms) are involved in longevity. One example of these is transmembrane protease serine 6 named as TMPRSS6 which control level of ferrum (Fe) in blood and consequently level of oxidative stress. As yet, SNPs in or near APOE have achieved genome-wide significance in GWAS of lifespan-related traits (Nebel et al., 2011). Also, genes in the insulin/IGF-1 signaling (IIS) and telomere maintenance (TM) pathways are associated with longevity. Nine IIS genes (AKT1, AKT3, FOXO4, IGF2, INS, PIK3CA, SGK, SGK2, and YWHAG) and one TM gene (POT1) are mainly responsible of this relation (Nebel et al., 2011).

1.5.2 Lifestyle Factors

Since healthy aging is a multidimensional state is not determined only by few factors but many aspects of human life, such as lifestyle and eating behavior play a major role on achieving it.

The significance of avoiding smoking (Bell et al., 2014; Depp & Jeste, 2006; R. Pruchno, Hahn, Wilson-Genderson, & Development, 2012), drinking no alcohol or in moderation (Kaplan et al., 2008; Nicholson et al., 2017) maintaining a normal body weight (Jackson, Dobson, Tooth, & Mishra, 2015) avoiding sedentary living (Hamer, Lavoie, & Bacon, 2014; Schwingel, Sebastião, & Chodzko-Zajko, 2016) are decisive patterns for successful aging in later life. It is remarkable that beneficial habits like these in later life may reverse the consequences of negative habits in early and adult life and even these of biological factors

Nutrition

Findings suggest that individual components of dietary recommendations such as single foods groups or single nutrients are not strongly associated with successful aging but specific whole dietary patterns may promote successful aging and less poor health outcomes. Studies underscore the importance of a healthy dietary pattern (i.e., closely following national dietary guidelines) in the process of successful aging. A specific scientific outcome is that older adults in the highest (greater adherence to dietary guidelines) versus lowest quartile (poor adherence to dietary guidelines) of the TDS (total diet score assessing adherence to the Australian dietary guidelines) had a 58% increased likelihood of succeeding healthy aging over the 10 years (Gopinath, Russell, Kifley, Flood, & Mitchell, 2016). One the other hand a 'Western' dietary pattern during both adolescence and adulthood was found to be associated with an increased risk of type 2 diabetes in US middle-aged and older people (Malik et al., 2012; van Dam, Rimm, Willett, Stampfer, & Hu, 2002) as well as in Chinese men and women (Odegaard et al., 2011).

The importance of diet has been further recognized in different parts of the world where populations exhibit greater healthy ageing, which means living longer without disabilities and being more physically active even when aged over 90 years. Population groups in Sardinia (Italy), Nicoya Peninsula (Costa Rica), Loma Linda (California) and Okinawa (Japan), have obviously longer life expectancy and lower rates of age-related diseases (including CVD and dementia) compared with other countries. These areas are well-known as the 'Blue Zones' and are part of a large research project to discover lifestyle factors that explain healthy longevity. Despite their different ethnic and socioeconomic backgrounds, those living in these 'Blue Zones' share some common lifestyle behaviors such as diets abundant in plant-based foods (i.e. fruits, vegetables, beans, soybeans and lentils) and low in meat (Buettner, 2008). Furthermore, other dietary patterns with high consumption of plant-based food and relatively low consumption of meat have been associated with lower risks of mortality, cardiometabolic disease and of poor cognitive outcomes (Fung et al., 2004; Fung, Willett, Stampfer, Manson, & Hu, 2001). As regards dietary habits, one of the most analyzed dietary patterns in the scientific society which have similar characteristics with these described above is the Mediterranean diet with its potential health effects have been acknowledged since Renaissance (Haber, 1997). This dietary pattern has been associated with better health, longevity (Georgousopoulou et al., 2017) and with

plenty of positive effects on many diseases such as CVD, dementia and cancer, therefore could be associated with successful aging (Jenny, 2012). The traditional Mediterranean diet is characterized by high dietary intake of monounsaturated fats, mainly from olive oil, fruits, vegetables, nuts, legumes, whole grains, fish and poultry in low to moderate amounts, and limited consumption of red meat, as well as a moderate alcohol intake (Panagiotakos, Pitsavos, & Stefanadis, 2006). One characteristic of Mediterranean diet is the high intake of whole grains products that have a greater amount of fibers than the refined products. Fiber is a very beneficial nutritional component that contribute to normal body weight, glycemic control, better lipid profile and digestive health (Curtain & Grafenauer, 2019). Additionally, higher content of whole grain products in various micronutrients and vitamins (i.e., phosphorus, thiamine, magnesium, niacin, folate acid, vitamins E, B6, K, A, zinc, iron, potassium, riboflavin and calcium) plays an important role in the prevention of diseases like dementia and Alzheimer's disease (Rantanen et al., 2014). Vegetables and fruits—both of which are highly associated with successful aging— have long been associated with beneficial health effects mainly due to their rich proportion of phytochemical contents, including polyphenols, phytoestrogens, and antioxidants (Slavin & Lloyd, 2012). A high ratio of monounsaturated-to-saturated fatty acids, antioxidants, and polyphenols that is presented in Mediterranean diet may also enhance the process of healthy and successful aging (Mathers, 2013). In contrast, an eating pattern based on meat and other fatty foods is negatively associated with successful aging (Hodge, O'dea, English, Giles, & Flicker, 2014). Tea and alcohol consumption, within the context of a healthy and balanced diet, may affect the level of successful aging up to a point.

Seven countries studies highlight that restricted energy intake through the adherence of Mediterranean diet was positively associated with longevity and with lower levels of morbidity (Keys et al., 1984). Recently, studies have revealed that the excessive energy intake and positive energy balance are strongly associated with poor health outcomes (Weiss & Fontana, 2011) and are inversely associated with the levels of successful aging, irrespective of the age, gender, urban residence, smoking habits, and alcohol, tea, and coffee consumption. Mechanisms of pathophysiology can explain this association. The decreased energy consumption is related with increased mitochondrial mass through mitochondria biogenesis in order to achieve greater uptake of glucose. The capacity for mitochondrial biogenesis has been shown to decrease with age, and such decreased mitochondrial function has been associated with diabetes and cardiovascular

disease. Mitochondrial biogenesis along with auto-phage, stress resistance, and genome integrity that are supported by restricted energy consumption, lead to healthy aging (North & Sinclair, 2012). Obesity in midlife which is a result of positive energy balance is associated with disability in old age (R. A. Pruchno & Wilson-Genderson, 2015). Other studies confirm the previous relation from another spectrum as they mention that participants with normal weight in midlife had more healthy years without diseases than obese (Stenholm et al., 2017). Lower levels of total cholesterol in midlife is a positive predictor of active and healthy aging (Urtamo, Huohvanainen, Pitkälä, & Strandberg, 2019) while high cholesterol is associated with cognitive decline or dementia in later life. High serum cholesterol and systolic blood pressure, and mainly the co-existence of these two, have been mentioned as risk factors of Alzheimer disease in old age (Kivipelto et al., 2001).

A representative example is Ikaria, a Greek island in the Eastern Aegean Sea, where residents live longer without highly rates of healthy problems, due to their general lifestyle (Stefanadis, 2013). Evidence shows that dietary patterns rich in fruit, vegetables, fish, whole grains and starchy low-fat staple foods likely reinforce life expectancy, lower risk of cardiometabolic diseases and adverse cognitive outcomes which contribute to healthy aging. Healthy aging and each determinant such as nutrition has been studied to Greeks residents. For example, exclusive consumption of olive oil beneficially impacts healthy aging. Moreover, it should be noted that olive oil phenols, such as tyrosol, hydroxytyrosol, and oleocanthal, and other important bioactive compounds could be partially responsible for the positive association between olive oil consumption and successful aging. Bioactive compounds of olive oil, e.g., hydroxytyrosol, oleuropein, and tyrosol, have antioxidant and antimicrobial effects.Finally, monounsaturated fatty acids, such as those of olive oil, are positively correlated with longevity, as well as diminishment of age-related morbidities (e.g., cognitive deficits) (Foscolou et al., 2019).

However, there is lack of evidence related to these characteristics of Greeks of Diaspora. Furthermore, in later life people face age-related physiological changes like dental and chewing problems, progressive loss of taste and smell that may lead to reduction in consumption of food and weigh loss (Giezenaar et al., 2016; Nieuwenhuizen, Weenen, Rigby, & Hetherington, 2010; Shlisky et al., 2017). Even energy requirement is lower for older people, need for many nutritional components is essential. Studies support many inadequate intakes of nutrients like

protein, fibre and a range of micronutrients (Shlisky et al., 2017). This fact is related to poor health status with high possibility of CVD, cancer and is a barrier to healthy aging (Hlebowicz et al., 2013; Reedy et al., 2014; Schwingshackl & Hoffmann, 2015). Social support, interaction and participation are linked to better psychological state and healthier behavior such as better eating behavior (Conklin et al., 2014; Locher et al., 2008; Pieroth, Radler, Guenther, Brewster, & Marcus, 2017). On the contrary, living alone is a compounding factor of poor diet (Irz et al., 2014). Just as importantly, lower resilience, self-efficacy and higher geriatric depression scores are related to high nutritional risk (Greene GW, 2017 Bailey RL, 2009). All the factors and the possible paths that contribute to the quality of diet and consequently to health aging in elder people are presented in figure 8.
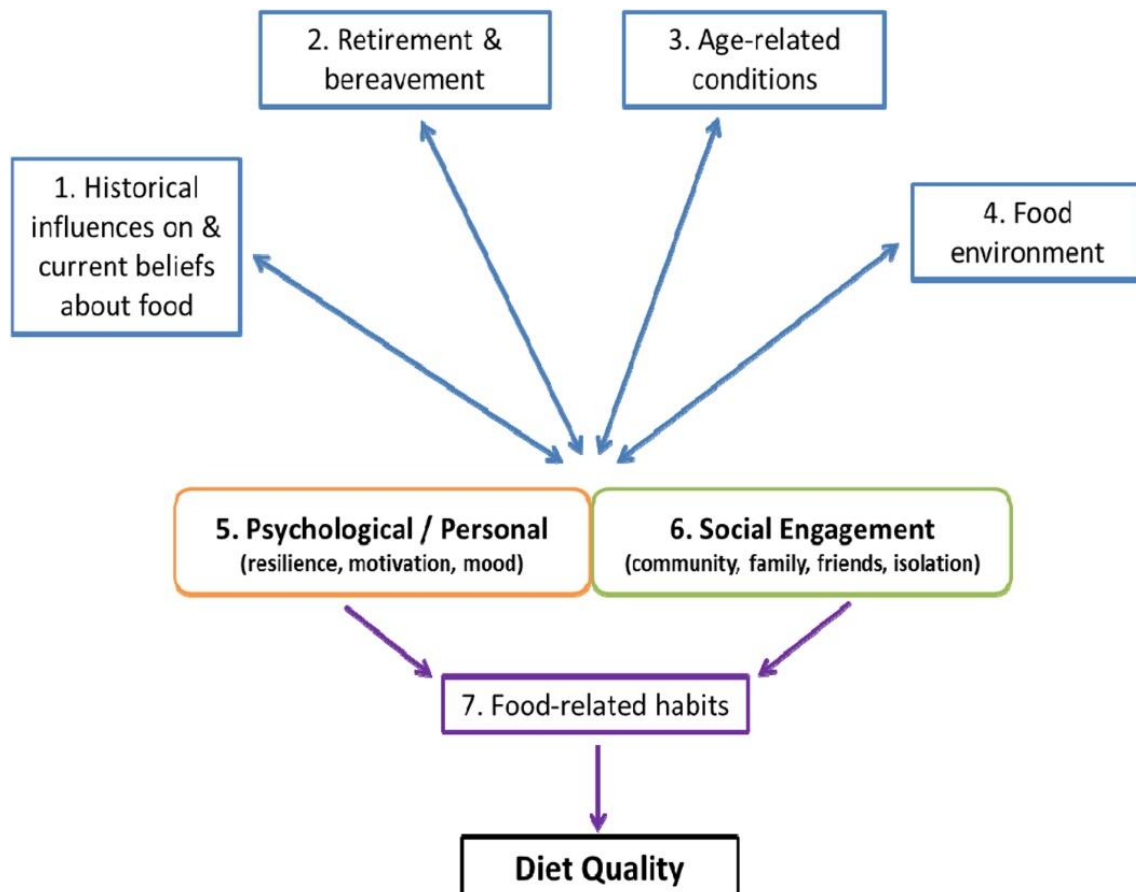

Figure 8 Hypothetical model of the relationships between factors and potential routes to impact on diet quality in older age. From Bloom et al., 2017.

Physical Activity

Another major factor that is correlated to healthy aging is physical activity. Being physically active benefits older people as far as their physical health and reduce the possibility of all-cause mortality (Resnick, Klinedinst, Yerges-Armstrong, Choi, & Dorsey, 2015) and especially the development of cardiovascular disease, metabolic disease, and osteoarthritis. According to the American College of Sports Medicine guidelines, at least 150 minutes of moderate weekly physical activity (30 minutes, 5 days/week) is recommended in order to ensure healthy outcomes. The WHO stated that inactive older people will gain additional health benefits by shifting from complete inactivity to some level of activity. Performing physical activities seems to reduce the stress ,maintain and support psychological health (Marini et al., 2015), raise the level of enjoyment and satisfaction of their life, self-care/dietary behavior, support a more independent way of life (Bowling, Hankins, Windle, Bilotta, & Grant, 2013) and social interaction with their peers (Gutierrez, Tomas, & Calatayud, 2018). Older adults who systematically include physical activity in their life consider that they have earned successful aging (Resnick et al., 2015). However there are some barriers to participating in physical activity such as sense of intimidation or inability to perform exercise in a correct way, social isolation, lack of motivation from experts or professionals, pain or fatigue associated with physical activity or thoughts like physical activity increases the possibility of injury and exercise is only for the young and fit people (Costello, Kafchinski, Vrazel, & Sullivan, 2011; Kosteli, Williams, & Cumming, 2016). These barriers have to be eliminated as physical activity is an established determinant of successful Aging A representative example is the group of master athletes which is healthier and has a better quality of life than other groups of age-matched peers (Hawkins, Wiswell, & Marcell, 2003). The fact that even walking is positively associated with successful aging facilitates older peoples' daily life as walking is the most common form of exercise for them and certainly one of the easiest to perform (Resnick et al., 2015).

The Browning et al. (2009) study represents an important step in understanding the interaction of factors contributing to older people's physical activity behaviours. In Figure 9, Browning et al. reported that the variables of age, educational status and income were shown to be correlates of total physical activity. Other predictors of energetic physical activity were age, education, personal security scores and positive health beliefs. Browning et al. also reported that positive

health beliefs predicted energetic activity independent of the reported health status of the participant. In other words, these authors reported that how people felt about their health and functional abilities predicted their physical activity levels to a greater extent than their actual health and functional status. This is important because if perceptions of health can be changed independently from actual health status then this provides a potential point of intervention to help older people become more active.
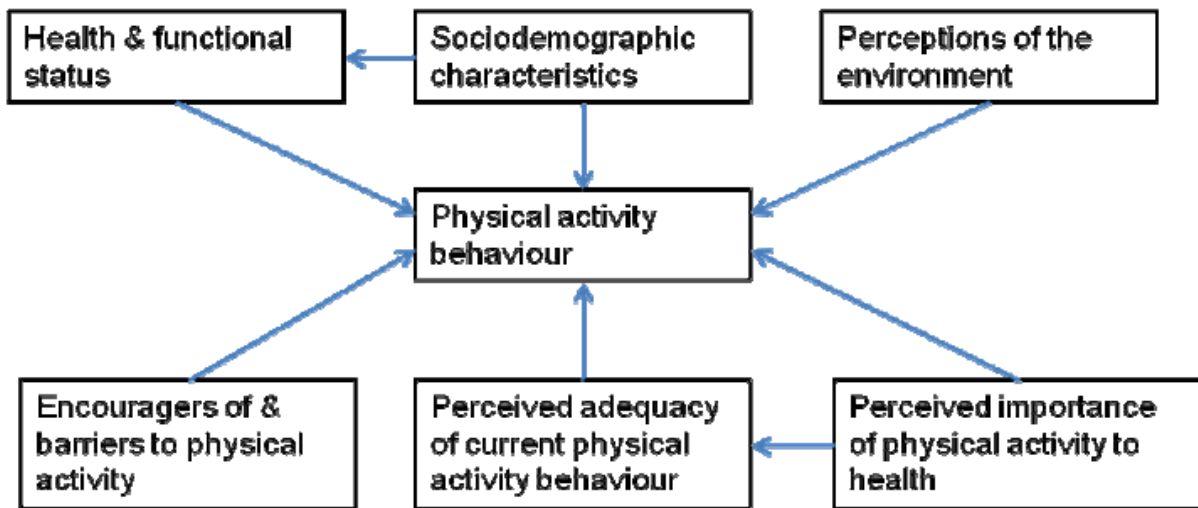
Figure 9 Health action model of physical activity behavior (Browning et al., 2009)

Smoking

Data from the USA and European Union show that prevalence of smoking habit reach a pick at the first three decades of human life, but it starts to decrease after 65 years of age. The trend of smoking and age of individuals seems to be quite similar between the USA and European Union countries. Specifically, in the USA the proportion of smokers in the age range of 18-24 years old is 7.8%,in the age range of 25-44 years old is raised to 16.5%, in the age range of 45-65 is stable to 16.3% but over 65 years old is declined to 8,4%. [1]

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[1] (internet source 2020 for Data from National Health Interview Survey, United States of 2018 https://www.cdc.gov/tobacco/campaign/tips/resources/data/cigarette-smoking-in-united-states.html#three)

Smoking is a primary example of unhealthy habits and through researching and scientific data it is nowadays well-known that smoking affects health in many aspects and leads potentially to premature death. Smoking habit cause damage nearly into every organ and system in the human body, is strongly associated with many diseases, and burden health status of smokers in general. In many developed countries smoking is the predominant preventable cause of death (Health & Services, 2014). Smoking specifically increases the risk of developing numerous diseases, such as chronic obstructive pulmonary disease, coronary heart disease, stroke and peripheral vascular disease all of which may related to harmful effects on the physical, mental and social health of smokers. Independently each disability declines autonomy, increases the risk of dependence, reduces quality of life and years of survival which means that contribute indirectly to loss of healthy aging.

Non-smoking in midlife is a strong predictor of active and healthy aging Similarly, smoking has been associated with disability and diseases in older stage of life in several studies (R. Pruchno, Hahn, & Wilson-Genderson, 2012; Willcox et al., 2006; Yates, Djoussé, Kurth, Buring, & Gaziano, 2008). Not surprisingly, scientists found a higher likelihood of Successful Aging (among nonsmokers than smokers, but no overall difference in likelihood of Successful Aging between current and past smokers (R. Pruchno, Hahn, & Wilson-Genderson, 2012). However, other evidence supports that one is never too old to stop smoking and older smokers can still benefit from quitting this habit.

1.5.3 Socio-economic Factors

Morbidity and mortality rates are systematically higher among people with lower SES Higher income was associated with successful ageing in a study on Malaysian older adults. Particularly, economic loss associated with reduction of income and expenditures for healthcare services like hospitals is considered a negative factor for maintaining successful ageing (Hamid, Momtaz, & Ibrahim, 2012). Education plays an important role in prevention of diseases and supporting of a positive health status as it raises awareness in health issues and risk behaviors. Education may be considered as a mediator of Successful Aging through different beneficial ways such as better cognitive function, better occupational opportunities, and better income. Also, high occupational status promotes health of individuals through prestige and occupational acquisitions, and combined with satisfying income that it may offers, influence health through the more efficient access to healthcare services, less environmental hazards, affording food consumption, and the elimination of psychological burden of being poor (Gathmann, Jürges, & Reinhold, 2015). Educated people also are more able to take advantage of their qualifications in order to achieve social mobility, independently of their family's socioeconomic status where they have raised.

Researches reveal that differences in successful aging between countries are significantly associated with income inequality even after accounting for individual-level factors of successful aging (Brandt, Deindl, & Hank, 2012). Large-scale studies on income inequality show evidence that not all people have access to successful aging in the same level (Brandt et al., 2012; Hank, 2011). Significantly higher rates of successful aging in Northern European (e.g., 21% in Denmark) than Southern European (3.1% in Spain) and Eastern European (1.6% in Poland) countries have been noticed due to differences in income inequality and policies or measures for employment and retirement. Minorities, for example, are less likely than non-Hispanic Whites to have access in medical and healthcare services. Racial and ethnic inequalities in healthcare system may occur due to implicit biases from health professionals (Hall et al., 2015), which are difficult to eliminate. In addition, Successful Aging may be threatened by the stress experienced by these people when they are victims of discrimination and racist behavior (Thoits, 2010).

Findings from studies have reported that between men and women, greater proportion of women satisfy the criteria of Successful Aging (McLaughlin, Connell, Heeringa, Li, & Roberts, 2010), although other studies have mentioned that male gender is related to Successful Aging (Hank,

2011), and still others have found no differences depending on the gender in Successful Aging (Meng & D'arcy, 2014). Similar controversial data exist in the relation between marital status and Successful Aging (Meng & D'arcy, 2014). Widows and European migrants were social groups found to be significantly at risk of not aging well (Kendig, Browning, Thomas, & Wells, 2014).

Research for the relation between race and healthy aging has documented that racial minorities are more likely to have poorer health status and more disrupted physical functioning in older age (Warner & Brown, 2011). One possible explanation for this, is that older black men report less levels of mastery in comparison with their white peers (Oates & Goode, 2013). Mastery is a psychosocial state that people consider themselves as having the ability to control different situations which means that they can be adopted over stressful conditions. As a result, they benefit from dealing with the harmful consequences of stress on health. For this reason, mastery is a major determinant of health across lifespan. Given that old black men may live under stressful conditions due to racism and socio-economic marginalization, they develop the sense of mastery in lower level and have fewer possibilities of accessing healthy aging (Roepke & Grant, 2011).

Social participation is a key indicator of successful aging and is associated with mortality, morbidity and quality of life. World Health Organization claims that social participation would one of the tools for controlling population aging. When older adults have more frequent and enough connections with family, friends and neighbors (informal social participation) or they usually take part in activities like volunteering, or be a member of a community club or church, they feel fulfilled and more life satisfaction. Moreover, they gain more social support which means various kind of help or assistance when they need it (Holt-Lunstad, Smith, Baker, Harris, & Stephenson, 2015) and the sense of trust for others and whole society. A representative example which has been mentioned, is   that having 5 or more close personal contacts increased the chance of successful ageing and is related to lack of disability, over 6 years. Many studies in different old population like Chinese and Canadian have demonstrated that social connections are associated with less depressive symptoms and generally better mental health, lower levels of cognitive decline and dementia (Eshkoor, Hamid, Nudin, & Mun, 2013), physical functioning and lower utilization of healthcare service (Bélanger et al., 2016). Generally, engagement in

activities and socialization are basic components of successful aging (Cannon, 2015). Along with engagement with social opportunities, lifelong learning, having a purpose-in-life, and having a positive attitude are among major characteristics of healthy aging (Howell, Seater, & McLinden, 2020; Reichstadt, Sengupta, Depp, Palinkas, & Jeste, 2010). Specifically, creating new friendships, participation in outdoor activities or creative activities that help them express themselves and gain emotional relief , traveling, engaging with new meaningful hobbies, and visiting family or friends are all concepts linked to better health outcomes (Boyle, Buchman, & Bennett, 2010).

1.5.4 Environmental Factors

Many elders, even if they have clinically diagnosed by a disease, don't visit very frequently a heath care center or use a healthcare service due to barriers like distance from the health care center, geomorphologic difficulties, inadequate transportation system, financial limitations (Lloyd-Sherlock, Beard, Minicuci, Ebrahim, & Chatterji, 2014). Furthermore, the rural areas have been associated with low availability of the health care services (Tyrovolas et al., 2011). Inability of ensuring neighborhood safety, pedestrian infrastructure, and aesthetics of environment are basic factors that can affect walking (i.e., especially older adult's outdoor walking) and therefore physical activity level (Van Cauwenberg et al., 2017). Neighborhood defective structure is also seen to increase the risk of fall-related injuries (Zandieh, Martinez, Flacke, Jones, & Van Maarseveen, 2016) which emphasizes the protective effects of stable and safe neighborhoods on health status of residents (Lee, Lee, & Rodiek, 2017). Aging adults living in communities with high rates of poverty, unemployment and low education levels, probably be in the center of criminal and violent episodes. As a result, they are discouraged adults from being physically active because they consider their environment unsafe (Hannon III, Sawyer, & Allman, 2012). In this case, older people live under stressful conditions, without trust other people and turned to be more isolated. All the above lead to worsen health outcomes and inability to achieve successful aging. Furthermore, higher daily stress, as a single factor, led to lower successful ageing scores. The variety of changes that older adults experience, including decline of physical functions, are thought to induce daily stress and affect successful ageing

World Health Organization (WHO) encourages "Aging in place" theory in order to avoid the negative emotions of leaving home. "Place" is not only the principal residence, but also the community where people feel safe, confident and active. Those aging in place often have a strong drive to stay active and to have meaningful social interactions with others, and they also wanted to contribute to the society (Fänge, Oswald, & Clemson, 2012).

There is strong evidence demonstrating that exposure to air pollution for example living in urban areas, has negative health effects and increases the risk of morbidity and mortality caused by pulmonary and cardiovascular health issues (Hoek et al., 2013). As a result, air pollution has adverse outcome in the state of longevity (Corria et al., 2013).

1.5.5 Factors in childhood and early life

Studies have also emphasized the importance of parents' longevity and early-life development to healthy aging. Characteristics such as socioeconomic status in childhood and in adult life, employment status, health behavior of family, social support and education through lifetime are strongly positive influencers of achieving successful aging as older adults (R. A. Pruchno & Wilson-Genderson, 2015; R. A. Pruchno, Wilson-Genderson, Rose, & Cartwright, 2010). Indeed, studies reveals that unpleasant family experiences during development of children such as parental loss or abuse may be determinants of poor health outcomes such as diseases (Schafer & Ferraro, 2012) and mortality (Montez & Hayward, 2014) during adulthood. Early life circumstances may affect health and quality of life in adults afterwards with two ways directly or indirectly. On one hand, nutritional deprivation in childhood, for example, might directly lead to negative health outcomes of children such as delayed physical and mental development but will influence the health status during the total aging process (Huang, Soldo, & Elo, 2011). On the other hand, poor health and economic restrictions in childhood might affect health in next stages of life indirectly through low socioeconomic power. However, there are scientific works that reveal that habits which are adopted in later life, play the most crucial role in being able to succeed a successful aging.

1.6 Life aspects in Greece, France and Canada

The Organization for Economic Co-operation and Development (OECD) is an international organization that works to build better policies for social welfare. Its goal is to involve in developing policies that empower prosperity, equality, opportunity and well-being for all.

Along with governments, policy makers and citizens, they work on establishing international norms and offering evidence-based solutions to deal with various social, economic and environmental challenges. Depending on the data for three countries of Greece, Canada and France we can easily realize many differences in variables such as health status, income and wealth, subjective well-being, social connections, education and skills, and jobs and earnings. Starting with Greece, the average household net-adjusted disposable income per capita is 17.700 a year, much lower than the OECD average of 33.604 a year. There is a major gap between the richest and poorest – the top 20% of the population earn more than six times as much as the bottom 20%. In terms of employment, about 54% of people aged 15 to 64 in Greece have a paid job, below the OECD employment average of 68%, and the lowest figure in the OECD. In Greece, 73% of adults aged 25-64 have completed upper secondary education, less than the OECD average of 78%. As regard health, life expectancy at birth in Greece is almost 82 years, two years higher than the OECD average of 80 years. Life expectancy for women is 84 years, compared with 79 for men. in Greece, where 80% of people believe that they know someone they could rely on in time of need, less than the OECD average of 89%. In general, Greeks are less satisfied with their lives than the OECD average. When asked to rate their general satisfaction with life on a scale from 0 to 10, Greeks gave it a 5.4 grade on average, one of the lowest scores in the OECD, where average life satisfaction is 6.5.

On the other hand, In France, the average household net-adjusted disposable income per capita is 31.304 a year, not so far from the OECD average of 33.604 a year. In terms of employment, about 65% of people aged 15 to 64 in France have a paid job, a higher proportion that this of Greece. In France, 78% of adults aged 25-64 have completed upper secondary education, in accordance with the OECD average of 78%. Life expectancy at birth in France is a little over 82 years, two years higher than the OECD average of 80 years. Life expectancy for women is 86 years, compared with 79 for men. It is obvious that there is a powerful sense of community in

France, where 90% of people believe that they know someone they could rely on in time of need, broadly in line with the OECD average of 89%. When asked to rate their general satisfaction with life on a scale from 0 to 10, French people gave it a 6.5 grade on average, in line with the OECD average.

Finally, Canada performs very well in many measures of well-being relative to most other countries. In Canada, the average household net-adjusted disposable income per capita is 30.854 a year, quite close to France and almost twice as Greece. In terms of employment, about 73% of people aged 15 to 64 in Canada have a paid job, above the OECD employment average of 68%, quite similar with Canada and obviously higher than Greece. Good education and skills are important requisites for finding a job. In Canada, 91% of adults aged 25-64 have completed upper secondary education, well above the OECD average of 78%, the highest between the three countries. Life expectancy at birth in Canada is 82 years, two years higher than the OECD average of 80 years. Life expectancy for women is 84 years, compared with 80 for men. In Canada, 93% of people believe that they know someone they could rely on in time of need, more than the OECD average of 89%, quite close to France and higher than Greece. Generally, Canadians are more satisfied with their lives than the OECD average. When asked to rate their general satisfaction with life on a scale from 0 to 10, Canadians gave it a 7.4 grade on average, higher than the OECD average of 6.5 and significantly higher that French and Greeks citizens. Also total expenditure on health per capita differs among these countries, with Greece at 2.098 Intl $ which is more than the half amount of France (4.508 Intl $) or Canada(4.641 Intl $) (WHO, 2014).

Another important source of information on the countries of the world is "The Statesman's Yearbook" published by Palgrave Macmillan which is a one-volume reference book. The book edition of 2018 offers many details about the health system of Greece, Canada and France. According to this doctor and hospital treatment within the Greek national health system is free, but patients have to pay 25% of prescription charges. Those living in remote areas can reclaim a proportion of private medical expenses. In 2011 there a total of 53,773 hospital beds. In 2005 there were 55,556 doctors and 13,438 dentists. In 2007 Greece spent 9·6% of its GDP on health. of any country. As far as retirement policy, the basic pension is calculated on the length of the insurance period and on pensionable earnings in the last five years. A reduced early pension is

available to men aged 62 with 10,000 days of contributions and women aged 62 with 4,500 days of contributions. The 'official' retirement age is 67, although on average Greek men retire at 63 and women at 59. In 2013 only 36% of Greeks between the ages of 55 and 64 were in employment. The minimum pension for a single person is €487 per month and the maximum is €2,374. In 2008, 46·3% of Greek adult males and 33·5% of females smoked on a daily basis. Greece has among the highest smoking rates. In France Health Ordinances of 1996 created a new regional regime of hospital administration and introduced a system of patients' records to prevent abuses of public health benefits. There were 208,191 physicians, 41,444 dentists, 483,380 nurses, 70,498 pharmacists and 17,483 midwives in 2007. In 2008 France spent 11·2% of its GDP on health which is the highest percentage in the EU. The orders laid down in Aug. 1967 ensure that the whole population can benefit from the Social Security Scheme, at present all elderly persons who have been engaged in the professions, as well as the surviving spouse, are entitled to claim an old-age benefit. A law was passed in Nov. 2010 to raise the minimum retirement age from 60 to 62 by 2017, with the fully pensionable retirement age rising from 65 to 67 In 2009, 33% of the population aged 15 and over were smokers. In Canada Health spending accounted for 10·9% of GDP in 2011, the highest between three countries. In 2010 there were 69,648 physicians, giving a rate of 2·1 per 1,000 population; in 2011 there were 319,026 nursing and midwifery personnel (9·3 per 1,000 population); and in 2012 there were 35,555 pharmacists (1·0 per 1,000 population). The Old Age Security of Canada pension is payable to persons 65 years of age and in 2011 the maximum OAS pension was $533·70.

Although all of these previous data shape a general idea of standard of living in each country, with France and Canada excel Greece in the majority of the examining factors, they are mainly referred to the native populations not the immigrants or residents of other nationality. As a result, a serious issue is appeared and there is need to be analyzed. This issue of great importance is included in the question of how living in a different country than peoples' place of origin (or homeland) influences habits as far as social, economic, lifestyle and health status. It is obvious that findings from different studies are controversial. Several studies claim that lifestyles of new immigrants change as a result of contact with a different culture, that turns to significant modifications in the social, cultural, political and economic status of them under the conditions of the new society (Abraido-Lanza, Chao, & Flórez, 2005; O'Loughlin, Maximova, Fraser, & Gray-Donald, 2010). For example, the health status of immigrants in Canada was negatively

influenced as they had adopted sedentary lifestyles and an increased body mass index (BMI) after a couple of years in the host county (Newbold, 2006; Setia, Quesnel-Vallee, Abrahamowicz, Tousignant, & Lynch, 2009). Another part of bibliography supports that factors like difficulty in speaking the official language of the host country, lack of social networking and support, not having a family doctor, lack of being a part of new community, unemployment and poor income lead to a deterioration of health conditions and status of immigrants (Kobayashi & Prus, 2012; Newbold, 2005). Another research states that immigrants arriving the new country in reasonably good heath converged to native levels of health status after 10-20 years in the United States, Canada and Australia (Markides & Rote, 2019).

Greece is a Mediterranean country and especially its islands located at the crossroads of Europe, Asia, and Africa. Marseille, in addition is the largest city and port of France on the Mediterranean coast. Both countries due to their Mediterranean character have adopted common dietary patterns, characterized by similar climate conditions but have also their own particularities. For example, Greeks consume more fruits and vegetables and French excel in the intake of wine (8). On the other hand, people in Canada live in a totally different location and environment. Canada is placed at the northern part of North America, extend from the Atlantic to the Pacific and northward into the Arctic Ocean. The Canadian Community Health Survey reveals different dietary patterns of grain-based foods among adults in Canada and between them and immigrants that live in the same residence. Particularly in the group of consumers of "rice" (58% of grain-based foods is rice and then a high consumption of bread, followed by other products like cereals, cakes, muffins) there was a considerable percentage of immigrants. This indicates that immigrants have maintained the high consumption of rice in their cuisine as they mainly come from Asia, India and South America (Hosseini et al., 2019).

1.7 Definition of terms "Immigration" and "Emigration"

Immigration is a topic that is as important among anthropologists as it is the general public. Almost every culture has experienced adaptation and assimilation when immigrating to a new country and culture; usually leaving for what is perceived as a "better life". Not only does this diaspora change the country of adoption, but also the country of origin. Many large nations in the world have absorbed, and continue to absorb, large numbers of immigrants. The foreseeable future will see a continuation of large-scale immigration, as many countries experience civil war and secessionist pressures.

The term immigration was coined in the 17th century, referring to non-warlike population movements between the emerging nation states. First used in English in Jeremy Belknap's history of New Hampshire, and he generally is credited with having coined it. When people cross national borders during their migration, they are called migrants or immigrants (from Latin: migrare, wanderer) from the perspective of the country which they enter. From the perspective of the country which they leave, they are called emigrant or outmigrant.

Migration is an umbrella term that covers both "immigrate" and "emigrate. "Immigrate" and "emigrate" are two words that have similar meanings and can be easily confused. The differences between the two are subtle but important "Immigrate" is to enter a foreign country to live but "Emigrate" is to leave a country in order to live in another.

According to Global Migration Indicators Report 2018 by IOM's (International Organization for Migration) Global Migration Data Analysis Center (GMDAC), the estimated number of international migrants worldwide is 258 million. Among them 25.4 million are registered refugees, 124.8 million are woman and 36.1 million are children. Also, migrant workers are 150.3 million and 4.8 million are international students all over the world. Figure 10 shows many details for the estimated number of migrants from different part of the world and the country of their origin.
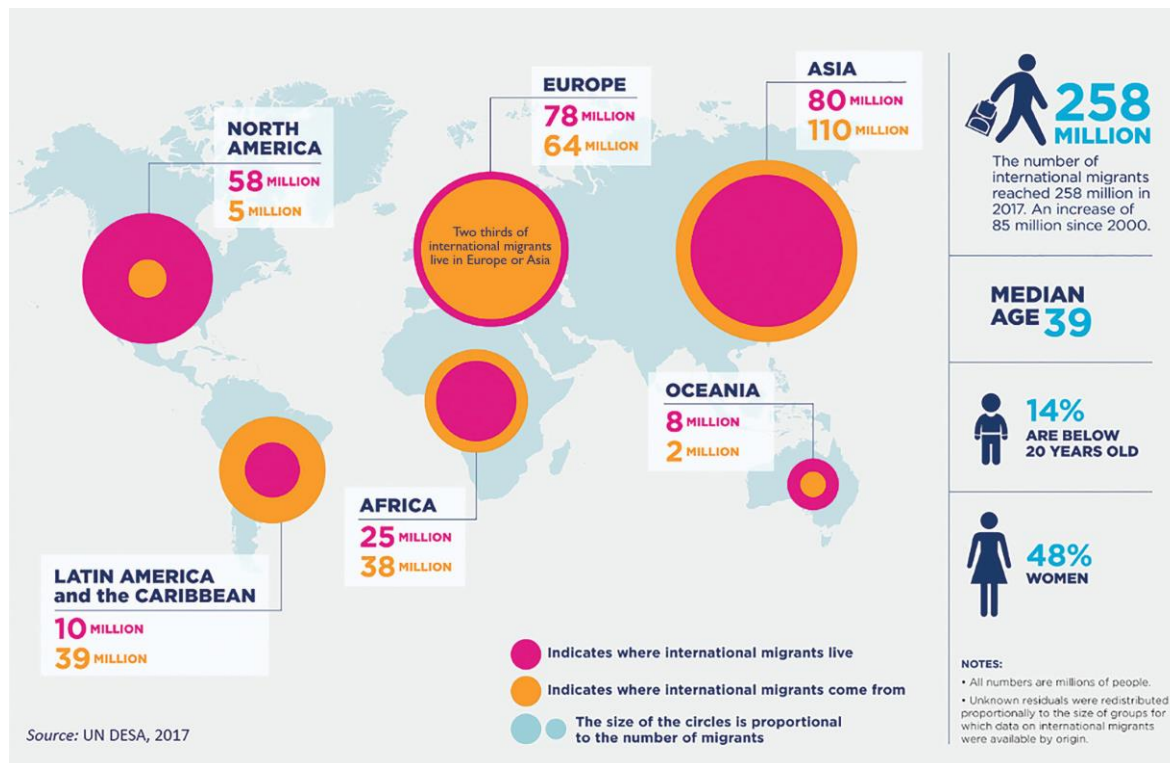
Figure 10 Number and data of international migrants in 2017.

1.8 The Greek Diaspora

The Greek diaspora is called "omogenia" in Greek (diaspora is a Greek term as well!), and refers to the communities of Greek people living outside the traditional Greek homelands of Greece and Cyprus, but more commonly in other parts of the world, such as the United States, Canada, Australia, the UK, Germany, Sweden, France, Belgium, Italy, Argentina, Brazil, South Africa, Russia or other countries around the world. Members of the omogenia can be identified as those who themselves, or their ancestors, migrated from the Greek homelands.

1.9 History of Greek Diaspora

The early twentieth century was marked by the rise in the number of labor migrants moving from southern Europe mainly to the United States and Canada, Although the absolute numbers of

Greek emigrants have always been small, in relation to the size of the population, Greece is among the countries with a very high percentage of emigrants (Kotzamanis, 1987). The number of Greek migrants to the United States kept rising until the period 1922 to 1924, when the specific immigration legislation was formed in order to prevent the continuous migration until after World War II.From the last decades of the 19th century to 1924 it is estimated that 500,000 Greeks (Moskos, 1999) moved to USA, mainly from the south Greece and especially form the Peloponnese. Emigration had been a well-known way or opportunity of achieving material advancement since the beginning of the 20th century Emke-Poulopoulou had reported that , "unemployment, underemployment, limited job offers and low and unequally distributed incomes among sectors, regions and classes were the predominant traits for most of the post-war era. These were the objective determinants that drove the Greeks away from their country" (Emke-Poulopoulou, 1986). Post-war emigration was just as massive as that of the beginning of the century, but only a small part was directed to the former main destinations. For the 1946-1954 period, and for the period after 1977, there are no demographic data of emigration because the National Statistical Service of Greece did not register them. However, expert estimates, however, the number of emigrants between 1946 and 1977 was approximately 1,300,000 (Kotzamanis, 1987). If we take into account the fact the Greece's population was fluctuating between 7,600,000 in 1951 and 9,200,000 in 1971, one in nine persons was involved and affected by this mobility.

Analysis of history of the post-World War II migration has indicated that the post-World War II mobility of populations was the most intense event of labor migration in the "modern time" of Greece (Ventoura, 1999). In the 1960s Greeks migrated to different places all over the world like Western and northern Europe (mostly to Germany and Belgium), the United States, Canada, Brazil, Argentina, New Zealand, and Australia. The largest proportion of migrants to Europe were settled in Germany, whereas the majority of transoceanic migrants were moved in Australia. Greek migrants in Germany and other European countries started to work mainly to industries as workers due to high need for cheap industrial labor during the period of rapid economic development. As a result, Greek communities with rich political and cultural activity was established during the last decades. The increase of the number of Greek migrants in the 1960s in some cases exceeded the birth rate in Greece. Thus, postwar migration was often related to the decrease of working force especially derived from young adults, which eventually declined

the opportunities for socio-economic rise of the country .On the other hand, many of the migrants to the host countries were used as unskilled workers, which did not allow them to grow their economic power and to achieve social mobility.

Greek political refugees were persons who were forcefully moved to Eastern European countries (Yugoslavia, Bulgaria, Romania, Hungary, Czechoslovakia, Poland or the USSR) during the 1946- 1949 civil war and were not permitted by the Greek governments to return to homeland until the fall of the Greek dictatorship in 1974. By the early '80s about 40,000 had come back, mainly begun a new start in Macedonia Thrace and a part of them in Athens. Of those, only 30% had been born in Greece, the others were their children who had born outside of Greece (Glytsos, 1995). As we can conclude the history of "Greek Diaspora" is a long term issued of social, economic, political and cultural background which first appeared in the early twentieth century.

According to statistic data of General Secretariat for Greeks Living Abroad which are based on the immigration of Greeks from 2010 as a consequence of economic crisis, the contemporary distribution of Greeks of Diaspora for each continent worldwide is: USA: 61% (approximately 3.000.000), Europe: 23% (approximately 1.000.000), Oceania: 13% (including Australia and New Zealand, 650.000 to 700.000), Africa: 2% (approximately 100.000) and Asia : 1% (approximately 100.000). Generally, based on the most recent estimations of General Secretariat for Greeks Living Abroad more than 5.000.000 citizens with Greek origin live in countries abroad.

1.10 Effects of Immigration and Emigration

1.10.1 Effects to the homeland and the host country

Emigration have led to various effects in the size, the rate of evolution, the structure by sex and age group, the mortality, the ageing and the traits of the Greek population. The effect of emigration, in particular, on the size and rate of evolution of the population has been negative, depriving the population of the most vigorous and dynamic age-groups. That is, apart from the fact that there was a negative correlation between fertility and emigration, during the period of intense emigration, 1961-1971, an rapid increase in the ageing rate of the Greek population was

also obvious (Emke-Poulopoulou, 1986). The ageing of the population was particularly marked in rural areas, due to high levels of migration both to urban centers and abroad by persons of child-bearing age. Decreasing mortality rates have also contributed to the ageing of the population. When adult children emigrate, kinship networks shrink and become more distant. As a result, there are fewer human resources to support those who remain in the native country, especially older adults (Mbanaso & Crewe, 2011).

A related to migration phenomenon is "Brain drain" that can be defined as the process in which a country loses its most educated and talented workers to other countries This trend is major problem, because the most highly skilled and competent young adults leave the country, and offer their expertise and knowledge to the economic development of other countries while their own country has to deal with economic hardships .Brain drain is occurred when people from academic and technological fields change place of resident through a continuous chasing of more favorable geographic, economic, or professional environments. As regards "brain drain", it seems that no serious issues were developed directly in Greece because the country had limited need for people to engage with research and technology as these fields were at an early stage of progress. However, it is an indisputable fact that Greece offered the host countries the advantages of free human capital for which it had the responsibility of the costs of preparation. Although the emigration stream largely consisted of people with few formal educational qualifications, many of them had other skills like ambition, desire of working, inspiration and capability of initiative and cooperation. These factors became relevant later on when full employment was achieved in the late 1960s and 1970s and there was a significant need for human talent.

1.10.2 Effects of immigration in different aspects of individual

Generally, the concept of migration and health follow the idea that there are various factors and conditions that influence the health of migrants. These factors and conditions are referred to as social determinants of health. There are various levels of social determinants of health, which range from the socioeconomic, legal, cultural, environmental, and physical environments to individual factors such as lifestyle, age, hereditary, and behavioral factors that impact the health of migrants (Figure 11). There may be differences in the development of diseases and health

profiles between immigrants and native populations, or inequalities in the access and use of preventive interventions or treatment and therapies according to the Migration Data Portal which is developed and controlled by IOM's (International Organization for Migration) Global Migration Data Analysis Center (GMDAC).
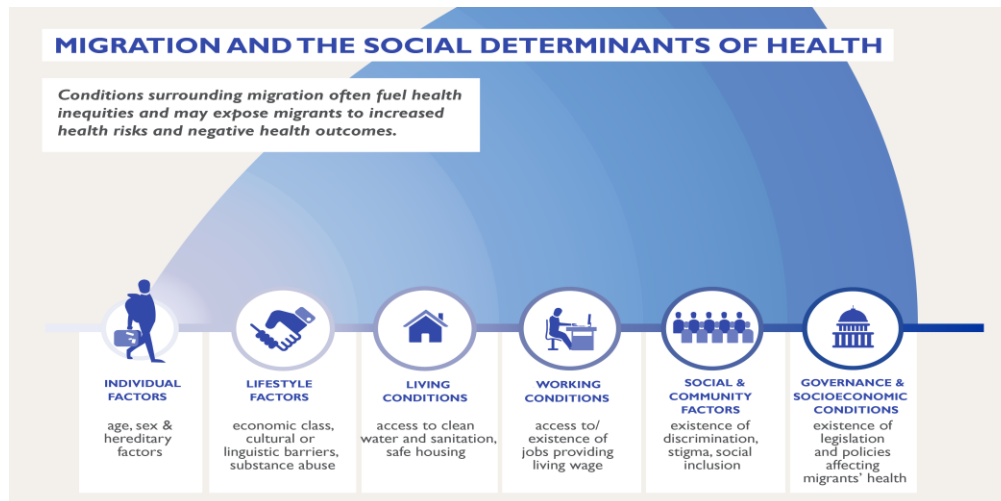
Figure 11 Adaptation of an infographic found in a World Health Organization (WHO)'s Comission on Social Determinants of Health (CDSH) report in 2008.

Some studies have shown that healthy individuals are more likely to immigrate because they are financially and physically to follow the migration process in a legal framework. Also, medical screening is a essential tool that host countries use in order to ensure that immigrants are not a threat to public health and they would not overload the health system and services with high-cost expenditures. These facts have been used to give an explanation on "healthy immigrant effect" (HIE), a phenomenon that immigrants have a better health status than the native population. Specifically, immigrants have reported self-reported health and functional health than the Canadian-born peers (Newbold, 2005; Newbold & Simone, 2015). Other studies among late life immigrants have suggested that this group is associated with lower mortality risks than native previous studies, as explained in the researching field by terms as "epidemiological paradox" and "mortality advantage" (Angel, Angel, Díaz Venegas, & Bonazzo, 2010; Markides & Gerst, 2011). In addition, for certain chronic conditions including cancer, lung disease, and cardiovascular disease, or late life immigrants have lower possibilities to prevalence of disease (Colón-López, Haan, Aiello, & Ghosh, 2009). However, researchers have noticed a major decline of the superior health status of immigrants a couple of years after their settlement in the

new country. For example, immigrants have more possibilities of developing chronic health diseases (e.g. cardiovascular disease or diabetes) than native individuals with increased length of time in Canada. Moreover, declines in immigrant mental health have been observed such as the development of depression and alcohol dependence. Many experts have suggested that through acculturation, many immigrants adopt unhealthy and risky healthy habits such as increase in smoking and sedentary habits, Western dietary patterns and increased alcohol use (Park, Myers, Kao, & Min, 2009).

Another issue that may involve in the weakening of immigrants' health status is the numerous barriers to access in health care such as difficulty in the national language and lack of common cultural components (Asanin & Wilson, 2008). Some types of health care service are only reachable through employee medical benefit package and along with high prevalence of immigrants' unemployment they cannot receive them. Migrants' access to health services has increasingly been a key indicator of people-centered, rights-based and equitable health systems that aim at reducing health barriers, but the social exclusion of migrant groups continues to take place in the absence of explicit affirmative policies.

Greek immigrants presented higher rate of depression and anxiety disorders. Researchers suggested that cultural norms and values such as 'philotimo' and child-rearing encouraging over-protectiveness in Greeks and may lead to a sense of insecurity, contributing to numerous emotional disorders. Although culture of immigrants may involve in their mental health, conditions of immigrants' living can often hide major risks for psychological morbidity. These may include dealing with unfamiliar institutions and processes in the host country, high levels of unemployment, drawbacks of lower socio-economic status and lower levels of education, the barriers of language and absence of support and feeling safety from social networks (Kiropoulos, Klimidis, & Minas, 2004).

It is indisputable fact that individuals who immigrate later in life challenge with numerous disadvantaged determinants of healthy aging in the host country. These include language barriers, low access to health care system, services and public support, inability to drive or use transportation, lack of independent income, social isolation and insufficient social network, and worsening physical health (Markides & Eschbach, 2005). Elderly immigrants mention greater

difficulty adapting to their new environment circumstances than younger adults (Kim, Jang, & Chiriboga, 2012). The biological stressors and comorbidities of aging combined with the challenges of moving and settling in another country away from homeland push this population to the development of poor health outcomes (T. R. Blair, 2012).

As the proportion of people moving between countries is a global phenomenon, the variety of motivations and conditions for mobility such as the socioeconomic conditions and political climate in which this mobility occurs, leads to different health challenges faced by migrants in various states of their sending, transit and arriving at countries of final destination.

In addition to the phases of the migration process, some migrants are also placed in detention, jails, and other closed facilities due to national migration policies. Detention most often affects asylum-seekers, refugees, displaced populations, trafficked persons or irregular migrants. Health-related diseases can increase due to numerous factors such as the lack of access to health services, inadequate hygiene within densely populated living spaces, inadequate consumption of food, water and violence. The length of detention has been associated with the severity of mental disorders and psycho-social issues. Moreover, immigrants workers, especially those with low education and skills, are employed in sectors often very dangerous, difficult and demeaning, with low wages, hazardous and harsh working conditions, a lack of status recognition, social protection and occupational health rights.

## 1.11 Policies of Greek Diaspora

When Greek state realized the relatively permanent settlement abroad, it was time to create various Greek consulates, "Greek Houses" in cities around Western Europe and there was an effort to set up schools or offer language courses for children of emigrants, with teachers hired for that purpose (Royal Decree 1964). The Greek state helped in ensuring the presence of priests and Orthodox churches in places were Greeks had settled, and at times financed and organized cultural events for them. Moreover, Greek governments made a network of organizations abroad to help maintain the connection between the homeland and Greeks of Diaspora in order to safeguard the Greek culture, tradition and decreased absorption of characteristics of host countries. Greek governments tried at different times to involve the Diaspora both in overseas

countries and in Europe in economic development schemes and in plans of regional development by promoting their trips to the homeland in order to stimulate tourism and by offering incentives for the import of their capital.

1.12 Characteristics of Greek Diaspora

A survey with the title "Hellenism in the world: a survey across five continents" was conducted by Kapa Research (a company operates in the fields of market research and the center of Hellenic Studies in Harvard University during 2016-2018). The purpose of the survey was to study many life's aspects of Greeks of Diaspora. Some important finding are mentioned:

1. Employment rate is estimated to 78% with the proportion of each socio-economic class and the perceived income status depicted in Figure 7.

2. The majority of Greeks of Diaspora express themselves as optimistic about their future, approximately in a proportion of 84%.

3. Most of them are familiar with technology as the 87 % has internet access

4. Among parents, 71% of them have familiarized their children with the Greek custom and traditions

5. Most of them are religious and fairly close to the church.
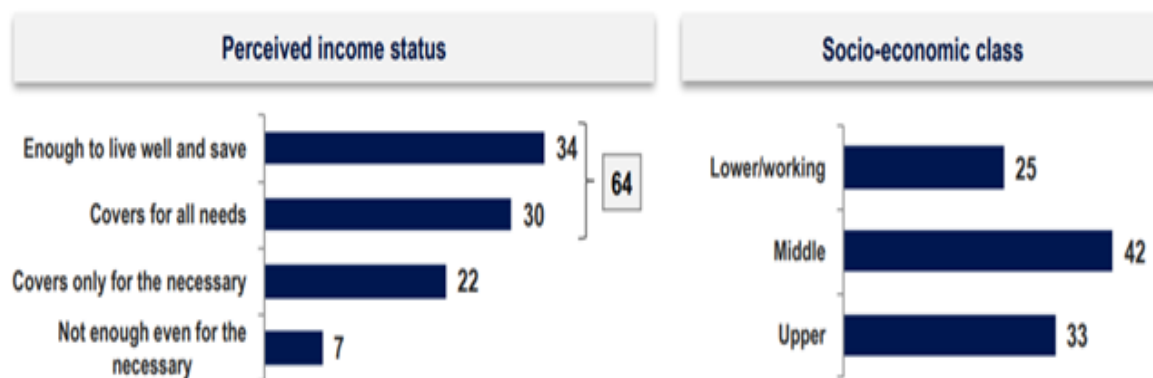
Figure 12 The perceived income status and the proportion of each socio-economic class referred to Greeks of Diaspora.

As regard the health status of Greeks in Diaspora, many studies have tried to give evidence on this matter. A study back in 1996, suggested that elderly Spata Greeks are 'healthier' than elderly Melbourne Greeks, especially with respect to blood lipid profiles and immune function. Compared with Spata Greeks, Melbourne Greeks had significantly greater intakes of animal foods (meat), legumes, protein, margarine, polyunsaturated fats, and beer, and lower intakes of cereals, carbohydrates, wine and olive oil. The role of these dietary differences, as well as the influence of high storage iron levels, impaired immunity and greater prevalence of obesity that is linked to cardiovascular disease and cancer (A Kouris-Blazos, Wahlqvist, Trichopoulou, Polychronopoulos, & Trichopoulos, 1996). A notable fact is that Greek migrants are torn between their love for their homeland and their host country especially when close family members are still in Greece. Especially elders tend to challenge with depression as they realize they may not be able to return (Panagiotopoulos, Walker, & Luszcz, 2013). It has been found that Greeks in UK who cannot adjust to the different culture well tend to suffer mental health challenges (Dunkas, Nikelly, & Palermou, 1993).

1.13 Aim of the present study

Considering all the above and the lack of current data regarding differences in healthy aging between residents of Greece and Greeks of Diaspora (in Canada and Marseille), it is considered necessary to carry out a research on this topic. The aim of the present study was to evaluate the role of dietary habits and behaviors on healthy aging between these two populations. Both groups have the same origin with common cultural characteristics, but it is unknown if Greeks of diaspora has maintained them, such us Mediterranean diet during the past centuries or they have been influenced by their new residence and have developed others cultural and behavioral particularities.

Chapter 2: MATERIALS AND METHODS

2.1 Methodology

The Mediterranean Islands (MEDIS) study is an ongoing, large-scale, multinational project in the Mediterranean region, conducted by the Harokopio University of Athens and the Hellenic Heart Foundation, which aims at exploring the association of lifestyle habits, psycho-social characteristics and living environment, on cardiometabolic factors, among adults' permanent residents of the Mediterranean area. However, the present study is part of MEDIS that includes only the same participants of Greek islands and also homogenous Greeks that live in Marseille of France and in Canada (U.S.A). Its purpose is to reveal the association between dietary habits and behaviors on healthy aging among people over 45 years old.

2.2 Study's sample

During 2005-2019, a multi-stage (i.e., stratified by Mediterranean country), convenience sampling was applied to voluntarily enroll older people (i.e., aged 60+) from many Greek islands

Mitilini, Samothraki, Cephalonia, Crete, Corfu, Limnos, Ikaria, Syros, Naxos, Zakynthos and Salamina, Kassos, Rhodes and Karpathos, Tinos). (Greek islands of Lesvos (n = 142), Samothraki (n = 100), Cephalonia(n = 115), Crete (n = 131), Corfu (n = 149), Limnos (n = 150), Ikaria(n = 76), Syros (n = 151), Naxos (n = 145), Zakynthos (n = 103), Salamina (n = 147), Kassos (n = 52), Rhodes and Karpathos (n = 149),Tinos (n = 129), Ai Stratis (n = 30), Spetses (n = 92), Aegina (n = 59), Paros (n = 90).

In addition, during 2018-2019 142 Greeks with their permanent residence in Marseille and 71 Greeks with their permanent residence in Canada, were also enrolled this study.

For the present work, information from n=1290 men and n=1,144 women totally, aged from 74±7,8. According to the design of the study, individuals who resided in assisted-living centers, had a clinical history of cardiovascular disease (CVD) or cancer, or had left the island for a

considerable period of time during their life (i.e., >5 years), were not included in the study; these exclusion criteria were applied because the study aimed at assessing lifestyle patterns that were not subject to modifications due to existing chronic health care conditions or by environmental factors, other than living milieu.

A group of health scientists (physicians, dietitians, public health nutritionists and nurses) with experience in field investigation collected all the required information using a quantitative questionnaire and standard procedures.

2.3 Bioethics

The study followed the ethical considerations provided by the World Medical Association (52nd WMA General Assembly, Edinburgh, Scotland and October 2000). The Institutional Ethics Board of Harokopio University approved the study design (16/19-12-2006). Participants were informed of the aims and procedures of the study and gave their consent prior to being interviewed.

2.4 Evaluation of clinical characteristics

All of the measurements taken in the different study centres were standardized. Weight and height were measured using standard procedures to attain body mass index (BMI) scores (kg/m^2); obesity was defined as BMI >29.9 Kg/m^2. Diabetes mellitus (type 2) was determined by fasting plasma glucose tests and was analysed in accordance with the American Diabetes Association diagnostic criteria (glycated haemoglobin A1C $\geq$ 6.5 or fasting blood glucose levels greater than 126 mg/dl or 2-h plasma glucose > 200 mg/dl during an oral glucose tolerance test-OGTT- or a random plasma glucose > 200 mg/dl or by history of previously established diagnosis of diabetes). Participants who had blood pressure levels >140/90 mmHg or used antihypertensive medications were classified as hypertensive. Fasting blood lipids levels (HDL-, LDL-cholesterol and triglycerides) were also recorded and hypercholesterolemia was defined as total serum cholesterol levels >200 mg/dL or the use of lipid-lowering agents according to the NCEP ATPIII guidelines.

2.5 Evaluation of lifestyle and socio-demographic characteristics

A semi-quantitative, validated and reproducible food-frequency questionnaire was used in order to estimate the dietary habits of the sample (Tyrovolas, Pounis, Bountziouka, Polychronopoulos, & Panagiotakos, 2010). The MedDietScore (range 0-55) was calculated in order to understand the level of adherence to the Mediterranean diet with higher values of this score indicating greater adherence to this specific diet. According to the rationale of the Mediterranean dietary pattern, the weekly consumption of 9 food groups have included in the MedDietScore. For the consumption of items presumed to be close to this pattern (i.e. those suggested on a daily basis or more than 3 portions per week; i.e., non-refined cereals, fruits, vegetables, legumes, olive oil, fish and potatoes) we assigned score 0 when someone reported no consumption and scores 1 to 5 for rare to daily consumption. For the consumption of foods presumed to be away from this diet pattern (i.e. rare or monthly consumption; meat and meat products, poultry and full fat dairy products) we assigned the scores on a reverse scale (i.e., from 5 when someone reported no consumption to 0 when they reported almost daily consumption). Especially for alcohol we did not use a monotonic function, but we assigned score 5 for consumption of less than 300 ml of alcohol per day, score 0 for no consumption or for consumption of > 700 ml per day and scores 1 to 4 for consumption of 600-700, 500-600, 400-500 and 300-400 ml per day (100 ml have 12 g ethanol concentration)(Panagiotakos et al., 2006).

Main socio-demographic characteristics such as age, sex, retirement or still at work, as well as lifestyle factors, such as smoking habits and physical activity or sedentary life, were also collected. Current smokers were defined as smokers at the time of the interview. Physical activity was evaluated in MET-minutes per week, using the shortened, translated and validated into Greek, version of the self-reported International Physical Activity Questionnaire (IPAQ) (Papathanasiou et al., 2009). Estimation of depression's symptoms were assessed using the validated Greek version (also translated into all the cohort´s languages) of the shortened, self-report Geriatric Depression Scale (GDS) (range 0-20) (Fountoulakis et al., 1999). GDS is developed by Jerome Yesavage, as a self-rating screening tool to measure depressive symptoms in normal community-dwelling elderly and elders hospitalized (for depression) by distinguishing symptoms of depression and dementia (Brink et al., 1982). The original or "long version" contains 30 items. Finally a Successful Aging Index (SAI), ranging from 0 to 10, which has

been previously developed and validated, using 10 attributes that reflect and are associated with the aging process, was applied for assessing successful aging. The index encompasses health-related social-, lifestyle- and clinical factors, including education, financial status, physical activity, BMI, depression, participation in social activities with friends and family, number of yearly excursions, total number of clinical CVD risk factors (i.e., history of hypertension, diabetes, hypercholesterolemia, obesity) and level of adherence to the Mediterranean diet.

Further details about the MEDIS study protocol have been extensively published elsewhere (Tyrovolas et al., 2014; Tyrovolas et al., 2009).

2.6 Statistical analysis

Continuous variables are presented as mean ± SD and categorical variables as frequencies. Comparisons of continuous variables between groups were performed using the analysis of variance (ANOVA) for continuous variables while associations between categorical variables were tested using the Pearson's chi-square test. Linear regression models were used to evaluate the association between participants' characteristics (i.e., age, sex, retirement, smoking habits) and Successful Aging Index (outcome). Results are expressed as b-coefficients±SE and the 95% confidence intervals. STATA (M. Psarros & Associates, Sparti, Greece) software version 15 was used for all calculations.

Chapter 3: RESULTS

3.1 Lifestyle, socio-demographic and clinical characteristics.

Table 1 presents lifestyle, psycho-social and clinical characteristics of participants. Greeks of Canada have the higher percent of retired people (p<0.001) as approximately only 9% of them are not retired. Also, the 71% of them reported to be at a good financial state which was the higher among the 3 groups (p<0.001). The proportion of physical active participants was the highest in the group of Greeks in France (91%) (p<0.001).Greeks in France have the lowest possibility of having history of common cardiometabolic factors (hypertension(p<0.001), diabetes (p=0.006) and hypercholesterolemia (p<0.001)). BMI, MedDietScore and GDS have no differences between three groups (p>0.005).Furthermore, Greeks of Canada have the lowest proportion of current smokers(only 1,5%), followed by Greeks in France and finally them in Greece where the percent of smokers is almost twice (18%). Finally, the Successful Aging Index follows a decreasing tend from Greeks in France and Greeks in Canada which have similarly higher levels than their counterparts in Greece.

3.2 Area of living and adherence to Mediterranean diet

Totally the three distinct groups seem to have no differences in Mediterranean Diet score which indicates the level of adherence in this dietary pattern (P, P1, P2, P3 were all over 0,005). Although there were differences between each food category. For example, Greeks of France and Canada have similarly scores in fruits (P2>0,05) and this also happen between Greeks of France and native Greeks .However, Greeks in the country of their origin have lower scores in fruit than Greeks in Canada (4.3±1.1 vs 4.8±0.5 , p <0,001).The same pattern is presented in cereals and in legumes where there is no statistically significant difference between Canada and France and between France and Greece but Greece has lower scores than Canada. (2.3±1.79 Vs 2.9±0.4 for cereals and 2.9±0.8 VS 3.3±0.6 for legumes). Furthermore, score in fish and meat was lower among Greeks in France than among the Greeks in France (2.7±1.2 VS 3.1±0.5 and 2.6±1.1 VS 3.0±0.8 both p <0,05). Score of meat in Greece is higher that France (p<0,05 , 2.9±0.9 VS 2.6±1.1). Greece has also lower score of poultry than Canada (p<0,001, 2.8±0.8 VS 3.1±0.5)

3.3 Area of living and healthy aging

The Successful Aging index (SAI) of the overall sample was 2.8±1.4. Greeks in Canada have statistically significant higher score than their counterparts in Greece and this happened also between Greeks in France and their counterparts in Greece. However, there is no difference between Greeks of Canada and these of France. In Table 3 are presented the results from linear regression models that evaluated the association between lifestyle determinants i.e., age, sex, retirement or not and smoking habits on the outcome of Successful Aging index (SAI). It was found that participants of France compared to their counterparts in Greece had 1.95±0.12 units higher SAI score (p<0.001), after adjusting only for age and sex. This association remained significant, at a difference of 2.07±0.13 units (p<0.001) after adjusting for further lifestyle factors such as retired status and smoking habits. Participants of Canada had 1.73±0.16 units higher SAI score (p<0.001) than the counterparts in Greece after adjusting for age and sex and 1.65±0.17 units (p<0.001) after adjusting for further lifestyle factors such as retired status and smoking habits. Finally, Greeks of Canada and France, together as a group had 1.86±0.10 units higher SAI score (p<0.001 than their counterparts in Greece after adjusting only for age and sex. This association remained significant, at a difference of 1.91±0.11 units (p<0.001) after adjusting for further lifestyle factors such as retired status and smoking habits. Canada scores higher in olive oil than Greece (p<0.001, 4.8±0.8 VS 5.0±0.2)

Table 2. Lifestyle, socio-demographic and clinical characteristics of n= 2,434 participants in total, depending on their residence.

	All (n=2,434)	Greece (n=2,221)	France (n=142)	Canada (n=71)	P	P1	P2	P3
Age(years)	74±7,8	74±7,2	67±13	75±7,5	<0.001	<0.001	<0.001	0.98
Men n (%)	1,290(53)	1,177(53)	61(43)	36(50)	0.07	0.07	0.78	1.00
Retired n (%)	1,850(76)	1,688(76)	91(64)	65(91)	<0.001	0.007	<0.001	<0.001
Good Finance n (%)	487(20)	355(16)	65(46)	51(71)	<0.001	<0.001	<0.001	<0.001
Physical Activity n (%)	1120(46)	910(41)	129(91)	60(85)	<0.001	<0.001	1.00	<0.001
Smoking Habit n (%)	389(16)	400(18)	14(9,8)	1(1,5)	<0.001	0.07	0.22	<0.001
History of hypertension n (%)	1,533(63)	1466(66)	54(38)	41(58)	<0.001	<0.001	0.002	0.21
History of diabetes n (%)	584(24)	533(24)	22(16)	23(33)	0.006	0.10	0.004	0.07
History of hypercholesterolemia n (%)	1,217(50)	1,133(51)	31(22)	42(59)	<0.001	<0.001	<0.001	0.20
BMI (Kg/m^2)	28±6.3	28±4.5	27±1.9	29±3.6	0.058	0.10	0.07	0.98
MedDietScore (range 0-55)	32±5.2	32.4±5.1	31.5±7.7	32.5±3.5	0.14	0.15	0.56	1.00
Geriatric Depression Scale (range 0-20)	2.3±3.3	2.3±3.4	2.5±2.0	2.7±2.6	0.35	1.00	1.00	0.50
Successful Aging Index (range 0-1)	2.8±1.4	2.6±1.3	4.5±1.5	4.3±1.3	<0.001	<0.001	0.61	<0.001

Values are presented as percent (%) or mean ± standard deviation. p: p-values derived from analysis of variance (ANOVA) for continuous variables or the chi-square test for the categorical variables, p[1]: between "Participants of Greece" and "Participants of France" group, p[2]: between "Participants of France" and "Participants of Canada" group, p[3] between "Participants of Greece" and "Participants of Canada" group; after correcting for the inflation of Type-I error with the Bonferroni rule

	All (n=2,434)	Greece (n=2,221)	France (n=142)	Canada (n=71)	P	P1	P2	P3
Cereals (0-5)	2.4±1.7	2.3±1.79	2.8±1.7	2.9±0.4	*<0.0001*	*0.009*	*1.000*	*0.001*
Potatoes (0-5)	3.0±0.8	3.1±0.84	2.9±0.9	2.5±0.7	*<0.001*	*0.11*	*<0.001*	*<0.001*
Fruit (0-5)	4.3±1.1	4.3±1.1	4.5±0.9	4.8±0.5	*<0.001*	*0.02*	*0.23*	*<0.001*
Vegetables (0-5)	3.7±1.8	3.6±1.3	4.3±1.0	4.4±0.6	*<0.001*	*<0.001*	*0.12*	*<0.001*
Legumes (0-5)	3.0±0.9	2.9±0.8	3.1±1.2	3.3±0.6	*<0.001*	*0.06*	*0.17*	*<0.001*
Fish (0-5)	2.9±0.9	2.9±0.9	2.7±1.2	3.1±0.5	*<0.001*	*0.08*	*<0.001*	*0.003*
Meat (0-5)	2.8±0.9	2.9±0.9	2.6±1.1	3.0±0.8	*<0.001*	*0.003*	*<0.001*	*0.13*
Poultry (0-5)	2.9±0.8	2.8±0.8	2.9±0.9	3.1±0.5	*<0.001*	*0.50*	*0.15*	*<0.001*
Full Fat Diary (0-5)	3.2±1.6	3.2±1.6	2.2±1.9	4.0±1.7	*<0.001*	*<0.001*	*<0.001*	*<0.001*
Olive oil (0-5)	4.8±0.8	4.8±0.8	4.8±0.5	5.0±0.2	*0.004*	*1.00*	*0.12*	*0.003*
Alcohol (0-5)	0.5±0.5	0.5±0.5	0.23±0.4	0.5±0.5	*<0.001*	*<0.001*	*<0.001*	*0.61*
MedDietScore (range 0-55)	32±5.2	32±5.1	31±7.7	32±3.5	*0.14*	*0.15*	*0.56*	*1.00*

Table 3. Decomposition of the MedDietScore, by each study region.

Values illustrates mean ± standard deviation score of each of the 11 MedDietScore components.

p: p-values derived from analysis of variance (ANOVA) for continuous variables or the chi-square test for the categorical variables, p1: between "Participants of Greece" and "Participants of France" group, p2: between "Participants of France" and "Participants of Canada" group, p3 between "Participants of Greece" and "Participants of Canada" group; after correcting for the inflation of Type-I error with the Bonferroni rule

Table 4. Results from linear regression models that evaluated the association between lifestyle determinants on Successful Aging Index (SAI) (outcome). Results are presented as b coefficients ± Standard Error (SE), their 95% CI: Confidence Interval and p-value

	Model 1			Model 2		
	b±SE	**95% CI**	*P*	**b±SE**	**95% CI**	*P*
France vs. Greece	1.95±0.12	1.71; 2.19	*<0.001*	2.07±0.13	1.80;2.33	*<0.001*
Age (yrs)	-0.01±0.004	-0.019; -0.004	*0.003*	-0.01±0.004	-0.02; -0.005	*<0.001*
Sex (m/f)	0.69±0.06	0.58;0 .81	*<0.001*	0.63±0.06	0.52;0.75	*<0.001*
Retired (y/n)	-	-	-	0.35±0.07	0.22;0.49	*<0.001*
Smoking (y/n)	-	-	-	0.18±0.08	0.02;0.33	*0.03*
Canada vs. Greece	1.73±0.16	1.42; 2.04	*<0.001*	1.65±0.17	1.3;1.99	*<0.001*
Age (yrs)	-0.01±0.004	-0.02; -0.004	*0.03*	-0.01±0.004	-0.02;-0.01	*<0.001*
Sex (m/f)	0.73±0.06	0.62;0.85	*<0.001*	0.66±0.06	0.54;0.78	*<0.001*
Retired (y/n)	-	-	-	0.37±0.07	0.23;0.50	*<0.001*
Smoking (y/n)	-	-	-	0.18±0.08	0.02;0.34	*0.03*
Canada, France vs. Greece	1.86±0.10	1.66; 2.05	*<0.001*	1.91±0.11	1.70;2.1	*<0.001*
Age (yrs)	-0.01±0.004	-0.02; -0.01	*<0.001*	-0.02±(-0.01)	-0.02;-0.01	*<0.001*
Sex (m/f)	0.68±0.06	0.57; 0.80	*<0.001*	0.60±0.06	0.50;0.70	*<0.001*
Retired (y/n)	-	-	-	0.36±0.07	0.23;0.49	*<0.001*
Smoking (y/n)	-	-	-	0.17±0.08	0.02;0.33	*0.03*

Chapter 4: DISCUSSION

In the introduction and results parts of this study, lots of issues were raised and can be analyzed and justified from different perspectives. The results would be summarized here and the interpretation of stated facts would be explained further in relation to the aim of the present study. However, not all raised facts in the used literatures are in support of the study's results.

The present work revealed that Greeks residents of France and Canada, unlike their counterparts of Greece, are of higher rates in successful aging index. This was mainly attributed to lifestyle differences, since Greeks of Diaspora seemed to be more physically active, especially with them of Canada present the highest percentage of following physical activity. Also, another beneficial lifestyle factor is the limited adoption of smoking among Greeks of Diaspora, related with their counterparts of Greece. Finally, Greeks of diaspora are in a better financial state than native Greek, with Canada have the highest percent residents with good financial status (71%), France with intermediate level (46%) and Greece with the lowest percent of only 16% of its participants. Comparing the older Greeks of Diaspora with the others of the Greek natives, the former ones seem to have had a better lifestyle profile but also better socio-economic environment. Specifically, the percentage of those retired was higher in Greeks than that of Canada, which allows them to give priority to achieving a more healthy life, without the stress they develop; not only because of their jobs, but also of the financial crisis, which is being experienced by their peers in the Greece until the end of the present study.

Researchers support that factors which determine life expectancy or longevity, as well as successful aging, are not definitely apparent and as a result the definition of them are complex (Kolovou et al., 2014). However, it is mentioned that the life and health status may be influenced by environmental and genetic factors, as well as attitudes and culture (Tourlouki et al., 2010). The best example is Ikaria, an island of the Eastern Aegean Sea, that is worldwide recognized for the major proportion of centenarians (Panagiotakos et al., 2011).The land morphology along with the climate of this island are similar to the rest of the other Greek islands. Besides, Greek older residents of these areas, own the same Greek culture but even Greeks of Diaspora may have altered some customs. It is common for people who were born and raised in a different country or even under different conditions, to

maintain the habits of their origin but maybe with some necessary changes (A Kouris-Blazos et al., 1996). For example studies based on older Greek-born Australians have revealed that even if they live in a different country from that of their parents, the Greek roots are still apparent and strong to affect many aspects of their daily life. It seems that the diet of Greek in Australia is very close to what the Mediterranean diet supports and this fact is mainly attributed to the low risk of death regardless of whether they were obese or had cardiovascular disease risk factors (Antigone Kouris-Blazos et al., 1999; Antigone Kouris-Blazos & Itsiopoulos, 2014). Furthermore, the same condition occurs with Japanese older adults born in Brazil and Japan. However, Japanese individuals from Brazil have altered some of the eating habits of their ancestors, due to the lack of specific food ingredients or the existence of some others (Cardoso, Hamada, de Souza, Tsugane, & Tokudome, 1997).

Dietary habits of Greeks from diaspora seems to be quite close with them of Greek natives. Greeks of Canada scored around 32 in MedDietScore, while Greek of France around 31 and their counterparts in Greece. This fact could indicate moderate to good adherence to the Mediterranean diet for all three groups. It has been proved that better adherence to the Mediterranean diet is associated with longevity (Trichopoulou, 2004; Trichopoulou, Costacou, Bamia, & Trichopoulos, 2003; Trichopoulou & Vasilopoulou, 2000). According to the Food and Agriculture Organization (FAO) of the United Nations the consumption of animal fat is 47 g/capita/day in France and 16 in the United States, as it is very common for French people to consume high amount of meat and products full of saturated fat. For this eating habit of French, the term French paradox was coined in 1992 to describe the relatively low incidence of cardiovascular disease in the French population, despite a relatively high dietary intake of saturated fats, and potentially attributable to the moderate consumption of red wine. Although in present study Greeks in France had the lowest intake of meat and full fat diary among the three groups, which may indicate that they do not follow exactly the French diet in this characteristic. Moreover, overall consumption of alcoholic beverages according to FAO is 255 g/capita/day in France and 269 in the United States and especially wine was 145 g/capita/day in France and 19 in the United States. This data is also represented here, as Greeks in Canada had the higher alcohol intake. From the results we would expect that the highest consumption of olive oil would occur in Greece as this local product is abundant in this country and in lower prices than other countries such as Canada. Indeed residents in Greek islands such as Ikaria

consume olive oil exclusively in high amounts (Foscolou et al., 2019). As far as the prevalence of obesity and overweight, it is well-known that USA presents the highest proportion of these worldwide. Specifically, the prevalence of overweight in USA is 64.2 % and the prevalence of obesity in the same country is 28.3%. On the other hand, the prevalence of overweight in the European region is 59.6 % and the prevalence of obesity in the same country is 22.9%. Findings of the present study reveal that the BMI does not differentiate between three groups and maybe the origin of Greek of Diaspora is protective against developing of obesity as they were not influenced by the new residence. However, we cannot be sure if the previous fact is a result of genetic predisposition or other lifestyle behavior such as maintaining the Greek nutrition and general way of life (Chooi, Ding, & Magkos, 2019).

A lot of researches attribute the successful aging of people to the adoption of physical exercise, as it is beneficial for a host of human systems like cardiovascular and respirational (Young, Angevaren, Rusted, & Tabet, 2015) indicating that physical active people achieve a better aging (Gutierrez et al., 2018). Physical activity has been systematically combined with decreased all-cause mortality rates and with probability of late survival (Bembom, van der Laan, Haight, & Tager, 2009; S. N. Blair & Brodney, 1999). A recent meta-analysis, based on only observational studies, revealed a positive, causal relationship between physical activity and healthy ageing (Daskalopoulou et al., 2017). Furthermore, several studies have stated the importance of avoiding sedentary life for achieving a healthy aging. (Blodgett, Theou, Kirkland, Andreou, & Rockwood, 2015; Schwingel et al., 2016).

Many studies such as a recent meta-analysis indicated that prolonged sedentary time is associated with all-cause mortality, cardiovascular disease (CVD) incidence and mortality, type II diabetes incidence and cancer) (Biswas et al., 2015). Regular physical activity is also recognized as an effective preventative measure against and treatment for the control of type II diabetes mellitus (. Prevention and disease management are affected by improved glycemic control via up-regulation of glucose transporters in skeletal muscle following exercise bouts. Physical activity also decreases fat mass reducing intracellular fat stores that are hypothesized to interfere with cell signaling in glucose metabolism and with mobility of glucose transporters. Although research reporting that up to 95 percent of people over 65 agree that physical activity is beneficial to them the reported rates and levels of participation are dramatically low. It is widely reported that up to 50 percent of elderly

people do not regularly participate in adequate levels of physical activity to achieve health benefits of it (Hetherington, 2012). In our study Greeks of Diaspora had almost twice proportion in participation at different physical activities from native Greeks. A possible reason for the previous is the environmental or residential location that may impact on physical activity levels, as our participants were from islands, mainly rural areas, from Greece but Greeks of Diaspora were from larger cities Canada and Marseille-France. In this point there is research that agree with the previous and reveals that rural adults are less physically active than urban and suburban residents (Patterson, Moore, Probst, & Shinogle, 2004). Limited access to exercise facilities, lower income, and less available information regarding specific benefits of physical activity put the typical rural adult at risk for being sedentary (Whaley & Haley, 2008). For example, in some rural settings, low population density, long distances between destinations, and lack of facilities may combine to discourage active transportation by walking ,issues that may not be as common in more urbanized areas (Yousefian et al., 2010).

Smoking habit is one of the most significant risk factors for cardiovascular diseases, and cancer, and a leading risk factor for all-cause mortality. Several studies have underlined the role of smoking on healthy aging or especially the significance of absence from smoking (Burke et al., 2001) as it can reduce the life expectancy of an individual (27,28). A recent meta-analysis has shown that never smokers have more than double the odds of experiencing healthy ageing compared with current smokers (Daskalopoulou et al., 2017). The association between tobacco consumption and frailty or disability and the benefits of smoking cessation in older adults has been previously described (Østbye, Taylor, & Jung, 2002). Other studies have also assessed the benefits of smoking cessation in the prevention of limitation for IADL over long periods of time (Kenfield et al., 2010). Instrumental Activities of Daily Living (IADLs) are activities related to independent living and are valuable for evaluating persons with early-stage disease, both to assess the level of disease and to determine the person's ability to care for himself or herself. In the present work, the same association between physical activity and Successful Aging and smoking habit and Successful Aging are revealed as both of these two factors are aggravating. In the present study native Greeks had an obviously higher proportion of smokers than Greek of Diaspora which agrees with the finding of   OECD (Organization for Economic Co-operation and Development) that Greece has one of the highest smoking rates.

Previous works have found that people being raised under average or above average socioeconomic conditions (as opposed to poor conditions) have increased chances of healthy aging (Ferdows, Jensen, & Tarraf, 2018). Socioeconomic position is positive associated with successful aging through lifetime (Whitley, Benzeval, & Popham, 2018). Considering the influence of financial crisis in Greece, it is evident that native Greeks are in a disadvantaged state as far as their health status and healthy aging. The financial crisis started in late 2000s, and lasted till the end of the present survey, seems to play a certain role in modifying people's health status as they have adopted new behavior adjusted to the lower financial capabilities. For example, it seems that during the years of financial crisis older adults could not afford a diet based on Mediterranean eating pattern and this may happen due to the preference of an unhealthier diet with lower cost. The financial crisis in a country usually affects negatively the behavior and health status of people with low and moderate SES and not the people with high SES. Also, under the pressure conditions of financial crisis, older people turn to adopt other unhealthy behavior like smoking. In addition, they are forced to work until older ages, as retirement cannot help them earning a living and they are more socially isolated. As a result, their mental, physical, social status is declined, and healthy aging is not achieved as other priorities for simply surviving are higher.

Psychological factors are of crucial importance for healthy aging. Many studies have included indicators of mental health, such as depressive symptoms, in order to examine their relationship with Successful Aging. Even if depression is not considered to be part of Successful Aging, it is strongly associated with it (Jeste et al., 2013) and is seems that many older adults value emotional functioning highly, in addition to physical functioning. Negative consequences of depression in late life are manifold, and include comorbidity, disability, complications in comorbidity and mortality. As a result, the present study examines the Geriatric Depression Scale among participants but there are no differences in scores between participants of three groups.

Last but not least, the differences between Greeks of Diaspora and native Greeks maybe are obvious due to inequalities in other factors such as health promotion and health system services. Indeed, Greece spent 9·6% of its GDP, France spent 11·2% and Canada 10·9% of GDP on health, according to "The Statesman's Yearbook" which may affect the easy access of Greeks of Diaspora in health services.

4.1 Strengths and Limitations

The present study is one of the few that contrasted three different groups of participants, all with the same nationality (Greek) but with different residence (Greeks of Diaspora, especially from Canada and France and native Greek) as far lifestyle factors, eating behaviors and healthy aging. Among the limitations of our study, the fact that is a cross-sectional study cannot provide as causal relationships. Accurate definition of healthy (or successful aging) among adults is a challenging task because it is still a controversial case in scientific area. The successful aging index that was used may not accurately estimate the successful aging status. This methodology, however, was based on a standard procedure described in the literature and previously used in other aging-associated definitions (i.e., frailty, healthy aging) (Parslow, Lewis, & Nay, 2011).

Chapter 5: CONCLUTIONS

Definition of Healthy aging is beyond elongation of life, it also emphasizes quality of life as a key concern for health and social care practitioners. To the elderly person, healthy aging means having a sense of wellbeing, the ability to undertake an independent activity, meaningful participation, enjoy supportive environments and positive attitudes or right frame of mind. The experience of aging is a highly individual and subjective experience dependent on a multitude of factors such as the presence of illness or injury, physical capacity, mental health, social support, social participation, socioeconomic status, residential location and personal preconceptions of the ageing journey.

The present work investigated the differences between Greeks of Diaspora and native Greeks, considering the lifestyle factors, eating behaviors and the influence of these to healthy aging. It is obvious that Greeks of Diaspora had higher level of successful aging and this is a possible result of higher physical activity levels, lower adoption of smoking habit and better financial status from their peers in Greece. Public health authorities should focus, control and promote these determinants in order to facilitate the aim of the WHO (2002) for establishing healthy aging worldwide as it has become a public health priority. Future scientific researches are needed to enrich our understanding of the determinants of healthy aging in older age. However, progress may also come from better recognition of opportunities for preventive strategies that start even earlier in the adulthood or even in the childhood. Achieving healthy aging is not only a matter of improving life of individual but from a cost-benefit perspective, a healthier and more industrious older population would result in sizable reductions in medical and hospital expense, welfare costs, and social security payments, while at the same time contribute to an increased gross national product and standard of living. That means that the economy of each country will raise and this is very important for nation welfare but also for people who would be benefit as residents of this country.

Population aging affects all countries, and all income groups .Understanding the cultural traits of immigrants is a key to serving them ethically and sensitively, It is therefore vital to be attuned with the complex parameters that shape the migration experiences of various groups including Greeks so that better support services can be extended to them to smoothen out their integration in the receiving environment.

Psychosocial models have also culminated in the positive psychology movement, with its proponents of the benefits of learnt optimism. It has been postulated that people can learn to see "a bottle half full" instead of "a bottle half empty" and that having a happy outlook is a skill that can be cultivated. Most health care provided in the developed world goes to those aged 65 years or above. The medical model is so dominant that few health professionals are aware of psychosocial ageing. The result is a focus on the burden of old age, the decline and failure of the body. This negative perspective inevitably dominates consultations between doctors and patients. However, there is ample evidence that many elderly people regard themselves as happy and well, even in the presence of disease or disability (Sarkisian, Hays, & Mangione, 2002). Doctors should be aware that many elderly people consider themselves to have aged successfully, whereas classifications based on traditional medical models do not. Health professionals need to respect the values and attitudes of each elderly person who asks for help, rather than imposing our medical model on to their lives (Callahan & McHorney, 2003). Last but not least, health promotion should occur throughout the life-course. It is never too late to adopt healthy behaviors or dismiss unhealthy ones, become more socially engaged, or reap benefits from more supportive environments.

Most of the current health guidelines such as dietary ones support a 'one size fits all' model and there is an emergency to change this since not all individuals within populations share the same dietary risks, food preferences and particularities , common culture, socio-economic environment and other characteristics. Obviously, a more personalized approach to dietary or health interventions may be more acceptable and more beneficial. Future research should realize this challenge or limitation and to clear up the complicated interactions among genotype, diet, lifestyle and environmental factors in order to form and carry out schemes for encouraging rich health outcomes. It comes without saying that personalized nutritional advice and counselling could improve eating behavior and promote healthy ageing to older people independently of their origin and their resident.

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