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Exploring the impact of complex socioeconomic, psychometric and behavioral factors and the social gradient concerning clinical and subjective measures of oral health, in Greek older adults

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Διερεύνηση σύνθετων κοινωνικοοικονομικών, ψυχομετρικών και συμπεριφορικών παραγόντων και διαβαθμισμένων ανισοτήτων σε κλινικούς και υποκειμενικούς δείκτες στοματικής υγείας ατόμων τρίτης ηλικίας, στην Ελλάδα

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ΤΡΙΜΕΛΗΣ ΣΥΜΒΟΥΛΕΥΤΙΚΗ ΕΠΙΤΡΟΠΗ

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Αφιερώνεται στους γονείς μου για το ζην,

στους Δασκάλους μου για το ευ ζην.

“I am indebted to my father for living,
but to my teacher for living well”

Alexander the Great

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Abbreviations

ADL	Activities of Daily Life
DMFT	Decayed, Missing and Filled Teeth
ELSA	English Longitudinal Study of Ageing
ISCED	International Standard for Education Classification
MMSE	Mini Mental State Examination
NDNS	National Dental and Nutrition Study
NHNES	National Health and Nutrition Examination Survey
OECD	Organization for Economic Corporation and
OHIP	Oral Health Impact Profile
OIDP	Oral Impacts on Daily Performance
OHRQL	Oral Health Related Quality of Life
OR	Odds Ratio
SHARE	Survey of Health, Ageing and Retirement in Europe
SEP	Socioeconomic Position
SES	Socioeconomic Status
SSS	Subjective Social Status
SWL	Satisfaction with Life
WHO	World Health Organization

Summary

It is very well-established that there are social inequalities affecting health and mortality. Longevity for those at the lower end of the social status ladder is considerably less attainable than those higher up the ladder; the higher one climbs up the social ladder, the better one's health. In spite of the well-documented differences in morbidity and mortality across the social spectrum, the amount and level of the gradient varies depending on the stage of life, gender, country, indicators of health and indicators of social inequality. These social class inequalities exist for almost all chronic diseases in industrial countries; similarly, these inequalities are also apparent in oral health. However, there is relatively little research available regarding these issues, for both clinical and subjective measures, in the ageing population of industrialized countries. Interest in ageing populations and social inequalities has increased in recent years. Ageing populations and chronic diseases are both concerns for all industrial countries.

This study is a cross-sectional epidemiological study in Athens and the Greater area of Athens. The principal aim of the study is to explore the impact of complex socioeconomic, psychometric and behavioural factors and the social gradient in clinical measures, tooth loss, sum of Decayed Missing Filled Teeth (DMFT), Oral Health Index Simplified (OHIS), as well as subjective measures such as self-reported oral and self-reported general health in a Greek population aged 65 years old and over. More specifically, the purpose is to explore and investigate the association between perceived, subjective and clinical measures of oral health and wellbeing for these older adults, and the extent to which these relationships vary according to socioeconomic indicators (education, occupation, income and subjective social status). Psychosocial factors such as acute and chronic stress, stressful experiences at work, loneliness, social organization, social networks and social support affect health; thus, the study assess whether the social inequalities and the gradient in oral health are influenced by psychometric factors such as: social networks,

cognitive ability, life satisfaction, and loneliness. Inequalities in health are unfair differences that are preventable, discriminating, and unsatisfactory in a present-day society. Reducing these social inequalities in health is a priority for public health officials and epidemiologists in prosperous societies, including many European countries.

Methodology: This is a cross-sectional study especially designed for adults 65 years old and over. The study has ethical approval from the Dental School of Athens, Greece. Participants were residents of Athens and Peireuas Municipalities, members of Day Clubs, who volunteered to participate in the study. Participants were included in the study only after successfully completing a pre-test of four simple cognitive screening questions; this was an indicator that participants were able to communicate and reply accurately and effectively. Data were collected through structured, face-to-face interviews and clinical examinations. Associations were considered as significant when $p<0.05$. Statistical analysis carried out using the Statistical Package for Social Sciences (SPSS) version 24.0 programme

Results: The main results of the present study are the existence of the social gradient in oral health of older adults from two municipalities of Attica region (Municipality of Athens and Municipality of Piraeus). Socioeconomic factors impact perceptions of health and show inequalities and educational, income and occupation gradients. Education, occupation, and income are predictors for Self-Rated Oral Health (SROH) and Self-Rated Health (SRH), and are statistically significantly associated with both SROH and SRH. Oral health hygiene, sum of Decayed Missing Filled Teeth (DMFT), tooth loss, and SROH and SRH in older Greek adults visiting Day Clubs have significant differences according to income, education, occupation and SSS. Associations between oral hygiene Oral Hygiene Index Simplified (OHI-S) and household income is statistically significant. Similarly, these associations are statistically significant for education, occupation and Subjective Social Status (SSS). Subjective social status is the

strongest predictor and verified to be a valid measure for examining health inequalities. Gender, years in pension, marital status, Oral Health Related Quality of Life (OHRQL), and cognitive ability (Mini Mental State Examination test) have an effect on missing teeth. Education, occupation and SSS are also significant predictors for missing teeth and their associations with the number of missing teeth are statistically significant. Participants who reported last main occupation as being manual workers, less educated, in the low steps of the social ladder -subjective social status- (SSS), and with less money were more likely to have a higher number of missing teeth. There are socioeconomic inequalities for DMFT index; the results are significant for household income, education level, occupation, and SSS. All explanatory variables are significantly associated with DMFT, in the examined population. The results are significant for all participants in the analysis; and remained statistically significant when only dentate participants were included. Thus, those with more money, higher level of education, in non-manual occupations and with higher subjective social status are more likely to have lower scores of the DMFT index. Tooth loss, DMFT, OHI-S, SROH and SRH are associated with cognitive ability (MMSE score) in elders, visiting Day Clubs in Athens and Piraeus, Greece. In the examined population those with higher scores of MMSE test experienced fewer missing teeth. Also, those who were older, males, with less years of education, lower income, and felt dryness in the mouth had significantly more missing teeth. Participants who brushed their teeth or dentures less than once a day, visited the dentist only when they had trouble or pain and were manual workers with lower income experienced significantly more missing teeth. Psychometric factors have a significant impact and contribute to explaining inequalities and the gradient; cognitive ability, SWL, loneliness and social network impact and partly explained inequalities and the social gradient.

Conclusions: The results are summarized as confirming oral health gradient inequalities in older adults in Greece, in the examined population. The social gradient in health and oral health exist and

these inequalities do not diminish with age, and psychosocial factors (Satisfaction with life, social networks, loneliness and cognitive ability) partly explain the gradient. These results are significant and help to understand oral health inequalities and the gradient in older people; they are also important for policy makers to identify the nature of oral health inequalities' affecting factors and the gradient; therefore this is helpful for those planning and implementing oral health promotion, and supporting for implementing healthy public policy and legislation for reducing social and health inequalities in adults and evaluating community preventive actions for older people.

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Popie Damaskinos

1st December 2019, Athens

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1. Social, clinical and psychometric factors affecting self-rated oral health, self-rated health and wellbeing in elders.
   Damaskinos P, Koletsi-Kounari H, Mamai-Homata E, Papaioannou W.
2. Social networks, loneliness and oral health in older adults in Attica, Greece.
   Damaskinos P, Koletsi-Kounari H, Mamai-Homata E, Papaioannou W.

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1. The social gradient in oral health in older adults in Greece. Results of a pilot study.
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   Poster Presentation. World Congress on Dental Research - Conference at Dubai, UAE, 2015.
3. Cognitive ability, socioeconomic factors and missing teeth in Greek older adults. Damaskinos P, Koletsi-Kounari H, Mamai-Homata E, Margaritis V, Papaioannou W. Poster Presentation. 23rd EADPH Congress. Palma de Mallorca, Spain, 2018.

PART 1

CHAPTER 1

Introduction

It is very well-established that there are social inequalities affecting health and mortality. Longevity for those at the lower end of the social status ladder is worse than those higher up the ladder. These social class inequalities exist for all chronic diseases in industrial countries with two exceptions; the risk for breast cancer (Strand et al, 2007; Mackenbach 2005; Dano et al, 2003 & 2004; Faggiano et al, 1997; Heck et al, 1997; Mackenbach et al 1997) and melanoma (Hiatt 2004).

The harmful effect of social inequalities on health has been reported and confirmed by previous studies in many countries (Marmot & Wilkinson, 2006; Subramanian & Kawachi, 2004; Braveman et al, 2000; 2005; Townsend and Davidson, 1988; Black Report, 1980). Longevity for those at the lower end of the social status ladder is considerably less attainable than those higher up the ladder; the higher one climbs up the social ladder, the better one's health. In spite of the well-documented differences in morbidity and mortality across the social spectrum, the amount and level of the gradient varies depending on the stage of life, gender, country, indicators of health and indicators of social inequality.

These social class inequalities exist for almost all chronic diseases in industrial countries; similarly, these inequalities are also apparent in oral health (Yfantopulos et al, 2014; Koletsi Kounari & Mamai-Homata, 2007; Pine & Harris, 2007; Sheiham & Watt 2000; Petersen 2003; Locker 2000; Sheiham 2000; Watt & Sheiham, 1999). However, there is relatively little research available regarding these issues, for both clinical and subjective measures, in the ageing population of industrialized countries. Ageing populations and chronic diseases are both concerns for all industrial countries. Thus, the Interest in ageing populations and social inequalities has increased in recent years.

Oral health is a vital element of general health and well-being not only for nutritional purposes but social life, as well (Kossioni,

2018; Kounari & Homata, 2007). Tooth loss affects the lives of older adults, and body mass index is closely correlated with the number of teeth a person has (Watt, 2005; Sheiham, et al, 2002). Oral health also inflicts chewing ability (Kossioni 2018; Österberg et al., 1990; Yamaga et al., 2002), quality of life (Tsakos et al., 2004; 2006), and fitness decline (Okyama et al, 2011). Furthermore, the link between the numbers of teeth one has and one's mortality risk has been found to be significant (Padilha et al., 2008), with mortality increasing by 4% for each missing tooth (Hamalainen et al., 2003). The social gradient in chronic diseases is similar to that of oral health. Sabbah et al, (2007) found a resemblance between the social gradients in oral health and general health in the same people, and cited the unvarying nature in the gradients for both subjective and clinical health outcomes (Sabbah et al., 2007).

Social class is strongly associated with tooth brushing, oral hygiene and smoking; good habits, tooth brushing and oral hygiene, are more common among the professionals and those in higher social class and related to the prevalence and severity of periodontal disease (Watt & Sheiham, 1999). In Japanese workers aged 50-69 years, there were inequalities and a gradient in oral health (DMFT and tooth loss) between workers and professionals (Morita et al., 2007a, b). In a nationally representative sample of Americans aged 17 years and over, there was a correlation between perceived oral and general health and periodontal disease and ischemic heart disease (Sabbah, et al., 2007). The shape of the socio-economic oral health gradient was reported to be linear for oral conditions (perceived oral health, tooth loss, chewing ability) in Australian adults 43-57 years of age. There was an approximately linear relationship of decreasing prevalence for each oral condition across quintiles of increasing relative social status (Sanders et al, 2006).

In Norway, Holst (2008) presented the results of a 30-year-long study examining socioeconomic conditions in light of tooth loss and a functional dentition of 20 or more natural teeth. The results confirmed the existence of the social gradient for these

oral conditions in 2002, but it was less obvious than it had been in 1975; however, the social gradient was persistent and steeper in the elderly (Holst, 2008).

Chronic non-communicable diseases and conditions, such as cardiovascular diseases (mainly stroke and heart disease), hypertension, cancers, chronic respiratory diseases, diabetes, and oral diseases have all had a major impact on global mortality and disability. All of these share a set of preventable common risk factors including poor quality of diet and nutrition, smoking, excessive alcohol intake, inadequate hygiene and trauma. Chronic diseases are mainly related to lifestyle determined by social, economic, cultural, political and environmental factors (Petersen, 2003; Sheiham & Watt, 2000). According to WHO, oral health and oral diseases are influenced by socioeconomic status. The persistent association between income, occupation and educational level, and the prevalence and severity of oral diseases is well known for all age groups in all countries.

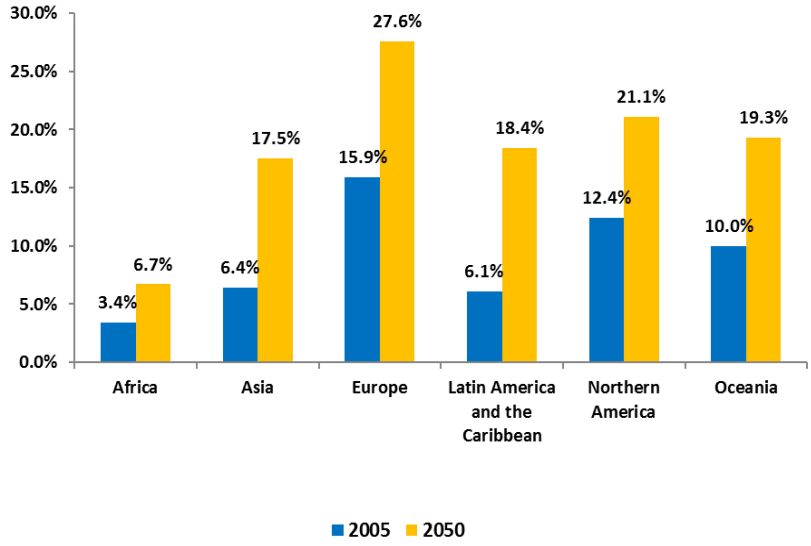
Oral health inequalities are considered as differences in oral health that are avoidable, unfair and unjust in modern society (World Health Organization. Equity, social determinants and public health programs, 2010). Only a limited number of studies have assessed the effect of socioeconomic differentials on the social gradient of oral health for older adults aged 65 years and over in terms of both clinical and subjective measures (Holst, 2008; Sabbah et al, 2008; 2007; Jamieson & Thomson, 2006). The social gradient in physical and mental health has been found among Greek adults (Theodosiou & Zangelides, 2006).

1.1. The Importance of an Ageing Population

'Humanity is growing older' (Bowling & Ebrahim, 2001, p.223).

Demographic ageing is one of the key issues faced by industrialized countries. The segment of the population aged 65 and over is growing faster than any other age group (Fig.1). Demographic shift has occurred through public health welfare policies and socioeconomic development, though declining birth rates have also had a significant impact. As a result, modern industrialized societies need to consider how best to support older people with respect to their health, functional capacity, social participation and their security (UN, 2019; WHO, 2009; Ferrie and Baker, 2006).

Figure 1: Demographic Change: United Nations Programme on ageing, indicating the percentage of the population aged 65 and over in major areas around the globe in 2005 and 2050 (UN, 2019).

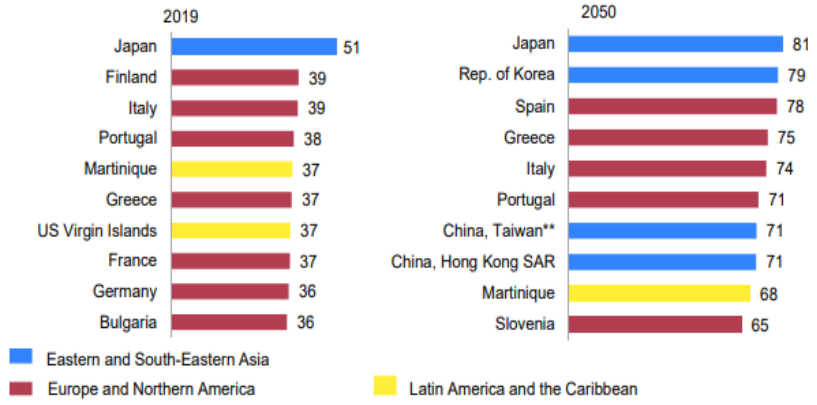


Source: United Nations, Department of Economic and Social Affairs, Population Division.

The report of Eurostat (2019) on population structure and ageing is highlighting the impact of demographic ageing within the European Union (EU). The profile of the EU28's age pyramid is changing and restructuring because of low birth rates and higher life expectancy. The increasing share of older people in the total population is expecting to upturn because increased percentage of the post-war 'baby-boom generation' will retire (Eurostat, 2019).

Figure 2, presents the ten countries (areas) with the highest old-age dependency ratio (OADR) for estimated projections through the years 2019 and 2050. The old-age dependency ratio (OADR) is defined as the number of old-age dependents (persons aged 65 years or over) per 100 persons of working age (aged 20 to 64 years).

Figure 2. Ten countries or areas with the highest old-age dependency ratio (65+/20-64), in 2019 and 2050



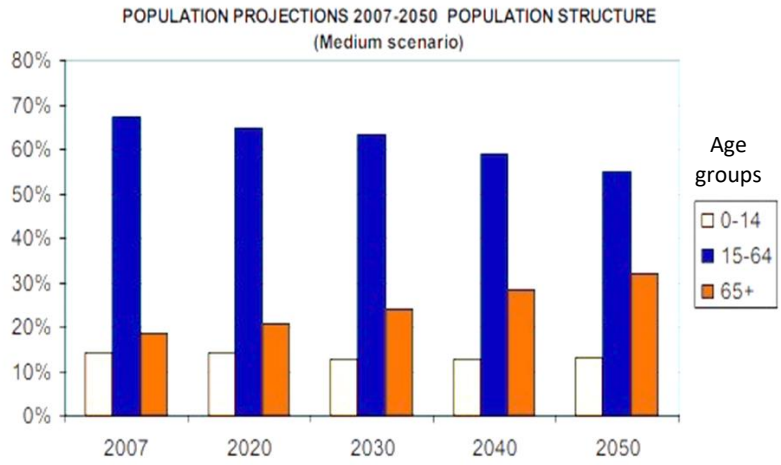
Source: United Nations, Department of Economic and Social Affairs, Population Division (2019). *World Population Prospects 2019.*
*Excluding Australia and New Zealand.
** China, Taiwan Province of China.

1.2 Demographic Changes in Greece

The demographic shift towards a 'grey' society is also evident in Greece, as the 65 years old and over age group has been significantly increasing in recent years (Daniilidou et al 2003;

Emke-Poulopoulou, 1990; General Secretariat of National Statistical Service of Greece, 2007). This ageing demographic profile for Greece is due to a combination of factors: (a) reductions in fertility, especially after 1960 (b) increased life expectancy; and (c) migration (Commission of the European Communities; 2005; Mouriki et al, 2002), and (d) life style changes, i.e. late family life, and smaller families. The forthcoming demographic changes (medium scenario) in the structure of the Greek population are shown below (Figure 3).

Fig. 3: Forthcoming Changes in the Structure of the Greek population



Source: General Secretariat of National Statistical Service of Greece.

http://www.statistics.gr/documents/20181/995904/Population+projections+for+the+years-+Note+%28+2007+-+2050+%29/720fb616-b2bb-4c31-add1-6f57a8b384c9?version=1.0

As shown in Figure 3, the Greek population is expected to shift significantly between 2007 and 2050 towards a rapidly ageing population and those aged 65 years and over is expected to rise from 18.5% of the population in 2007 to 32% by 2050 (medium scenario).

CHAPTER 2
Literature Review

'Systematic social differences in health that are judged to be avoidable are unfair, inequitable. Putting these inequalities in health right is a matter of social justice'.

Marmot and Friel, 2008

2.1 Social Inequalities

Health inequality is a term used to describe differences in health that are preventable, unsatisfactory and unfair in a present-day society (Daly et al, 2002), while health equity is the absence of disparities in health between different social groups (Braveman & Gruskin, 2003). Some health inequalities are avoidable, unfair, unnecessary and unjust, and uncontrolled by the individual; then the consequence is health inequalities and inequity in health. Inequality, is the unfair situation in society when some people have more opportunities, money etc. than other people. In accordance with this definition the American Dictionary defines inequality as lack of equality or fair treatment in the sharing of wealth or opportunities.

According to WHO (2019) ''Health inequalities can be defined as differences in health status or in the distribution of health determinants between different population groups. For example, differences in mobility between elderly people and younger populations or differences in mortality rates between people from different social classes. Some health inequalities are attributable to biological variations or free choice and others are attributable to the external environment and conditions mainly outside the control of the individuals concerned. In the first case it may be impossible or ethically or ideologically unacceptable to change the health determinants and so the health inequalities are unavoidable. In the second, the uneven distribution may be unnecessary and avoidable as well as unjust

and unfair, so that the resulting health inequalities also lead to inequity in health'' (WHO, 2019).

Another definition for health inequalities was introduced by Mackenbach and Knust in 1997. They presented a summarizing, brief definition of health inequalities: "Health inequalities are the differences in the prevalence or incidence of health problems between individual people of higher and lower socio-economic status" Mackenbach and Knust, 1997).

Numerous studies have confirmed the existence not only of health inequalities but also of a social gradient in disease, morbidity and mortality across populations. Inequalities in health and mortality affect not only the least affluent and the most advantaged but they are also distributed across the socioeconomic spectrum, in individuals, countries and nations (Batley, 2004; Kunst, 1997; Mackenbach et al., 1997; Marmot, 2001(a)(b); Marmot, 2004; Subramanian SV & Ichiro Kawachi, 2004). Reducing these social inequalities in health is a priority for public health officials and epidemiologists in prosperous societies, including many European countries (Mackenbach, et al., 2000; Mackenbach, et al. 2007; Siegrist & Marmot, 2006; Stafford, et al., 2008). The destructiveness of health inequality is not limited to those suffering hardships or to the less affluent people in a society. Rather, it affects a society's whole spectrum. The existence of the social gradient in morbidity and mortality is present in every grade of the socioeconomic status. The first Whitehall study of British civil servants revealed that men in the highest administrative grade had four times lower mortality rate than younger men in lower employment grades (Marmot, et al. 1997; Marmot, et al., 1978). In other words, the higher one climbs up the social ladder, the better one's health. In spite of the well-documented differences in morbidity and mortality across the social spectrum, the amount and level of the gradient varies depending on the stage of life, gender, country, indicators of health and indicators of social inequality (Siegrist & Marmot, 2006).

2.2 Social Inequalities and Social Gradient in Health

The time at which one dies is related to one's class
Antonovsky, 1967

Historically, there is evidence that social determinants have been recognised as affecting and leading to social inequalities in health. Social conditions and environments have been reported as determinants of health since the fifth century B.C. (by Hippocrates), and in modern times by Chadwick, Villerme, Virchow, Farr and more recently, the Black Report (Lynch & Kaplan, 2000(b); Marmot & Friel, 2008; Siegrist & Marmot, 2006; Whitehead 1992, Whitehead & Dahlgren 2006).

Social inequalities in health are of great concern to public health officials and epidemiologists in many countries, including prosperous societies (Siegrist & Marmot, 2006), as differentials in morbidity and mortality among the socioeconomic groups remain a problem (Adler & Ostrove, 1999; Antonovsky, 1967; Davey Smith, 1996; Davey Smith & Egger, 1996; Link & Phelan, 1995; Lynch & Kaplan, 2000;Lynch, et al., 1998; Marmot, et al., 1987).

Unequal distribution of income and inequality in occupation and education contribute to differences in health outcomes; health inequalities are persistent for all: the more affluent and privileged and the less affluent (Adler & Newman, 2002). However, Marmot (2001(a), 2004) made it clear that poverty alone is an insufficient explanation for the inequalities in health standards in and among nations.

Theories of relative and absolute deprivation and negative social comparisons have been examined and these hypotheses have been debated by scientists for many years. Wilkinson (1997) argues that both material and social influences affect inequalities in health, but relative status and social comparison

entail the effect and contribution of psychosocial pathways. 'Mortality in developed countries is affected more by relative than absolute living standards' (Wilkinson, 1997).

Psychosocial stress is a more profound determinant than absolute deprivation and the social gradient affecting health emphasises its universal impact on everyone, whether poor or rich; advantaged or disadvantaged. Regardless of one's position in the hierarchy, those higher up enjoy better health outcomes than those lower down (Marmot, 2001(b), 2004; Wilkinson 1999).

While socioeconomic status (SES) and unequal opportunities are fundamental causes of health inequalities (Adler & Ostrove, 1999; Link & Phelan, 1995; Kim and Durden, 2007), argue that studies have paid too much attention to SES and its impact on social inequalities in health, while the role of age differences in health outcomes remains unclear and further research is needed in this area.

Interest in ageing populations and social inequalities has increased in recent years. However, the results of both cross-sectional and longitudinal studies are inconsistent. A synopsis of these results is presented below in Table 1. Overall, this table summarizes patterns of social inequality in adults and older people as reported in studies from 1980 to 2017, and differences in both methodologies as well as the socioeconomic and health indicators used. The social gradient in health in older age groups is puzzling, as the results are not consistent. While the results from cross-sectional studies found fading or declining evidence of the social gradient among the oldest age groups (Huisman, et al 2003; Macintyre & Hunt, 1997; von Dem, 2003), results from longitudinal studies are contradictory, as greater inequalities were found in health in older people (Chandola, et al, 2007; Ferrano & Farmer, 1999; Hoffman, 2005) and the positive association of education and health inequalities in older age (Ross & Wu, 1995). Further, in other studies, inequalities have been shown to be less obvious in older adults (Beckett,

2000; House et al., 1994; Liang et al., 2002). Moreover, Knesebeck, et al., (2007), reported that socioeconomic differences in quality of life do not diminish after the age of 65.

Bowling (2003) suggests that the inconsistent results highlighted above might be due to the social indicators and health measures used, and considered that the main problem for measuring social inequalities in older people is choosing the foremost measure to reveal ranking inequalities, enabling the social gradients in health to be examined. In a study of the social gradient in morbidity and mortality, a model should be applied that encompasses the issues of age and social inequalities in health, and should be sufficient to recommend measures that are appropriate for evaluating SES in older people.

Explanations of the diversity and variation of the results for age and socioeconomic inequalities in health are the competing hypotheses of the 'cumulative advantage theory' and the 'convergence' theory (House et al., 1994; Ross & Wu, 1995). The first theory supports the idea of increasing inequalities with age, and holds that assembled resources create significant diversity amongst older, rather than younger, ages. The second theory supports the view that inequalities diminish in old age because of socio-economic deviation and the influence of the middle years of age; those years during which labor is greatly affected by psychological, behavioral, and environmental risk factors that are part of the subject's quality of life (Knesebeck et al., 2007). Nazroo (2017) in recent research and analysis of the English Longitudinal Study of Ageing, showed increasing inequalities in health in later life across cohorts. His concerns and agonize are the unclear explanations for these changes and recommended reconsideration on policy options for older adults (Nazroo, 2017).

Table 1 (part 1&2), below, shows studies in aged people and measures used and patterns of social inequality (converging or diverging in later life).

Table 1: Studies and Measures of Social Indicators in Aged People (Part 1/2)

Reference	Indicator	Health / Disease	Age	Patterns of social inequality
Black Report, 1980; Townsend et al 1988	Occupation (O)	Mortality among retired men	65-79y	Diverging
Newacheck et al. 1980	Poverty status	Activity limitation	adults	Converging in later life
Aneshensel, Frerichs and Huba, 1984	Income	Mental and Physical health	adults	Consistent diverging gap
House et al, 1994	Education (E)	Physical health	>50	Converging in later life
Martelin, 1994	E, O,	Morbidity & mortality	≥ 60y	Converging in later life
Elo and Preston, 1996	Education	Mortality	≥ 35y	Converging in later life
Ross and Wu, 1996	Education	Physical health	18-90y	Diverging
Marmot and Shipley, 1996	SES	Morbidity & mortality	40-90y	Diverging
Van Rossum et al, 2000	SES	Morbidity & mortality	40-69y	Diverging
Beckett 2000	Education	Physical health	adults	Converging in later life
Miech and Shanahan, 2000	Education	Depression	>50	Diverging
Merlo et al, 2003	Income	mortality	40-80y	Converging in later life
Mishra, Ball, Dobson and Byles, 2004	Wealth	Self-reported health Functional impairment	45-75y women 70-75y	Converging in later life Converging in later life
Huisman et al, 2004	SES	Morbidity & mortality	50-90y & >90y	Diverging

Table 1: Studies and Measures of Social Indicators in Aged People (Part 2/2)

Reference	Indicator	Health / Disease	Age	Patterns of social inequality
Matthews et al. 2005	SES, Adequacy of income (Subjective)	Disability	≥75y, 70-79y 80-84y ≥85y	Converging in later life
Koster et al, 2005	SES, ownership, and assets	Mobility limitation	70-79y	Diverging
Herd 2006	Education	Physical health	>50	Converging in later life
Minkler et al, 2006	SES/poverty line	Functional limitation	≥55y	Converging in later life
Kim & Durden, 2007	SES	Physical; Mental Health	>25	Diverging
Dupre M., 2007	Education	Physical health	25-74	Converging in later life
Knesebeck et al. 2007 (SHARE Study)	Education, Income Home ownership	Quality of life	≥50y	The results vary according to the country
Chandola et al, 2007	Occupational grade	Self-reported health	35-74y	Diverging
McMunn, Nazroo, Breeze 2009	Wealth	Functional impairment SRH, Heart disease	Aged 50 or older	Converging in later life
Nazroo James 2017	Wealth Last main job	Health and well-being, cognitive function, Quality of Life, self-report health, frailty	Aged 50 or older	Diverging (widening)

2.2.1 Measuring Inequalities

Social class and prestige or social status, are the most prominently used measures representing social position, based on theories of social structure. The choice of this measurement method relies on an individual's preference for the theory of social structure (Bartley, 2004). Three major sociological traditions have impacted knowledge and must be considered when measuring socioeconomic position regarding health: the theories of Marx, Weber and the Functionalist perspective (Lynch & Kaplan, 2000).

Socioeconomic position (SEP) includes class, status and wealth measures (Bartley, 2004) and refers to economic and social aspects that give shape to an individual's position in a society (Adler, et al., 1997; Lynch & Kaplan, 2000). Moreover, SEP has been used in assessing mortality and morbidity inequalities in both children and adults (Khang, 2005; Nabi et al, 2008; Tillin et al, 2007).

The term 'socio-economic status' has been used in the social epidemiology and found to be interrelated with health outcomes (Adler et al, 1999; Link and Phelan, 1995) in chronic diseases such as diabetes, cardiovascular diseases, hypertension, arthritis, and other diseases like cancer and even low birth weight (Banks et al., 2006; Adler & Newman, 2002; Marmot et al., 2001). Link and Phelan (1995) argue that social conditions and SES are fundamental causes of health inequalities (Link & Phelan, 1995; Phelan & Link, 2010).

In an extensive review measuring class in the United States' public health system, Krieger et al, 1997, identified methodological concerns regarding the socioeconomic parameters in use and suggested multilevel measures for SEP (e.g. income, poverty, deprivation, wealth, education); moreover data should be collected at the individual, household, and neighbourhood level (Krieger & Fee, 1996).

Grundy and Holt (2001) searched for the best indicators to use for people aged 55 to 69. They used seven different indicators (social class of last occupation, income, educational qualifications, housing tenure, household resources, Townsend deprivation indicators and car affordability). Their results showed that all seven indicators highlight differences in self-reported health, but the best pair of indicators were educational qualification or social class paired with a deprivation indicator.

Although these measures have been used in various studies, as illustrated above, occupation-based measures have limitations, as they can only be used for working people who are presently employed, but not for homemakers, the unemployed, children and the retired (Arber, 1991; Martelin, 1994; Krieger et al., 1997). For these groups, measurements of social and occupational class must be based on proxies, for example:

(I) Last main occupation (for the unemployed, those not engaged in formal employment, and retired workers)
(II) Spouse's occupation (for homemakers, those not formally employed or caregivers)
(III) Parent's occupation (for children).

The present study's population is mostly retired, and many of the women involved are homemakers, therefore all of the above proxies will be used. The reason for using the last proxy, even though children are not being studied, relies on the fact that parents' occupations will provide us with information regarding circumstances and adverse conditions the present study's participants likely faced during childhood (Krieger & Fee, 1996; Arber & Ginn, 1993).

Limitations in relation to the use of education measures is the fact that they measure years of education, but there is no information on the quality of those years. Moreover, the amount of education available in 1950 might be equivalent to that of 1990, but there are likely differences in the quality, quantity and nature of the knowledge attained (Krieger et al, 1997). However, education remains an essential indication of

socioeconomic position when examined in a lifespan trajectory, as it can account for the socioeconomic position of the child's parents (Lynch & Kaplan, 2000).

Rose (2008) showed that the social gradient for literacy levels of young adult offspring is relevant to parental education; educated parents have children who perform better. It should be noted that in terms of literacy, the gradient is steeper for Sweden and Canada than for the United States (Rose, 2008).

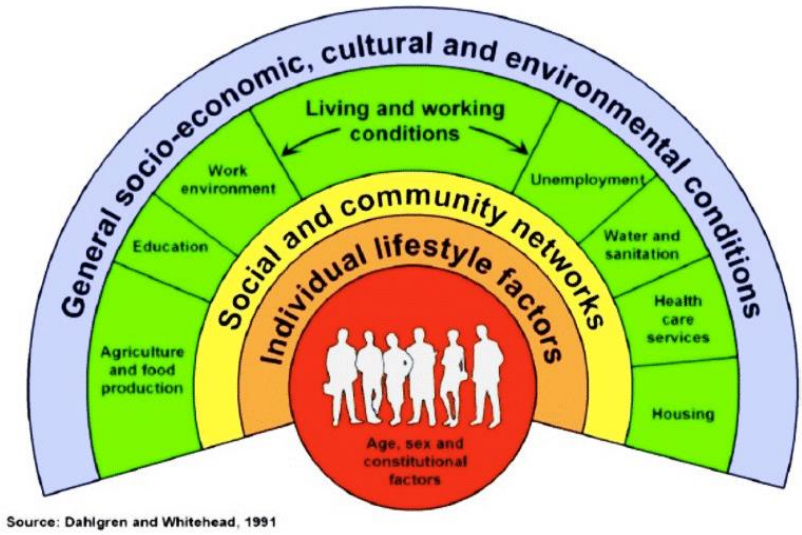
Martelin, (1994) argues that in epidemiological studies of the elderly, decisions on appropriate measurements should be based on the study's purpose. Lahelma et al, (2004) suggest that the use of a single socioeconomic indicator is not appropriate when examining health inequalities, as the effect of each socioeconomic factor on health is either mediated or explained by other socioeconomic indicators.

2.3 Social Determinants of Health and Oral Health

Social determinants of health are the conditions where people are born and live. Determinants of health affecting the abnormal distribution of disease and illness are: socioeconomic and environmental conditions, cultural, lifestyle, behavioral and gender differences, environmental and early life circumstances, living and working conditions, social and community influences, and hereditary factors (genes).

Dahlgren and Whitehead (1991) created the rainbow of social determinants (Figure 4) that encompass the main determinants of health: poverty, education, social exclusion, unemployment, discrimination, poor housing, unhealthy early childhood conditions and food supply.

Figure 4: The rainbow of social determinants (Dahlgren and Whitehead, 1991)



Rainbow of social determinants. Explanation of the four layers:
Layer 1: The general socioeconomic, cultural and environmental conditions (outer layer).
Layer 2: Living and working conditions, food supply, education and access to health care.
Layer 3: Social and community relationships.
Layer 4: Lifestyle (personal behaviour, smoking, drinking, diet, exercise).

During the last years researches were interested in the third layer of the Rainbow thus social and community relationships or psychosocial environment. Oral health is affected by the same determinants as general health - social, economic, cultural, environmental and behavioural (Daly et al., 2002; Hobdell et al., 2002; Sheiham 2000(a); Watt & Sheiham, 1999). Social determinants of health produce inequalities and a graded distribution of diseases across the whole spectrum of society in and between nations. These are the underlying causes or roots of the causes or "causes of the causes" (Marmot, 2005).

“Money, status, power and control over life and opportunities to participate fully in a society are powerful determinants of the social gradient” (Marmot, 2002). Accordingly, those being in the privileged group where people who had jobs, financial security, social participation and social network resources; all these are factors affecting individuals’ sense that they governor their life.

As presented in the Rainbow model (Fig.4) in the second layer, food is an essential determinant of health (Dahlgren & Whitehead, 1991; Robertson et al, 2006). Oral health inequalities are particularly determined by differences in practices and schemes of consumption of non-milk extrinsic sugars and use of fluoride toothpaste (Watt & Sheiham, 1999). There is evidence that optimal fluoridation of communal water supplies is a low-cost procedure that authentically diminishes oral health inequalities that are caused by socioeconomic disadvantage (Hobdell et al., 2002). Sanders et al. (2008) found that affluent neighborhoods protect tooth retention among adults with a low-income, and argue that community resources, not just individual behaviors, are essential determinants of health (Sanders et al., 2008). Moreover, in another study Sanders et al (2005 c) revealed that risk behaviors for oral and general health have a tendency to cluster among individuals without homeownership and those with lower levels of education. Lack of access to material resources and social participation in a geographical area (area deprivation) had an impact in oral health in some studies (Lang et al., 2008; Locker & Ford, 1996; 1994), but not in others (Bower et al., 2007).

The social determinants of oral health are multidimensional: psychosocial (Sisson, 2007; Watt, 2007; 2005), economic, political and environmental (Watt, 2005).

2.3.1. Psychosocial Factors and Oral Health

Psychosocial refers to the subject's psychological development, social interactions and considerations, needs, experience and personal perceptions and culture influences in this social environment.

Psychological and interpersonal social factors, depression and loneliness were examined and found to be associated with periodontitis in adults (Monteiro da Silva et al, 1996). However, there were no associations between depression measured with Geriatric Depression Scale (DGS-5) and oral health outcomes in older Greek adults (Gkavela, 2019).

Psychosocial effects on oral conditions were shown to be of more important to socioeconomic circumstances of the subjective oral health of adults 60 to 65 years in Liverpool from both affluent and deprived communities (Tickle et al., 1997).

Psychological distress (Stansfeld et al., 2002) and low job control (Bosma et al., 1997; Marmot et al., 1997) were associated with coronary heart disease in the Whitehall II study. Work stress has been associated with periodontal disease (Marcenes & Sheiham, 1992), and chronic stress was found to be positively related to elevated plaque and gingivitis levels (Hugo et al., 2006). Additionally, academic stress in medical students was found to be associated with nonperformance of oral hygiene and increased plaque accumulation (Deinzer et al., 2001).

Increased stress was also associated with periodontitis in the case control studies (Castro et al, 2006; Croucher et al, 1997; Moss et al, 1996), in case series (De Marco, 1976) and in cross sectional studies (De Silva et al, 1996; Genco et al, 1999; Hugoson et al, 2002). According to Genco et al (1999) stress is either associated with a trigger of the hypothalamic–pituitary-adrenal axis and the result is to release a corticotrophic hormone (hypothalamus), adrenocotropic hormone (pituitary gland) and glucocorticoids (adrenal cortex) or may be associated

with a poor diet, increased smoking and the lack of oral hygiene resulting in an increased risk of developing periodontitis.

Psychosocial circumstances during childhood have a long-standing inferential effect on oral health outcomes over the lifespan (Sanders & Spencer, 2005a; Sheiham & Nicolaou, 2005; Nicolaou et al., 2003a; 2003b; 2003c; 2007). Moreover, Sheiham & Nicolaou (2005) found that there was a gradient in periodontal diseases. Furthermore, it has been determined that Brazilian adolescents' Self-rated oral health is associated with psychosocial factors (Pattussi et al., 2007).

Yiostalo et al, (2003) examined optimism and life satisfaction as determinants of general and oral health behaviors. Their results showed that education, life satisfaction and optimism were associated with general and dental health behaviors. Associations were stronger for general health behaviors, but the effect of income was stronger for oral health behaviors, suggesting that optimism and life satisfaction are determinants for both dental and general health behaviors (Yiostalo et al., 2003).

Analysis of data from NHANES III, found a social gradient in both general and oral health. They used a marker of stress (allostatic load) to explain educational gradients in both general health (ischemic heart disease) and oral health (periodontitis), after adjusting for the allostatic load. Indicators of the allostatic load were found to be associated with ischemic heart disease and periodontal disease and had a mediating effect that partly explained the social gradients in both diseases. Their results showed a possible common stress pathway that correlated the socioeconomic position to both conditions (Sabbah, et al, 2007).

2.3.2 General and Oral Health of Older People

The World Health Organization's "Active Ageing" policy framework, introduced in 2002, suggest and holds oral health as a significant factor in the health of older people and emphasizes oral health promotion and the effect of oral diseases on a

person's general health and quality of life. Emphasis was given to a widespread of acceptance in developed and developing countries' oral health policy makers. They should embrace appropriate strategies, and organise affordable oral health services for older people, as the need for care is typically greater for disfavoured and vulnerable groups (Petersen & Yamamoto, 2005; WHO, 2002).

2.3.3. Social Inequalities and Gradients in Oral Health of Older Adults

Studies reveal the existence of a gradient in general and oral health outcomes that is affected by a patient's socioeconomic position in society. Inequality indicates that individuals in poverty have poorer health while the gradients show that at each lower level of the social hierarchy, individuals have worse health than those directly above them. Thus, the social gradient is not only for the poor and does not rely only on absolute deprivation or poverty, but is mainly accounted for by relative socioeconomic position (Sabbah et al., 2007; Lopez et al., 2006; Marmot 2004; Marmot & Wilkinson, 2001; Locker, 2000; Marmot, 1994;1996; Adler et al., 1994). The socioeconomic gradient in health invoke as the worse health of those being in lower socioeconomic position, regardless of the socioeconomic measures to use (education, income, occupation) and this apply for all, even those who have more opportunities and are in relatively high economic position (Kawachi et al, 2002; Adler & Ostrove, 1999). Thus, the social gradient in health is a term used to define the spectacle whereby people who are more advantaged in terms of socioeconomic position have better health, and longevity, than those who are less privileged or fortune. The dynamic of class, and occupation gradient differences in health are shown in the Black Report and the Whitehall study of British civil servants. There was a sharp inverse association between social class and health and mortality; those in lower jobs and social status had worse health and mortality rates from those just above their occupation or

perceived social status. Those in the lowest social strata had shorter lives, with more health problems than those in the level above them; for each level there are differences compared to those on each higher step of the social ladder and a gradient; from the bottom to the highest point (Donkin A, 2014).

While research on inequality focuses on the effects of material conditions and the use of services (access to better housing, nutrition and health care), relatively little research has focused on the potential effects of psychosocial factors in explaining the social gradient in health. Individuals with higher SES are exposed to less stress than the individuals with lower stress provoked by the socioeconomic hierarchy on health (Adler & Snibbe, 2003).

The social gradient in the oral health of older people has been examined and reported to exhibit similarities with those of general health (Sabbah et al, 2008), to exist in subjective measures (Tsakos et al., 2009) and in clinical and subjective measures (Holst, 2008; Sabbah, et al., 2008; Sabbah et al., 2008; Sabbah et al., 2007; Damaskinos et al, 2016; Gkavela, 2019). Studies exploring and explaining the social gradient in oral health use either clinical measures (Holst, 2008; Perera & Ekanayake, 2008; Morita et al., 2007a; Morita 2007b; Thomson & Mackay, 2004; Zurriaga et al., 2004; Poulton et al., 2002; Lopez et al., 2001; Watt & Sheiham, 1999) or subjective measures (Tsakos et al., 2009; Sanders et al., 2006; Stahlnacke et al., 2003) or both clinical and subjective measures (Sabbah et al., 2008; Sabbah et al., 2007; Damaskinos et al, 2014) for oral health outcomes. The limited number of studies indicates that there is a gap in the literature, as little research has examined the social gradient in the oral health of people 65 years and over of age.

2.4 Pathways and Mechanisms of the Social Gradient

The Black Report (1980) identified four possible explanations for health inequalities in mortality in UK: artefact, natural and social selection, materialist/structuralist, cultural/behavioral.

- *Artefact*: the association between social class and health were possibly magnified because of artefact, and the way occupational class was measured.
- *Natural and social selection*: health determines social class as a consequence of health-related social mobility (those in good health move up the social class while those in poor health to move down the occupational scale).
- *Materialist/structuralist:* social class determines health because of social class differences in the material circumstances of life (living and working conditions). Higher social groups have less risks and exposure to hazards. Those in the lower social groups live in poorer housing, work in risky, dangerous work, determinants that impact health.
- *Cultural/behavioral*: smoking habits, alcohol, exercise, food and nutrition. Social class determines health via social class differences in health -damaging or health-promoting behaviors (health-related lifestyles).

The above proposed mechanisms and pathways to explain and illuminate inequalities and the social gradient in health in the UK have provoked arguments for three decades, and additional pathways and models have been suggested to elucidate socioeconomic health inequalities (Commission on Social Determinants of Health, 2007; Siegrist & Marmot, 2006; Macintyre S, 1997). Hertzman et al (1994) suggested a model of six explanations: reverse causality (the sick become poor), differential susceptibility, individual life-style, physical

environment (potential harmful effects of exposure to physical, chemical and biological agents), social environment (and psychosocial response) and differential access to/ response to health care services. Thus, it is not only poverty that counts for inequalities in health.

Smith & Morris (1994), analyzed socioeconomic inequalities and mortality in Glasgow, and revealed inequalities for those relatively well off, and thus absolute poverty could not be an explanation for these inequalities. They suggested that the explanation could not rely on the notion of absolute poverty. Bartley (2004) suggested five mechanisms and explanation types for the gradient: material wealth, cultural and behavioral factors, life course, psychosocial factors and political economy. Other mechanisms have been investigated to explain differences in health and the social gradient; early life environment (Barker 2004; Fuhrer et al, 2002; Kuh & Sholomo, 1997; Power & Hertzman, 1997); psychosocial (Lynch et al, 2000a,b); differential health behaviors (Blank & Diderichsen, 1996; Lantz et al., 1998; Lynch et al, 2000a); differences in access to medical care (Bunker 1995; Larson & Halfon, 2010); social relationships (Stansfeld 1998; 2003; Berkman & Syme, 1979), cognitive function (Damaskinos et al, 2018a,b; Tsakos et al., 2009; Sabbah et al, 2008; Sighn-Manoux et al, 2005; Berkman & Glass 2000); psychobiological process (Steptoe & Ayers, 2004; Ayers et al, 2007); chronic stress and allostatic load (Sabbah et al., 2008; Cohen et al., 1985b; McEwen & Seeman, 1999; Brunner, 1997) and 'control beliefs' (Adler et al., 1994; Bosma 2005; Marmot 2004). Fuhrer et al, (2002), in a cross-cultural comparison suggest that some common susceptibility such as early childhood environmental factors and adult psychosocial work characteristics, may highlight the social gradient in health and disease.

Moreover, genetic differences (McGue, 1997), occupational factors (Boffetta et al., 1999), job stress (Bosma et al,1998; 2005; Wamala et al., 2000; Marmot, 1997), and nutrition (Davey

Smith & Brunner, 1997), all have been examined as possible explanations of social inequalities and the gradient in health.

2.4.1 Behavioral Factors and Oral Health

Oral health as part of general health, is also affected by personal behavior and lifestyles, and access to health care services. Thus, lifestyles are often the center of interest of health promotion interventions. Many of the elders are medically compromised and take medications. Those that are able to have a daily oral hygiene and regular dental attendance have better oral health, than those who cannot brush their teeth daily or have no regular dental visits. Health damaging behaviors are differentially distributed across individuals with different socioeconomic status or social class, and contribute to inequalities and the gradient. Positive health behavior is an essential determinant and protective factor for health.

Health is connected and associated to individual social, working, and economic conditions, environmental, cultural, behavioral factors and personal lifestyle. In developed countries when analyzing risk factors for diseases, mortality, and trauma the impact of health behavior is exposed. Health behaviors can be both a reason for a disease but also the path to prevent disease and avoid or limit other behavior-oriented problems.

Determinants of health affecting the abnormal distribution of disease and illness are: socioeconomic and environmental conditions, cultural, behavioral and gender differences, environmental and early life circumstances, living and working conditions, social and community influences, lifestyle and hereditary factors (genes). Cultural, lifestyle, and behavioral health damaging behaviors freely chosen by individuals in different social classes explain in part health inequalities. Health damaging behaviors are differentially distributed across individuals with different socioeconomic status or social class, and contribute to inequalities and the gradient (Marmot, 2005;

Marmot & Friel, 2008). Macintyre (1997), proposed that health damaging behaviors freely chosen by individuals in different social classes, can explain in part inequalities and the gradient, by the cultural, lifestyle, and proposed the behavioral explanation.

Many diseases, communicable and non-communicable chronic diseases, are linked to health behaviors. The lifestyle of modern life has increased human risk behavior. Medical theories specify and characterize successful ageing as longevity without mental and physical decline, and being autonomous; reaching old age in good health without chronic diseases, or physical dysfunction, and moreover being able to communicate, and interact in the community, with limited risk factors for diseases (Bowling and Dieppe, 2005).

Despite we have limited knowledge about the mechanisms that give rise to health behavior (World Health Organization, 2008) there are some studies searching for explanations and exploring the effectiveness of interventions to change health behaviors (Jepson et al, 2010; Potempa et al, 2010). Furthermore, Nakazono et al, 1997, in diverse ethnic groups searched for possible influences and sociodemographic determinants of oral health beliefs, in Baltimore, Maryland, two Native American communities and San Antonio, Texas and found sociocultural disparities in health prevention. The results showed that Whites in Baltimore and San Antonio had significantly more clear and confident beliefs than ethnic minority groups (Nakazomo et al, 1997).

Is the main track to successful ageing having healthy behaviors? Rowe and Kahn (1987; 1997), suggest that the main direction to successful ageing is having healthy behaviors and healthy lifestyle choices. Healthy aging is marked by gradual changes and physical process by improving or maintaining functional ability as much as possible, sustaining and establishing healthy status in the aged members of the society (Beard JR, 2016; WHO, 2015). Similarly, Potempa et al, (2010) proposed the

''Healthy Ageing Model" of primary care for elders with chronic health conditions that give emphasis on active engagement in health care. The model focuses on motivation, behavior change and coaching techniques.

Recent research for health in elderly populations has focus on inequalities, social determinants and socioeconomic factors affecting health outcomes; one of the aspects of health inequalities is being associated to limited resources and limited access to health services. Furthermore, lifestyle and health behaviors affect health and oral health. Among other factors (social, economic) behaviors are related, to tobacco use, alcohol consumption physical activity, nutrition, frequency and reason for medical and dental examination, and have a powerful influence in health. Moreover, medication, alcohol consumption and smoking also contribute to malnutrition. Healthy behavior such as not smoking, having a nutritious diet and daily physical activity or exercise have been associated with lower risk for diseases such as cancer, diabetes, obesity, musculoskeletal problems, dementia and Alzheimer's disease.

Cigarette smoking is a major problem for public health and related to coronary heart disease. Smoking cause cancer of the lung, larynx, esophagus, mouth, and bladder and contributes to cancer of kidneys, the pancreas, and cervix. In elder population there are physical, and health status changes i.e., limited functioning, limited chewing ability, digestion, and food digestion, lack of appetite and might be underweight. In other cases, either because of poor diet, or being unable to prepare meals, receiving medication and physical inactivity the elders may become overweight (Kushi et al, 2006).

2.4.2.1 General Health and Oral Health Behaviors

Generally, there are differences in the health and behavior of various age groups; these differences are attributed to either aging or cohort effects. Getting older is associated to aging effect, while cohort effects are those differences characterizing

people from different generations who had similar lives and historical events during their life course. The differences between younger and older generations are because of these differences in experienced knowledge and not because of some more years in age. Similarly, behavior differences in younger and older groups usually are not related to social and biological maturing, but mainly because of cohort effects.

Health related behaviors such as unhealthy diet, overweight, smoking and alcohol consumption more than recommended level, and not being physically active, are lifestyle factors affecting more people in the lower socioeconomic group than those in the higher group. As people get older their habits and behavior change because of changes in the body. Smoking is no more considered a nice habit and there is reduction in old age smokers. This may attribute to the effective health preventive programs in many countries, selective mortality, or diseases and medication they receive. Thus, smoking goes down in older age. There are occupation and socioeconomic inequalities in smoking, physical activity and alcohol intake in older people. The lower the class the more smoking and inactivity levels (McMunn et al, 2003).

The SHARE study in European countries revealed that more than 33% of men and more than 25% of women were smokers for at least a year. While 63% of these men and 55% of these women declared that they stop smoking, there are still many people that are current smokers, 24% of men and 13% of women. Moderate alcohol consumption likely benefits health, but excessive alcohol intake is harmful. A percentage of 1% of men and 42% of women declared non consuming alcohol during the last 6 months. Those that consumed more than two drinks almost every day, were about a quarter of men and about 7% among women (Aro et al, 2005).

A recent study in Japan, examined periodontal tissue condition in relation to alcohol consumption; increased mean clinical attachment level (CAL) was significantly associated with alcohol

drinking in community-dwelling elderly Japanese (aged 73 years) compared with non-drinking. The study revealed that there was an increased risk of periodontal disease associated with high alcohol consumption (Suwama K, et al, 2018). Health and effects of light and intermittent smoking in adults was examined and presented in the review of Shane et al, (2009); previously, light smoking was consider as a situation of short time to shift from heavy smoking to nonsmoking status (Hassmiller et al, 2003; Owen et al, 1995; Shane et al, 2009; Wortley et al, 2003) but new evident reveals that light smokers use this tactic for a long time and in an endless way (Levy et al, 2009; Shane et al, 2009).

Epidemiological studies mainly investigate individual risk factors for syndromes, illness and disease. Individuals who are not smokers or never smoked, are at lower risk for illness and disease than those being smokers. Behavior is a key element for preventing diseases and epidemics. Cardiovascular disease is associated to high blood pressure and plasma cholesterol but these are also related to obesity, diet high in satiated fat and salt, and alcohol consumption. This is a public health problem because of lifestyle and unhealthy behavior.

Why do people choose these unhealthy behaviors? The explanations might go as far as cultural and family influences, or economic distress, unaffordability or unavailability of healthy food choices. But sometimes we have to think of social status that impact health through risk behaviors e.g. smoking, related to premature disease, functional decline, and morbidity (CDC, 2018; Marmot, 2006; Stuck et al, 1999; Vineis, 2014).

Health behavior factors were examined in mortality rates in the Netherlands to explain educational inequalities; smoking current smokers, former smokers, non-smokers), alcohol use (excessive, moderate, abstaining), and physical inactivity (inactive, moderately active, active). Educational inequalities in the examined population (men and women 17-74 years), were explained by behavioral, psychosocial, and material factors (Van Oort et al, 2005). Vineis' (2008) review, stress out that even

nonsmokers who involuntary respire and exhale smoke from nearby smokers, despite the lower doses they also have negative health effects because they get the same carcinogens. Nonsmokers are of lower risk of lung cancer if their spouses are nonsmokers, than those their spouses are smokers. Death rates because of smoking will rise in the 21st century from about 100 million deaths to about one billion (Vineis, 2008). The optimistic scenario is that all campaigns bring to an end smoking behavior and prevent the rise of smoking rates in low- and medium-income countries (Mathers & Loncer, 2006).

A recent study in Qatar, the National Health Survey in Qatar, found associations between poor oral health status and dental attendance (Cheema S et al, 2017). Healthy behavior can prevent individual from unhealthy habits; for middle aged individuals health behavior is determined by financial difficulties (Stitt & Grand, 1995) culture and social position (Elstad JI, 1998, McMunn et al, 2006).

The Leisure World Cohort Study examined the association of dental health behaviors and dentition on all-cause mortality in older adults in California, USA. Longevity was associated to oral health behavior; dental visits, flossing daily, and tooth brushing were significant risk factors for more years in life of elders. Those who brushed their teeth every day, had about 25% lower risk of less years in life, than hose that never brushed their teeth at night. Similarly, dental flossing daily and dental attendance regularly decreases risk for less years in life about 30% and 30-50% respectively (Panganini-Hill et al, 2011).

2.4.2.2 Behavioral Factors and Oral health in Older Adults

According to the literature, smoking and alcohol together intensify the risk for mouth cancer. Furthermore, excessive alcohol consumption is associated to tooth erosion and is one of most important factors related to accidents, violent behavior and domestic abuse and these can lead to teeth and face trauma (NHS, 2018). Alcohol dependent people have more

caries than nonalcoholic subjects, and more missing teeth (Dasanayake et al, 2010; Hornecker et al, 2003; Kaplan and Shapiro, 1972; Priyanka et al, 2017).

A recent cross-sectional study in Italy, aimed to explore the potential presence of a social and behavioral gradient in dental health among Italian adults. The study examined lifestyle behavior including smoking and dietary habits, and oral health behavior, tooth brushing and frequency of dental examination attendance. The results showed oral health inequalities and the gradient; behavioral and social differences could explain the gradient. Healthier behavior and better social status were associated with less caries. Carcinogenetic diet, smoking, tooth brushing less than twice a day, and no frequent dental attendance, with low occupation profile and low education, was associated with higher numbers of dental caries (Arrica et al, 2017). This is in agreement with previous research (Eustaqio et al, 2010; Susin et al, 2005). Oral health is related to diet and nutrition and the consumption of sugars has been associated with an increased risk of levels of dental caries (WHO, 2003).

A research in Australia evaluated the role of dental behavior in oral health inequalities in dentate adults. Dental attendance and dental self-care had no effect on missing teeth and the gradient. However, Oral Health Impact Profile, (OHIP-14), and socioeconomic gradient was greatly diminished by dental attendance; there was no impact from dental self-care alone or combined with dental visits, thus the authors suggested that could not establish the view and theory that dental self-care and behavior can explain poor oral health (Sanders, et al. 2006). Perceptions of oral health and health behavior may be strongly influencing tooth loss (Donnelly and MacEntee, 2012; MacEntee et al, 1997; Fiske et al, 1998; Jones et al, 2003).

Dental attendance is influenced by factors such as education, socioeconomic status, behavior, age groups (Österberg, et al, 1998) and gender (Bagewitz et al, 2002). Availability of dental

services and insurance coverage for dental health are two other pieces of the dental attendance puzzle (Yfantopulos et al, 2014).

Some research report differences in lifestyle and dental health behaviors between the new elderly and the older elderly, 60-65 years and 75 to 80 years respectively. These differences were based on the impact of various cultural and social cognition and the way dental services were provided and executed and extractions than preventive dentistry was applied. Many of the elders are medically compromised and take medications; those that are able to have a daily oral hygiene and regular dental attendance have better oral health, than those who cannot brush daily or have regular dental visits (Locker, 1989). While some studies reported age cohort differences in oral health (Kiyak and Miller, 1982) comparing younger and older ages, some others found no significant differences (Bader et al, 1989). Lee and Kiyak 1992, found that older individuals had more recent use of dental services but were less informed about gingival and periodontal diseases.

Many studies about oral health behavior in elders are in community dwelling individuals, however there is very little evidence and research on elders living in long-term care (LTC). It seems that perceptions of oral health affect clinical dental status in elders. This perceptual experience affects social behavior, but it is unclear and doubtful if institutionalization impact these behaviors (Donnelley and MacEntee, 2011). Institutionalized elders have fewer teeth and worse oral health than community-dwelling individuals. The World Health Organization, established the goal, for deaths from chronic non communicable diseases, as an annual decrease of 25% in the overall mortality from cardiovascular diseases, cancer, diabetes, or chronic respiratory diseases, by the year 2050 (WHO, 2014, 2018).

Older people have increasing rates of tooth loss, and deterioration of masticatory function, and possibly use partial or full dentures.

Dental and oral diseases are chronic non communicable diseases. Oral health as part of general health, is also affected by personal behavior and lifestyles, and access to health care services. Therefore, lifestyles are often the center of interest of health promotion interventions. Dental attendance is influenced by factors such as education, socioeconomic status, behavior, age, gender, availability of dental services and insurance coverage for dental health (Bagewitz et al, 2002; Österberg, et al, 1998; Yfantopulos et al, 2015). Dental visits are also affected by living conditions and area living. Manski et al, 2002, reported that dental attendance was influenced by area living and education. Those in urban areas had more dental visits and more regular visits than those in rural areas and education had a positive impact in dental attendance. In contrast, Sanders et al, 2006, in Australia they examined oral health inequalities and found that Oral Health Related Quality of Life, and the socioeconomic gradient was greatly diminished by dental attendance; there was no impact from dental self-care alone or combined with dental visits, thus the authors suggested that could not establish the view and theory that dental self-care and behavior can explain poor oral health (Sanders, et al. 2006).

Locker (1989), reported cultural and cognition differences in lifestyle and dental health behaviors between the new elderly and the older elderly, 60-65 years and 75 to 80 years respectively. Another issue found was the way dental services were provided and executed and extractions than preventive dentistry was applied contributed to these differences. Numerous of the elders are medically compromised and take medications or maybe not be able to have a daily oral hygiene and regular dental attendance. Those who brushed daily or had regular dental visits ensured better oral health, than those not able to brush daily or had no regular dental visits (Locker, 1989).

Does the number of teeth have a significant role in a functional dentition? Jackson and Murray (1972), suggested that an acceptable functional dentition for individuals over 60 years old, should have at least 16 teeth (Jackson and Murray, 1972), while

others suggested at least 20 teeth to be considered in an adequate dental status and masticatory capacity (Shimazaki et al, 2001). Perceptions of oral health and health behavior may be powerfully influencing tooth loss (Donnelly and MacEntee, 2012; MacEntee et al, 1997; Fiske et al, 1998; Jones et al, 2003). Chewing ability is affected by tooth loss and then diet and dietary habits are affected too. Cultural and behavioral differences affect daily habits, diet, and food intake and health behavior. As an example, in Japan, they introduced the movement called “80/20 Movement”, and the purpose was to set the aim of having 20 teeth at the age of 80 years (Shinsho F, 2001).

Health is connected and associated to individual social, working, and economic conditions, environmental, cultural, behavioral factors and personal lifestyle. Healthier behavior and better social status were associated with less caries. In better socioeconomic and healthy behavior situation, then we have less caries and missing teeth, and less periodontal diseases. Carcinogenetic diet, smoking, tooth brushing less than twice a day, and no frequent dental attendance or only when in pain, with low occupation profile and low education, is associated with higher numbers of dental caries and missing teeth.

Oral health is affected by many factors such as socioeconomic, environmental, working conditions, genes, cultural and behavioral factors. Healthy behavior can be protective for disease and mortality while unhealthy behaviors can damage health.

2.4.3 Behavioral Factors and the Gradient in Oral Health

Tooth brushing, flossing, and frequent dental visits are essential behavioral factors to maintain good oral health, while poor oral health behaviors’, tobacco use, excessive alcohol use and poor or unhealthy diet are harmful for oral health, and leading to poor oral health.

Sabbah et al. (2008) explained the role of social gradient in oral health in a secondary analysis of data from the Third National Health and Nutrition Examination Survey (1988-1994). They examined the role of health behaviors in explaining socioeconomic inequalities in oral health outcomes (gingival bleeding, loss of periodontal attachment, tooth loss and perceived oral health). Their results showed inequalities, both for income and education groups and for all health outcomes, and behaviors. The gradient persisted even after regression models were adjusted for health-related behaviors (smoking, dental visits and frequency of fruit/vegetable consumption). Health-related behaviors according to these results explain only part of the socioeconomic inequalities in oral health (Sabbah et al., 2008).

Donaldson et al., (2008) found that the socioeconomic gradient in the number of sound teeth in adults is explained partly by the dental attendance pattern. While in agreement with the results of Sanders et al., (2006) that the socioeconomic gradient in OHRQoL was reduced/diminished by dental attendance, there is a disagreement regarding how these results showed dental attendance influencing the self-reporting of missing teeth. The socioeconomic gradient in the number of sound teeth in adults was partially explained by dental attendance, which, in turn, was determined by the effect of SES on impediments to regular dental attendance (Donaldson et al., 2008).

Sanders et al., (2006) in a representative sample (Australian adults), found that dental behavior and the social gradient (dental attendance and dental self-care) was not associated with missing teeth in adults. Although dental self-care and dental visits were associated with oral health outcomes in the adult population, this could not elucidate the socioeconomic gradient in oral health (Sanders et al., 2006).

2.4.4 Psychosocial Factors

Psychosocial factors such as acute and chronic stress, stressful experiences at work, loneliness, social organization, social networks and social support affect health. Cohen & Syme (1985a, 1985b) defined social support as assets, wealth and resources because of relationships and companionship offered by other people. While social support is both salutary and favorable for health, loneliness and isolation are antagonistic and opposed to wellbeing. Human relationships are complex and characterized by a variety of substantial behavioral, affective and cognitive elements.

While the measures of social networks are type and number of contacts (i.e., friends, relatives and children), the frequency of contacts and density of networks, the measures for social support are the two different types of support (emotional and practical). Sense of control, chronic stress, social support and life satisfaction were found as the psychosocial pathways for inequalities and their impact on adult's oral health (Sanders & Spencer, 2005b). Two different mechanisms related to social support affect health: the first one is the ''direct effect'', which directly affects one's health positively or negatively. The "buffering effect" is the second mechanism, implying that social support has not any direct effect on health, but its effect is through controlling acute and chronic stressors on health (Stansfeld, 2006). The literature reveals that in health psychology research and epidemiological studies one of the most profound evident intimates is the positive and emphatic role of social support on both physical and psychological wellbeing (Stansfeld, 2006; Cohen & Wills, 1985; Cohen & McKay, 1983; Berkman & Syme, 1979). Control, social capital, social participation, social networks, feelings of loneliness, negative emotions and coping/resilience are factors considered as explanations for socioeconomic differences in health.

2.5 Social Networks

"...The division of labor becomes the main cause of solidarity."
Emile Durkheim, p. 226 (1997)

Having positive and supporting relationships can promote health, but if these relationships are negative, demeaning or hostile, then, the effect on health will be negative and damaging (Melchior et al. 2006; Stansfeld, 2006; Berkman & Glass, 2000). The body is powerfully influenced and affected by the psychological aspects of social relationships because of social control. As mentioned above, social relations and social support encourage health-related behaviors. Having healthy behaviors (taking exercise, giving up smoking, or reducing fat in one's diet) is greatly influenced and encouraged by friends and relatives (and/or others).

Having friends and a social network is a source of emotional, appraisal, informational and instrumental support. Emotional support entails empathy, reassurance, liking, and respect. Appraisal support refers to feedback relevant to self-evaluation while informational support is about giving advice and information and solving problems. Finally, instrumental support is the aid people give as services, financial or other tangible aid (House, 1981).

Social control is a parameter strongly affecting the impact of social support on health (Stansfeld, 2006; Cohen et al., 2000). Furthermore, social networks do more than positively and encouraging healthy lifestyle behaviors. Not only peers and friends, but also strangers, can affect our behaviors and "your friend's friends can make you fat" (Christakis & Fowler, 2009; p. 105). Obesity, depression, financial panic, violence and suicide get passed around and are diffused. According to Christakis and Fowler (2009) social networks have a peculiarity and a tendency to "magnify whatever they are seeded with" (Christakis & Fowler, 2009; p. 31). The robust impact of social networks on

health outcomes and one's behavior implies the lack of complete control of our own choices; "our connections to others affect our capacity for free will" (Christakis & Fowler, 2009; p. 32).

Berkman and Glass (2000) examined the way social networks are structured and found that resources and flow from the networks greatly affects both behavior and health. They presented a conceptual model of how social networks impact health and argue that social networks control the behavioral level via four pathways: the provision of social support, social influence, the effect of social attachment and engagement and the access to material goods and resources. Berkman and Glass (2000), introduced a model that shows the complexity of critical domains of support and how these link to mental health. They argue that "social support is one of the main ways social networks influence physical and mental health status but not the only critical pathway" (Berkman & Glass, 2000; p. 144). Social networks impact on health behaviours through four pathways: social support, social influence, social engagement and attachment, and access to recourses and material (Berkman & Glass, 2000).

Broader social networks with family or friends have been associated with better Self-rated health. Evidence from the English Longitudinal Study for Ageing (ELSA) showed the existence of a socioeconomic gradient and that people aged 80 and older are more vulnerable to loneliness. Friends and family networks related to a higher degree of life satisfaction (Demakakos et al., 2007). Furthermore, social ties and social networks are protective against mortality in older people (Blazer, 1982; Giles et al., 2005; Seeman et al., 1993).

Evidence from other studies, including the so-called Roseto effect (Bruhn & Wolf, 1979; Egolf et al., 1992; Stout et al., 1964; Wilkinson, 2005), suggest that social networks are essential and that social interactions and social links affect health and behaviours (Berkman & Glass, 2000). Roseto is an Italian-

American town in Pennsylvania settled by immigrants in 1882. These immigrants heralded from a town named Roseto in south Italy and maintained a high level of ethnic characteristics, social homogeneity, cohesion, and close family ties. Compared to nearby towns, Roseto had a strong equalitarian sense of community and low mortality rate from myocardial infarction up to 1965. In the 1960s, new generations of Rosetans shifted to the typical lifestyle enjoyed by nearby towns, characterized by loosening family ties and social support and cohesion. Increased rates of myocardial infarction were reported in the 1980s as the society changed (Bruhn and Wolf, 1979; Egolf et al. 1992; Stout et al., 1964; Wilkinson, 2005).

Another example of change in the way people live, communicate, and build social relations and social capital, is the Glenn Valley, Pennsylvania, Bridge Club as mentioned by Putman (2000). This Bridge Club had more than 50 active members in the 1980's (and during the last fifty years), but only 7 active members in 1990. Changes in American culture, connections in the community and social capital are evident; these changes in the society lead America's movement away from social engagement and people's responsibility towards each other and the community. Putman, also refers to altruistic, activism, charity decline, and more over without mutual support and or trust for civic duty, and public life. 'Altruism and honesty are important diagnostic signs of social capital' (Putman R.D, 2000, p.117).

Friendship and social affiliations are essential elements affecting health through psychosocial impacts (Wilkinson, 2005) and contributes significantly to the capacity to cope effectively with life events such as loss of a partner (Rokach 2013).

Epidemiological studies for oral health and social networks for younger ages are limited and their results are non-consistent. While Pattussi et al., (2006) found that lower level of social capital in a person's neighborhood contributed to inequalities in oral health (more injuries) in Brazilian adolescents, Castro et al

(2006) reported that there was no significant association between periodontitis and psychosocial factors (anxiety, depression and life events) in Brazilian adults.

2.5.1 Social Networks and Oral Health of Older People

A study in Sweden examined social relations as determinants of oral health among persons over the age of 80 years, and found that people had more root caries if they also reported fewer social contacts (Avlund, et al., 2003). Isolation from the community with no social life may result in memory impairment and dementia, but when one has an adequate social network with social support, one can retain cognitive function. Thus, "being alone is what is risky, not living alone" (Berkman, 2000; p. 213).

Aida et al., (2009) reports that older Japanese people retained more of their teeth when horizontal (but not vertical) social capital was at a higher level, suggesting that horizontal (equalitarian) relationship has beneficial effect on numbers of remaining teeth in older Japanese. The study's results suggest that various forms of social capital are social determinants of oral health. Moreover, the impact of social capital on oral health might me minor and undetectable with a tendency to accumulate over the life course. As a result, there are differences in the number of remaining teeth (Aida et al, 2009).

McGrath and Bedi (2002) in non- institutionalized people aged 65 years and over found that social support was associated with reason and time since last dental visit. This was a national UK study with a random sample of 876 non- institutionalized people aged 65 and older; they examined the association between use of services, self-reported oral health status and oral health behaviours (time and reason for last dental visit) and social support (living alone). The results of regression analysis showed that social support was an important predictor of reason for last dental visit and denture status. Rouxel et al, 2015, in another study in UK, analyzed data from adults 50 years old and over

from the third wave (2006–2007) of the English Longitudinal Study of Ageing (ELSA), and examined the differential associations of structural and functional social capital with subjective and objective measures of oral health, and the interactions between social capital and other sociodemographic and health factors. The results showed that low social support was associated with poor Self-rated oral health and Oral Impacts on Daily Performance (OIDP).

Merchant et al (2003) in a prospective cohort examined the association between social support, anger expression and periodontitis in US based, health professional and more than half were dentists (only men). The results showed that men who had expressed anger less frequently were less likely to develop periodontitis and men who had more social support were less likely to develop periodontitis. The study has limitations such as no clinical periodontal measurements and the sample only men and health professionals. Tsakos et al (2013) used the National Health and Nutrition Examination Survey (1999-2004) data and they found that social relationships are correlated to both markers of good oral function, and subjective oral health. However, their results did not revealed associations with clinical measures of a lifetime history of oral disease among Americans aged 60 years or older. For the same data set Watt et al (2014) found that the size of the social friendship network was associated with health-promoting behaviours. In agreement with these results, Burr and Lee (2013), analyzing data of the 2008 Health and Retirement Study among older adults in USA found association between dental care service utilization and social relationships (Burr and Lee, 2013).

Social relationships and ties link to social support and health-promoting behaviours, and better health outcomes. However, there is a gap in the literature as there are only few studies in older adults and no studies in Greece about oral health and social networks.

2.6 Cognitive Ability (or Cognitive Function) and Health

"Cogito ergo sum"
René Descartes

The word cognitive comes from the Latin 'cogitio' and the meaning is 'I think'. Cognitive ability is the intellectual activity formulating thoughts and gaining knowledge thought the senses and experiences thus allowing the individual to perceive, memorize, conceive, recall information, analyze and synthesize, judge, evaluate and reason.

Cognitive function or cognitive ability or general intelligence 'g' has four components: verbal comprehension, perceptual organization, working memory and processing speed. The concept of general intelligence or 'g' was been discovered and proposed by Spearman in 1904.

Cognitive function or ability or 'individual differences in general intelligence' (Lubinski, 2004) or general intelligence 'g' (Spearman, 1904) is influenced by genes and environmental factors. Thus, intelligence is inherited in a percentage from the parents to their children but the environment has a contribution too. Cognitive ability 'g' has been considered in recent research as an important factor influencing health and cognitive ability has been associated with individuals' good health and survival in later life (Batty et al, 2007) and moreover with health outcomes.

Cognitive ability has been examined according to socioeconomic status, education, deprivation and adverse early life events, behaviours, genes and environment. There is evidence that cognitive ability is modulated by high blood pressure, cholesterol, diabetes, overweight and obesity, smoking and physical activity. Poor health has been associated with lower socio economic position but according to Singh-Manoux et al (2005) and their results from the Whitehall II study, health and intelligence were related but despite the correlations found for

social status and health yet their data could 'not explain social inequalities in health' (Singh-Manoux et al 2005).

Are cognitive functions important for daily life? Rui Nouchi and Ryuta Kawashima (2014), in a recent review confirmed the importance of cognitive functions for daily life at any age (Rui Nouchi & Ryuta Kawashima, 2014). The early life of the infant and child has been examined in many studies and it seems that it is a factor for well-being and survival in later life (Richards et al, 2004; Kuh et al, 2004).

Furthermore, according to Feinstein (1998), a child's abilities are greatly influenced by their mother's education achievement. The individual's behavior and lifestyle (smoking, nutrition, physical exercise) environmental and genetic factors as well, through various ways, affect well-being, morbidity, and mortality (Feinstein, 1998).

In summary, general intelligence is associated with well-being (Lubinski and Humphreys, 1992) and the results of epidemiological studies suggest that cognitive ability or general intelligence should be considered as the Achilles heel for the individuals' health result.

2.6.1 Cognitive Ability and Oral Health - Studies on Human Subjects

Results from studies that examined the association between cognitive ability and oral health status are few (see Table 2). These few studies explored associations between cognitive ability and dental caries, tooth loss, periodontitis, mastication, chewing ability and activities of daily life (ADL). The implications of ageing and dental function in older persons are associated, in that the greater the dental functional impairment, the lower the person's cognitive ability (Österberg et al., 1990). Kondo et al. (1994), in their study, suggest that losing one's teeth is a predictor for Alzheimer's disease. In a recent review Cerrutti-

Coplin et al (2018) reported that the mechanism for cognitive decline might be due: to periodontal systemic inflammation disease, reduced mastication that impact memory, or poor diet and nutrition Cerrutti-Coplin, (2018). Other studies have explored the association between cognitive ability and dental needs in older people and found differences between Alzheimer's patients and the healthy elderly, living in institutions and at home, respectively, according to their dental status and choice of foods (Nordenram et al., 1996).

As expected, older people who retained their teeth and were living alone with cognitive impairment and with no social support had more dental treatment needs. Nordenram & Ljunggren (2002) report that for those people living in a nursing home oral treatment need was predicted by cognitive and functional capacity and tooth loss. A person's level of education has been significantly associated with denture wearing by Weyant et al. (2004), suggesting that general health status is associated with oral health status. Those patients with depression and general health problems underused dental health services and had poor oral health. Results from two more studies have reported good dental health as a predictor for more years of survival (Hamalainen et al., 2003; Ohrui et al., 2006). These results are in agreement with Nakanishi et al. (2005), who suggest that the ability to chew (thus having natural or artificial teeth) and mastication are associated with mortality. The latter study had a self-report questionnaire, and self-reported masticatory ability was a predictor for survival (Nakanishi et al., 2005).

Österberg et al. (2002) in their study relating masticatory ability and nutrients in 80-year-olds, found no significant differences, but the fewer the number of teeth and the worse a person's general health were factors associated with impaired mastication. Their results showed that the older people, even with impaired mastication, had good nutrition. This is in contrast with Ohrui, et al. (2006) who claimed that tooth loss, impaired mastication and nutrition and lower ADL were associated with

lower cognitive function. Additionally, Kossioni (2018) in a recent review reported the potential positive effect of a healthy diet on cognitive performance and the importance of dietary choices in older adults (Kossioni, 2018).

One explanation for this could be that the premature loss of teeth or unsuitable prosthetic full or partial artificial dentition caused problematic chewing and obstructed good and adequate nutrition. Older people need to have adequate amounts of nutritious food. So, if they experience chewing difficulties very often or pain during mastication, then they are at greater risk for inadequate nutrition, due to the dental function impairments. This is often obvious from weight loss or decreases in body mass index (BMI). Another explanation is that the functional decline that linearly affects older people can also co-exist with memory impairment and difficulties in moving hands and loss of dexterity to brush teeth or maintain good oral hygiene. Furthermore, chewing ability and tooth loss may be linked to cognitive deterioration over malnutrition and dietary habits adjusted to fewer teeth in the mouth (Kossioni, 2018; Weijenberg et al, 2011).

As the global population ages, the need for dental treatment and nutritional counselling is increasing. Today, many of the people over the age of 70 retain a significant number of natural teeth especially in countries with established preventive dental/oral health policies. For example, in Denmark, Vilstrup et al. (2007) studied 191 individuals (85 years and older) and suggested that many of these people retained their natural teeth. They found that older people with no or very mild cognitive impairment retained more teeth. Those with more teeth, had fewer caries. On the contrary, people with cognitive impairment and functional decline experienced more active root and coronal caries (Vilstrup et al, 2007). These results are in agreement with Chalmers et al. (2002), suggesting a higher incidence of coronal and root caries among demented (community-living) older people (Chalmers et al., 2002).

From a different point of view, Hugo et al. (2007) exposed another sociological aspect of the oral health of older people with Alzheimer's disease: the supportive network of the patients' families and their efforts to sustain their Alzheimer patient's oral health. Interviews with 56 Alzheimer caregivers about oral health found that number of teeth in these patients was related to oral health behaviour, smoking, and the frequency of daily tooth brushing (Hugo et al., 2007). Similarly, Kossioni (2013) reviewed national and regional data on the oral health of community-dwelling older people globally and reported that the caregivers of people with mild cognitive impairment need to be aware for oral health and regular dental examinations (Kossioni, 2013). Wu et al (2007) examined community-dwelling older adults with low cognitive function and found that they are at risk for less frequent use of dental care for oral health serves as an intermediating factor between cognitive function and the se of dental care services (Wu et al, 2007).

These studies identified associations between cognitive or functional impairment and associated oral health outcomes using different methodological procedures. As mentioned by some of the authors, some studies have limitations (i.e. the study by Miura, et al. (2003) examined only women). These limitations are due to the small sample size - except for Henriksen, 2005; n=1,900, and Weyant, 2004; n= 805 and finally Syrjala et al. 2007; n=2,320. Most of these are cross-sectional studies. Furthermore, they examined people who are old or very old, and it is generally accepted that old age has other implications, like functional decline. Functional decline may gradually affect one's ability to brush one's teeth and even the desire for food might be limited, especially if the person needs assistance with eating due to cognitive or functional impairment. Older people with good functional and cognitive ability are usually more socialized, thus they take care of their oral health and use the dental facilities /clinics. The study by Yeh and Liu (2003) found that older people living in Taiwan who

reported increased social support also had higher cognitive function (Yeh & Liu, 2003).

Ikebe et al (2018 in a cross-sectional) examined factors associated with cognitive function of older community-dwelling Japanese adults in two age groups (70 and 80 years old) using the Montreal Cognitive Assessment (MoCA-J). Their results showed that cognitive function was associated with occlusal force, education and dietary intake (Ikebe et al, 2018). Analysis of the NHANES studies in the United States revealed that periodontitis was associated with cognitive impairment among older adults (Noble et al., 2009).

Lower scores of cognitive functions were associated with worse oral health status, but the impact of cognitive function on oral health decreased after controlling for regular dental visits (covariate) (Wu et al., 2008). Dental care use is strongly linked to cognitive functioning and there is a real significance in clinical oral health, but because of the study design (the cross-sectional nature of the data) no causal relationship between cognitive function, oral health and utilization could be reported (Wu et al., 2007; 2008; 2018).

In the NHANES III study, the social gradient in gingival bleeding was partly explained by cognitive function (Sabbah, et al., 2008). Furthermore, an analysis of the data from the same study revealed similar income and education gradients in oral and general health. Researchers found the social gradients in oral health with clinical measures (periodontal disease) and subjective measures (perceived oral health) and general health; they also examined general health in terms of both clinical (ischaemic heart disease) and subjective (perceived general health) measures. Their results revealed consistent gradients in clinical and subjective measures of both oral and general health. Poorer perceived general and oral health, ischaemic heart disease, and periodontal disease were more frequently reported at each lower level of the poverty-income ratio and education. At each lower level of education and the poverty-income ratio,

the prevalence of reporting poorer perceived oral and general health was significantly higher. There was education - and income - constant gradients present for both the prevalence of periodontal and ischaemic heart disease. Furthermore, there were similarities in the gradients in perceived oral and general health and in the prevalence of periodontal and ischaemic heart disease (Sabbah, et al., 2007). Sabbah et al., (2008) reported that people with poorer cognitive ability had poorer oral health and increased severity of gingival bleeding.

When studying and examining cognitive function and oral health in an older population, we should keep in mind three possible confounders. The first is that some general health conditions complicate the oral health results because of medication and synergic agents or symptoms like xerostomia. Second, studies that rely on self-reported masticatory ability might be biased because masticatory ability is not measurable in a defined way and is only related to an individual's objective perception. The third point is that, as the studies' populations get older, it is possible that undiagnosed dementia or a preclinical stage of Alzheimer's might be confounding and not result in an evaluated individual being put in the correct category. The reason for this is that the test results on a certain day might not be the same on another day. Mild cognitive impairment should be diagnosed and differentiated from normal ageing and early dementia or Alzheimer's disease.

In epidemiological studies for the ageing population is essential to use appropriate cognitive tests. Likewise, as the survival age increases, it is expected that researchers will find more people with functional and cognitive impairments, especially in institutionalised settings (Henriksen et al., 2005). The deterioration of functional and cognitive abilities has been shown to affect oral health in a nursing home population (Jablonski et al., 2005). In Table 2, there is a synopsis of studies in humans, examining oral health and cognitive ability.

2.6.2 Experimental Studies with Animals

Onozuka et al. (1999), in an experiment, suggests that the ability to masticate is important for retaining memory capacity, indicating the possibility of an association between impairment of spatial memory and reduced mastication. Furthermore, Onozuka et al. (2000) performed another exciting experiment with mice wherein the impairment of spatial memory was reconfirmed. Their results, using a water maze test, suggest that the mice with no molar teeth showed a significantly reduced learning ability (Onozuka et al., 2000). Recently, Tsutsui et al. (2007) suggested that mice fed with soft diets manifested reduced memory and learning skills.

Table 2. Research in cognitive function and oral/dental health

	Author/ Year	Title	Results
1	Kondo K, Niino M, Shido K (1994)	A case-control study of Alzheimer's disease in Japan – significance of lifestyles.	Tooth loss, among other factors, might be a risk factor for Alzheimer's disease (study of 60 Japanese cases).
2	Nordenram G, Ryd-Kjellen E, Johanson G, Nordstrom G, Winblad B (1996)	Alzheimer's disease, oral function and nutritional status	Dementia has a strong association to the ability to eat unaided and an association with dental status. Choice of food for the two groups was correlated to the dental status (n=40 D and n=40 non-D).
3	Onozuka M, Watanabe K, Mirbod SM, Ozono S, Nishiyama K, Karasawa N, Nagatsu I (1999)	Reduced mastication stimulates impairment of spatial memory and degeneration of hippocampal neurons in aged SAMP8 mice - In vitro study	Mice with no moral teeth had decreased learning ability and memory. Possible link between memory and mastication (in aged SAMP8 mice)
4	Onozuka M, Watanabe K, Nagasaki S, et al (2000)	Impairment of spatial memory and changes in astrological responsiveness following loss of molar teeth in aged SAMP8 mice - In vitro study	Suggests that impairment in spatial memory occurs following the loss of molar teeth in aged SAMP8 mice.
5	Shimazaki Y, Soh I, Saito T, Yamashita Y, Koga T, Miyazaki H, Takehara T (2001)	Influence of dentition status on physical disability, mental impairment and mortality in institutionalized elderly people	Mortality rate was higher in edentulous subjects without dentures. Deterioration in the systemic health of the aged was associated with poorer dentition status. Subjects with 20 or more teeth had significant better physical and mental health.
6	Onozuka M, Watanabe K, Fujita M, Tomida M, Ozono S (2002)	Changes in the septohippocampal cholinergic system following removal of molar teeth in the aged SAMP8 mouse - In vitro study	Removal of molar teeth in aged mice enhanced the age-related decline in the septohippocampal cholinergic system.
7	Nordenram G, Ljunggren (2002)	Oral status, cognitive and functional capacity versus oral treatment need in nursing home residents: a comparison between assessments by dental and ward staff	Older people with teeth and loss of cognitive and functional capacity have more dental treatment needs (n=192).
8	Chalmers JM, Carter KD, Spencer AJ (2002)	Caries incidence and increments in community–living older adults with and without dementia	Dementia (D) participants had more caries (coronal and root caries) (n=112 with D and 112 without D)

9	Miura H, Yamasaki K, Kariyasu M, Miura K, Sumi Y (2003)	Relationship between cognitive function and mastication in elderly females	Suggests that decline of masticatory function should represent a risk factor of dementia (n= 44 with D and n=44 without D).
10	Avlund K, Holm-Pedersen P, Morse DE, Vitanen M, Winbland B (2003)	Tooth loss and caries prevalence in very old Swedish people: the relationship to cognitive function and functional ability	People over the age of 80 with a low MMSE score had a four times higher risk of not using dental services regularly. Cognitive and functional status have been associated (n=159).
11	Weyant R, Pantav RS, Plowman J, Ganguli M (2004)	Medical and cognitive correlates of denture wearing in older community-dwelling adults	Depression was associated with poor oral health and underused dental health services. Denture wearing was associated with poorer Self-rated health (n=805 and ages over 73).
12	Shimazaki Y, Soh I, Koga T, Miyazaki H, Takehara T (2004)	Relationship between dental care and oral health in institutionalized elderly people in Japan	Dental care appears to be an important factor in maintaining a healthy oral status for the institutionalized elderly. N=719
13	Henriksen BM, Engedal K, Axell T (2005)	Cognitive impairment is associated with poor oral health in individuals in long term-term care	Poor oral status was associated with cognitive impairment (n=1,358 institution/ n=552 living at home).
14	Miura H, Kariyasu M, Yamasaki K, Arai Y, Sumi Y (2003)	Relationship between general health status and the change in chewing ability: a longitudinal study of the frail elderly in Japan over a 3-year period	In this study, cognitive status and QOL were not related to a change in Self-rated chewing ability (n=92 at base line, after n=60).
15	Siukosaari P, Ainamo A, Nahri TO (2005)	Level of education and incidence of caries in the elderly: a 5-year follow–up study	The level of education of the elderly was not directly associated with more caries (n=110).
16	Gatz M, et al (2006)	Potentially modifiable risk factors for dementia in identical twins	Tooth loss before the age of 35 was a significant risk factor for Alzheimer's disease.
17	Chandola T, Clark P, Morris JN, Blane D (2006)	Pathways between education and health: a causal modelling approach	Improvements in a population's educational attainment may not automatically lead to improvements in population health (n=17,416).

18	Vilstrup L, et al (2007)	Dental status and dental caries in 85-year-old Danes	Functional decline and cognitive impairment have higher levels of active coronal and root caries (n=191).
19	Syrjala A-M H, et al (2007)	Relationship between cognitive impairment and oral health: results of the Health 2000 Health Examination Survey in Finland	Cognitive impairment subjects have more carious teeth and are more often edentulous (n=2,320).
20	Tsutsui K et al (2007)	Influences of reduced masticatory sensory input from soft-diet feeding upon spatial memory/learning ability in mice	Reduction of masticatory afferent stimuli due to long-term soft-diet feeding may induce neuron loss in the hippocampus and reduced memory/learning ability (n=109).
21	Miura H, et al (2007)	Evaluation of chewing and swallowing disorders among frail elderly individuals.	Dysphagia was not correlated with age or cognitive ability, but it was correlated ($p<0.001$) to ADL (n=85).
22	Bergdahl M et al (2007)	Natural teeth and cognitive function in humans	People with functional natural teeth relate to relatively preserved cognitive functioning in older age.
23	Kim JM, Stewart R, Prince M. (2007)	Dental health, nutritional status and recent-onset of dementia in a Korean community population	In older people fewer teeth may be a marker of risk for dementia. N=686 aged >65
24	Stein P et al (2007)	Tooth loss, dementia and neuropathology in the Nun Study (Longitudinal Study)	The presence of a low number of teeth was associated with the prevalence and incidence of dementia.
25	Stewart R & Hirani V (2007)	Dental health and cognitive impairment in an English national survey population	Poor dentition associated with cognitive impairment. Dental health did not account for the association between cognitive impairment and low BMI. Nutritional status in those with cognitive impairment recognized to be at risk.
26	Wu B, et al (2007)	Cognitive function and dental care utilization among community – dwelling older adults	Older people with low cognitive function are at risk for less frequent use of dental care.
27	Wu B, et al (2008)	Cognitive function and oral health among community-dwelling older adults	Lower scores of cognitive functions were associated with worse oral health status, but the impact of cognitive function on oral health decreased after controlling for regular dental visits.

28	Stewart R, et al (2008)	Oral health and cognitive function in the Third National Health and Nutrition Examination Survey (NHANES III)	Poor oral health is associated with poor cognitive function throughout adult life
29	Noble JM, et al (2009)	Periodontitis is associated with cognitive impairment among older adults: analysis of NHANES-III	A serological marker of periodontitis (serum P gingivalis IgC) found to be associated with impaired delayed memory and calculation
30	Grabe H, et al (2009)	Tooth loss and cognitive impairment	Tooth loss was associated with cognitive impairment in females (p=0.002) but not in males (p=0.825)
31	Sabbah W, et al (2009)	The role of cognitive ability in socio-economic inequalities in oral health	The association between oral health and socio-economic position attenuated after adjustment for cognitive ability. Cognitive ability partly explained the socio-economic inequalities in oral health. Participants with poorer cognitive ability had poorer oral health for all indicators.
32	Stein P.S et al (2010)	Tooth loss, apolipoprotein E, and decline in delayed word recall	Initial word recall was not affected by the number of teeth
33	Lee Y, et al (2010)	Systematic review of health behavioural risks and cognitive health in older adults	Results indicate potential benefits of healthy lifestyles in protecting cognitive health in later life
34	Weijenberg R, Scherder E, Lobbezoo F (2011)	Mastication for the mind-The relationship between mastication and cognition in ageing and dementia-Review	There is a correlation between cognition and oral health in elderly humans. Nutritional status and ability to maintain oral hygiene might play a mediating role.
35	Hirano Y, et al (2010)	Effects of chewing ability on cognitive processing speed	The results suggested that chewing induced an increase in the arousal level and alertness (n=17, age 20-34)
36	Lee KH, Wu B, Plassman BL (2013)	Cognitive function and oral health-related quality of life in older adults	Oral health-related QoL, was better among those with normal cognitive function compared to those with CIND and those with mild dementia in the population studied. Participants with normal cognitive function had higher GOHAI total scores.

37	Noble JM, Scarmeas N, Papapanou P (2013)	Poor oral health as a chronic, potentially modifiable dementia risk factor: review of the literature.	This review present epidemiologic evidence of links between poor oral health and both prevalent and incident cognitive impairment.
38	Damaskinos P, et al (2014)	The social gradient in oral health in older adults	The results of the pilot study revealed the social gradient in oral health of older adults in Greece; cognitive function partly explains the gradient in this population. Moreover, there were associations between MMSE and oral and general health outcomes.
39	Peres MA, et al (2015)	Tooth loss is associated with severe cognitive impairment among older people: findings from a population-based study in Brazil.	This study lends support to hypothesized association between tooth loss and severe cognitive impairment. Older adults seem to be particularly vulnerable to such effects. However, the bidirectional association between tooth loss and severe cognitive impairment cannot be ruled out.
40	Gil-Montoya JA, et al (2015)	Is periodontitis a risk factor for cognitive impairment and dementia? A case-c0ntrol study.	No significant association was found between tooth loss and cognitive impairment. Periodontitis appeared to be associated with cognitive impairment after controlling for confounders such as age, sex, and educational level.
41	Tsakos G, et al (2015)	Tooth loss associated with physical and cognitive decline in older adults	Total tooth loss was independently associated with physical and cognitive decline in older adults in England.
42	Damaskinos P, Kounari-Koletsi Ch, Mamai-Homata H, Papaioannou W (2018 a, b)	Tooth loss and cognitive ability and socioeconomic indicators in older adults visiting day centers in Athens and Piraeus, Greece (cross -sectional study)	Cognitive ability was associated with tooth loss and socioeconomic factors. The number of missing teeth was significantly negatively correlated with the MMSE score, years of education, but significantly positively correlated with the age of participants.

Table 2: Explanation: The studies are mentioned chronologically.
Study no. 12, although mentioned, categorizing older people in good, fair, or poor mental status, and did not give results associating cognitive function and dental health outcomes.
Study no. 15 is the only one that did not test for cognitive function, but it is mentioned here because it has tested for oral health and education levels.
Study no. 17 proposed six pathways for explaining associations between education and general health (not oral health).
Study no. 35 had a very small sample and individuals of young ages

Evidence from previous research reveals associations between cognitive ability and health and disease. Furthermore, cognitive ability is related to age and education and associated with health, disease and mortality; the precise role is not clear, but new studies have encouraged interest in this subject (Signh-Manoux et al., 2005). Dietary patterns and cognitive ability have been associated in a healthy middle-aged cohort (Akbaraly et al., 2009) and it was found that educational achievements are greatly influenced by cognitive ability and this in turn has an impact on occupational status (Thienpont & Verleye, 2004).

This section includes studies that examined the association between cognitive function and oral health status. Their results vary and some suggest that the lower the cognitive ability (i) the more dental treatment needs, (ii) more caries, (iii) and more edentulous people.

Some studies suggest that there is no significant association between tooth loss and cognitive impairment (Gil-Montoya et al 2015) while other studies reported significant differences and association between tooth loss and cognitive ability (Stein et al, 2007;2010). Stein et al (2007, 2010) found that the higher number of lost teeth the higher risk of prevalence and occurrence of dementia. Total tooth loss was independently associated with physical and cognitive decline in older adults (Tsakos et al, 2015) and Grabe et al (2009) found significant association between tooth loss and cognitive impairment in females ($p=0.002$). Moreover, Mini Mental State Examination (MMSE) was associated to DMFT (sig. 0.3), frequency of tooth brushing (sig. 0.2) perceived general health (sig. 0.1), and OIDP (sig. 0.4) (Damaskinos et al, 2014). Furthermore, cognitive ability (MMSE score) was associated with tooth loss and socioeconomic factors. The number of missing teeth was significantly negatively correlated with the MMSE score, years of education, but significantly positively correlated with the age of participants (Damaskinos et al, 2018). Lee et al (2013), found associations between cognitive function and Oral Health-Related Quality of Life (OHRQL) in older adults.

However, some of these studies had some limitations according to their sample size and methodology. They examined very small and specific sample (i.e. in one study only women). Moreover, these studies

examined old or very old people with general health problems complicating their functional and cognitive ability. To clarify the results of the previous studies, new research is needed and different methodological approach is essential.

It is a general belief that aging and death are unavoidable facts in our life. As one become older changes on body (i.e. function), and mind (i.e. memory) are progressively present. Studies in older people have the limitation that general health complications like hearing or vision impairments or medication or extensive and/or often admissions in hospitals or nursing houses might complicate the scene.

While, the studies for oral health and cognitive function have shown an association still there is a big gap of knowledge and further multidisciplinary research needed in aspects of epidemiological and clinical treatment studies (Noble et al, 2013). Oral health studies should be advanced and investigate their association and possible mechanisms affecting cognitive ability and oral/dental/general health outcome.

In conclusion, some new studies should be applied to enrich and crystallize the knowledge about cognitive ability and diseases like high blood pressure, cholesterol, diabetes, overweight and obesity, smoking and physical activity which affect millions of people globally. Impaired cognitive ability has been associated with poor oral health in old and very old people and thus emphasizing the need for future studies to illuminate the many remaining aspects kept in shade.

2.7 Subjective Measures of Oral Health and Oral Health Quality of Life

'Health depends on a state of equilibrium among the various factors that govern the operation of the body and the mind; equilibrium, in turn, is reached only when man lives in harmony with his external environment'

Hippocrates, 460 - 377 B.C.

In social epidemiology is essential to use not only clinical but also subjective measures of health and oral health. Individuals' feelings, personal beliefs, and life experience are fundamental for their own perceptions of well-being. Self-rating measures of oral health and OHRQoL encompass not only physical, and mental domains of health, but also social aspects and everyday functioning. Thus, in the literature, there is an increasing volume in epidemiological studies using Self-rated health measures and OHRQoL. The OHRQoL instruments, embrace and record psychological wellbeing and physical fitness. These subjective measures and multidimensional instruments, should be able to record subjective evaluations of health and illness with consistency, reliability, internal consistency, and validity.

Health is multidimensional, not only physical, but also mental, emotional, spiritual and social, and all these dimensions are important for individual's well-being. Objective measures are mechanical methods based on tests and laboratory reports, while subjective measures include judgment, personal beliefs, perceived health and felt well-being. Quality of life is the perceived quality of individual's wellbeing, including physical, social and emotional aspects in everyday life. The oral health related quality of life instruments evolved to record physical fitness and psychological well-being. The ideas of health, disease and illness have wide social, philosophical, cultural and socio-political dimensions and thus not only clinical but subjective measures of health are essential to record individuals' perceptions, feelings and well-being (Papaioannou et al, 2011a, b; Koletsi-Kounari and Mamai-Homata, 2007; Wilson and Cleary, 1995; Stokes 1982).

One of the first definitions to acknowledge the broad, multidimensional nature of health introduced by the World Health Organization in 1948, defined health as "…a state of complete physical, mental, social well-being, and not merely the absence of disease or infirmity" (WHO, 1948).

In 1998, WHO, health definition was expanded and defined as a fundamental human right and a positive idea; highlighting social and personal as well as physical capacities for everyday life (WHO, 1998). There is a wide variety of ideas for health definition, determined by each era's cultural, philosophical and political influences. Thus, it is difficult to have accurate and reliable measures for health and disease. Health, in a wide range of views, includes not only body and physical health, presence or absence of disease, but has personal feelings, spiritual and psychological well-being as well (Allen 2003; Locker 1995). According to Blaxter (1990), health includes the ideas of strength, zest, spirit and, and a person is healthy when free from illness, can function properly and participate in everyday life or has good physical status and well-being (Blaxter, 1990).

Oral health is related to general health, wellbeing and quality of life. WHO defines oral health as "a state of being free from chronic mouth and facial pain, oral and throat cancer, oral infection and sores, periodontal (gum) disease, tooth decay, tooth loss, and other diseases and disorders that limit an individual's capacity in biting, chewing, smiling, speaking, and psychosocial wellbeing" (WHO, 2018).

Health and disease are of fundamental importance for ethical considerations for medical provision, however their terms and definitions are confusing. Definitions are determined by cultural views, and thus difficult to propose for new definitions of health and disease that will be accepted without argument (Bircher, 2005).

There are different suggestions for what health stands in for humans, cultures and health policies. Principles of health and illness are difficult to define; introducing or adopting a universally acceptable definition seems an illusion, as each person has a unique sense of these terms according to his/her values of life and culture. The word *health* is derived from the Old English word for '*heal'* which means being *'whole*' (Naidoo & Wills, 2000) or '*sound'* (Boruchovitch & Mednick, 2002). *Disease* derives from 'desaise' meaning uneasiness or discomfort. Illness indicates a condition causing harm or pain (Naidoo & Wills, 2000). The dimensions of health are physical, mental, emotional, social and spiritual (Ebers, 1984), and societal (Daly et al, 2002). According to

Spector (2000), health is defined as the balance of the person, both within one's being physical, mental spiritual, and in the outside world-natural familial and communal, metaphysical.

The biomedical model of health is based on biological nature, incorporates the notions of pathology, physiology and biochemistry of a disease and human body has been seen as a machine and disease as a fault of this machine, while the WHO definition for health is in the holistic approach, and the social model of health. The WHO definition for health requires complete physical, mental and social well-being (WHO, 1948), provoked critics, characterized as 'almost a Platonic ideal of the Good' (Evans and Stoddart, 1994), and its lack to explain and associate well-being and health and the risk of medicalizing social problems (Peter, 2004; Engelhardt, 1975). Moreover, beside the biomedical and social models of health there are also lay beliefs and concepts of health and illness dependent on individual beliefs and the social impact. These lay perceptions form a definition for each one that is not constant; on the contrary the definition of health, one has in his youth, is flexible and will be transformed as a new one in older age, because older people are more concerned about functioning and coping with their everyday life (Jones, 1994).

The majority of measures and indices for health and disease (physical and psychological), are based on health definition according to functional ability (McDowell, 2006; McDowell and Newell 2006; 1996). In health epidemiology, during the years 1980-1999, most measurements of health were clinical but, in some studies, Self-rated health and subjective measures for well-being and quality of life were introduced. There were associations between clinical health outcomes and feelings and perceptions of the individual. Being healthy is an issue, but being able to function physically, mentally and socially are equally important aspects for health.

Health is not only related to biological but also to social and environmental factors (Corson et al, 1999; Locker & Ford, 1996; Slade 1997; Leao and Sheiham, 1996; WHO, 1995; Locker et al, 1994; 1988; Locke r& Slade, 1994, 1993; Locker & Miller, 1994; Atchison & Dolan, 1990; Hunt et al, 1985; Hunt & McEwen 1980). If we use clinical

measures the result is to measure disease and illness. But what is the impact of disease or illness on the person's daily life? Is there any psychological effect that distorts and disturbs everyday living and social life? Objective measures are mechanical methods based on tests and laboratory reports, while subjective measures include judgment, personal beliefs, perceived health, and felt well-being. Subjective measures are useful to record feelings, perceptions, and subjective ratings. Objective measures are made by experts and consider 'strong' but we should not believe that subjective measures are simply "soft" (McDowell, 2006).

2.7.1 Measures of Quality of Life

Quality of life (QoL or QOL) is the perceived quality of individual's well-being, including physical, social and emotional aspects in everyday life. In health care, health-related quality of life (HRQoL or HRQOL) is an assessment of how the individual's well-being may be affected over time by a disease, disability, or disorder. Health related quality of life (HRQOL) has been defined as a multi-dimensional concept that embrace a wide range of every day's activities, related to physical, mental, emotional, and social functioning, thus is connected to well-being, psychological state and life satisfaction (Wilson & Cleary, 1995). Wilson and Cleary (1995) proposed a conceptual model of dominant causal associations of biological, social and psychological factors.

2.7.2 Subjective Measures of Health and Health Related Quality of Life

Quality of life is described as the satisfaction in one's life that comes from having good health, comfort, good relationships, rather than from money and wealth.

World Health Organization (WHO) defines Quality of Life (QOL) as individual's perception of their position in life in the context of the culture and value systems in which they live; in relation to their goals, hopes, worries, measures and benchmarks. It is affected in a complex way by the persons' physical health, psychological state, level of independence, social relationships, personal beliefs and their

relationship to important features of their environment, based on their personal judgments, perceptions and beliefs (WHO, 1995).

Quality of life as defined by WHO has a broad concept, while Health related quality of life (HRQOL) is limited to the impact of illness on QOL. These two measures record different aspects of health and disease although both seize subjective perceptions and indicate well-being.

Subjective measures of health are used in epidemiological studies because perceived health is important for both clinically measured health and psychological factors (Singh-Manoux et al., 2006) and in older adults Self-rated oral health was found to be a better measure of health than of morbidity (Matthias, et al., 2007). Self-reported health and oral health encompasses psychological aspects of how the individual perceive his or her health and is an indicator of well-being (Perera & Ekanayake, 2008).

2.7.3 Oral Health Related Quality of Life

Thinking of oral health, according to this holistic and broad definition of health by WHO, then the definition for oral health should be a complete healthy dentition meaning either 20 sound primary teeth for children about 6 years old, or 32 permanent teeth for adults. All teeth should be straight and sound, and no periodontal disease or other soft tissue lesions, which results in a 'state of physical, mental and social well-being' (Daly et al 2002). Dolan, 1993 and Locker, 1988 suggest their own definitions of oral health with functional, social and well-being aspects. According to Dolan (1993), oral health means a functional dentition, with absence of any discomfort, allowing individuals to participate in social life. The need to develop subjective measures of oral health status was first proposed by Cohen and Jago (1976), who indicated the lack of data relating to psycho-social impact of oral health problems at that time.

Cohen and Jago (1976), reviewed existing clinical indicators for dental use and suggested the formulation of new sociodental indicators. They introduced new indicators that encompass social dimension of health and disease, stretching out that dentistry, and dental care, greatly

contribute to quality of life. The oral health-related quality of life (OHRQoL) instruments evolved to record physical fitness and psychological well-being. Slade & Spencer, 1994, based on Locker's conceptual model for measuring oral health and WHO measures, developed OHRQoL instrument with 14 items.

The oral health impact profile short form (OHIP-14) used in epidemiological studies worldwide, for oral health related quality of life studies, is a conceptual model for measuring oral health was proposed by Locker (1988). Locker's model was influenced by the World Health Organization (WHO, 1980), suggesting complex associations of diseases, disorders and their impacts on the individual's well-being, affecting everyday life; this was the base for a new era in dental and oral health epidemiology as researchers developed instruments for subjective oral health well-being, by eliciting the negative impact of disease and illness (Brondani and MacEntee, 2007; Slade, 1997; Locker, 1988; 1994). The development of the Geriatric Oral Health Assessment Index (GOHAI), was introduced by Dolan and Atchison (1990); this is a self-reported measure planned to assess the oral health problems of older adults and has good reability. It has been translated and validated in many languages including the Greek language (Gkavela, 2019).

Locker et al, (2001), in a cross-sectional study compared two OHRQL instruments, in older adults, OHIP-14 and GOHAI; both the GOHAI and OHIP-14 demonstrated good psychometric properties in the examined elder population, but Cronbach's alpha was lower for the GOHAI than the OHIP-14, indicating lower internal consistency reliability (Locker et. al.,2001).

2.7.4 Epidemiological studies in Greece and OHRQL

During the last two decades, researchers in Greece used different OHRQL measures in oral health epidemiological studies (Table 3). Four studies used the Oral Impact Profile short form (OHIP-14) (Roumani et al, 2010; Papaioannou, et al 2011; 2015; Papagiannopoulou et al, 2012; Polyzois et al, 2015), and two studies used the Oral Impacts on Daily Performances (OIDP) measurement (Tsakos et al, 2001; Damaskinos et

al. 2014). One study used both OHIP-14 and OIDP measurements (Stamadianos et al. 2009), while only one study used the Geriatric Oral Health Assessment Index (GOHAI) (Gkavela et al, 2015). Tsakos et al., (2001), evaluated a modified index of OIDP in Greece (681 participants – opportunistic sample) and UK (753 independently living people participated in the National Diet and Nutrition Survey (NDNS). The psychometric properties examined in this cross-sectional study, showed construct validity and consistency, for the examined population 65 years and older. Their results showed that the modified OIDP is a valid and reliable measure of oral health related quality of life in elderly people in both countries, Great Britain and Greece. Stamadianos et al., (2009), examined dental patients, aged 18 years and older, in the General Hospital of Kalymnos, a small Greek island. They used OHIP-14 and OIDP instruments to evaluate OHRQOL of these dental patients and moreover to evaluate and compare validity and reliability of the two measures. Their results showed that both OHIP-14 and OIDP are suitable for the Greek people; OHIP-14 and OIDP had Cronbach's coefficient 0.92 and 0.84 respectively, and their scores were strongly correlated (rs = 0.94). Roumani et al, 2010, validated the Greek version of the oral health impact profile (OHIP-14) in adolescents (15 years old).

Papaioannou et al, 2011, in a cross-sectional study examined OHIP-14 and OHRQOL in adults 35-44 years old, in different regions of Greece. Associations of the total OHIP-14 score and its 7 sub-scales measured an overall weighted score of 1.1 (SD 1.9). The study showed differences in functional limitation, handicap, physical pain, and psychological discomfort affecting the QoL of the subjects according to region and education. Subjects from metropolitan regions had lower OHRQL compared to those in non-metropolitan and more years of education indicated less impact and lower scores of OHIP-14.

Papagiannopoulou et al, 2012, tested the validity of the short form of the Oral Health Impact Profile (OHIP-14) for use among adults aged 35 years and above, in Greece. Damaskinos et al, (2014) examined a population of 734 elderly people from two different municipalities in Attica area; the results demonstrated oral health inequalities and the social gradient in clinical and subjective measures of health, according to education, Mini Mental State Examination, (MMSE), and

socioeconomic status. For oral health-related quality of life they used the OIDP instrument and the results showed satisfying internal consistency (Cronbach's a: 0.87).

Gkavela et al, 2015, validated the Greek version of the Geriatric Oral Health Assessment Index (GOHAI) in a population 60 years old and above (N=100), and GOHAI scores showed satisfying internal consistency (Cronbach's a: 0.88). Papaioannou et al, 2015, in a representative sample of adults aged 65-74 years old, examined oral health related quality of life using OHIP-14 and revealed a medium impact of oral health with a weighted OHIP-14 score of 2.1. In contrast to their previous study in 2011, they did not find any differences according to education. These two studies have a limitation as they had only subjective but no clinical measures of oral health.

Polyzois et al, 2015, examined associations of OHIP-14, on new complete denture wearers using denture adhesives, in two and four weeks, and after 6 weeks of wearing the new set of dentures. A summary of these studies is presented below (Table 7); the instruments used OIDP, OHIP-14 and GOHAI, are valid and reliable measures of oral health related quality of life for the Greek population. They captured impairment, functional limitation, pain, discomfort and dissatisfaction and rate of impact on physical, physiological and social performance of every day's life.

There is wide range of length, format and use of these questionnaires specially designed to measure physical functioning, disability and effect on everyday life. Health status has the quality and special features of biological integrity, allowing the individual to work and live a personal and family life and social interaction, with the absence of disease (Stokes et al, 1982). Kennedy (1983), while unmasking medicine, argues that illness, has the meaning of deviation from what is expected or accepted as normal.

Subjective measures and self-ratings of health have been associated with level of education, socioeconomic status and ethnicity. Poor Self-rated health is a strong predictor of subsequent mortality, as well as, or

better than, physical measures (Burstrom & Fredlund, 2001; Idler & Benyami, 1997; Mossey & Shapiro, 1982).

Individuals' feeling and perceptions of health, functional ability and social life are fundamental for assessing health status and well-being. Health is multidimensional and not only physical, thus mental, emotional, spiritual and social are important for individuals' well-being. Oral Health Related Quality of Life (OHRQoL) is a subjective measure of health that includes a wide range of fitness, physical, functional, and psychological well-being.

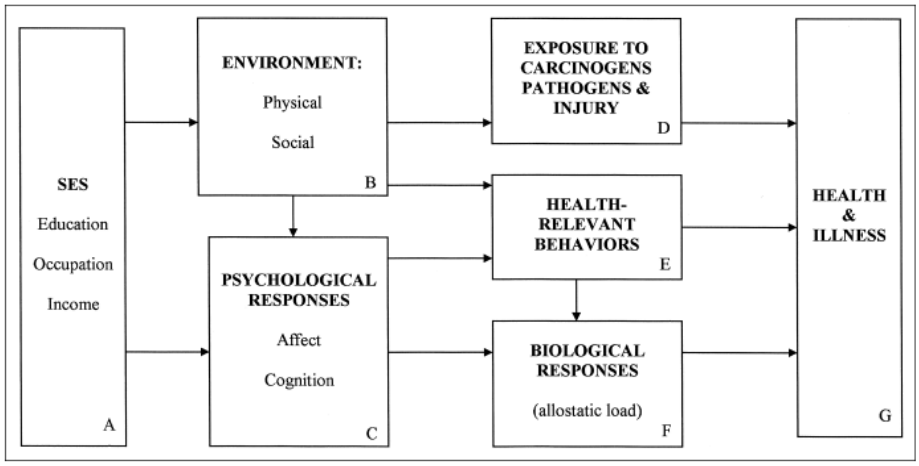
Table 3. Measures of OHRQoL used in epidemiological studies in Greece

Author / Year	OHRQoL Instrument
Tsakos et al, 2001 Evaluation of a modified version of the index of Oral Impacts on Daily Performances (OIDP) in elderly populations in two European countries.	OIDP Adults 65 and over
Stamadianos et al, 2009 Oral health and quality of life of dental patients in the General Hospital of Kalymnos	OHIP-14 & OIDP Adults 18 and over
Roumani T et al, 2010 Validation of a Greek version of the oral health impact profile (OHIP-14) in adolescents.	OHIP-14 Adolescents 15 years
Papaioannou et al, 2011 Oral health related quality of life of Greek adults: a cross-sectional study	OHIP-14 Adults 35-44years
Papagiannopoulou et al, 2012 Validation of a Greek version of the Oral Health Impact Profile (OHIP-14) for use among adults	OHIP-14 Adults 35y and over
Damaskinos et al, 2014 The social gradient in oral health in Greek older adults	OIDP Adults 65y and over
Gkavela et al, 2015 Oral health related quality of life in older people: Preliminary validation of the Greek version of the Geriatric Oral Health Assessment Index (GOHAI)	GOHAI Adults 65y or older
Papaioannou et al, 2015 The oral health related quality of life in different groups of senior citizens as measured by the OHIP-14 questionnaire	OHIP-14 Adults 65-74
Polyzois G et al, 2015 Short-term assessment of the OHIP-14 scale on denture wearers, using adhesives.	OHIP-14 Adults

2.8 Theoretical Model

The simplified model of Adler & Snibbe (2003) as shown below (Fig. 5) presents some of the pathways through which Socio-Economic Status (SES) may affect health. People with higher SES are exposed to less stress than those people with lower SES. Furthermore, there is a difference in experiencing less psychological response to that stress. Socioeconomic status is associated with the social and physical environment in which people live and work. Those individuals who have lower SES live in areas with higher pollution, and noise and accept jobs that have more physical risks. For these reasons, they are exposed to crowds and crime, have less social support and experience inefficient health care and recreation facilities (Adler and Snibbe, 2003).

Figure 5. The simplified model of pathways from SES to health (Adler & Snibbe, 2003)



Source: Simplified model of pathways from socioeconomic status (SES) to health. Modified from Adler and Ostrove (1999)

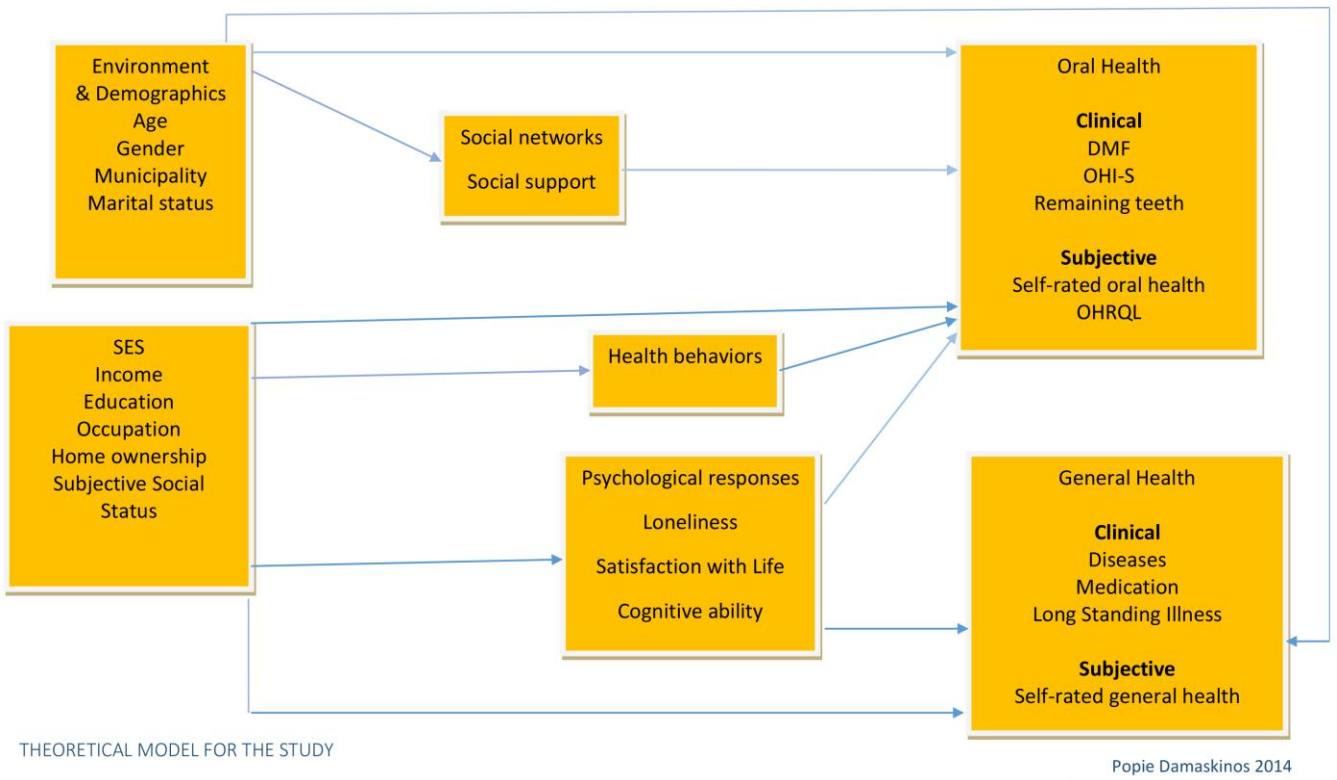
This is the simplified model Adler & Snibbe introduced in 2003. According to the above model, physical and social environment are associated to SES. The lower the socioeconomic resources and means, the higher the risk for living and working in unhealthy environment. The

environmental (physical and social) impacts on social networks and affective tendencies have a mediating role in the relationship between SES and health. People in the higher levels of SES report more mastery and control than do lower-SES individuals. Perceived control in the working environment is very important for health as the Whitehall studies revealed. Marmot et al (1997) found that more than half of the associations between SES and health were because of perceived control at work.

Behaviours are influenced by the social and physical environment and psychological responses. Social networks influence behaviours through social support, social influence, social engagement and providing access to resources and materials. Differences in health-relevant behaviours across the socioeconomic spectrum depend on the level of encouragement or constraint of the social environment. The mediating role of social networks and social capital was examined and despite the reduced negative effects of poorer socioeconomic position on health and well-being, they could partly explain the harmful effect of poverty on health and well-being (Cattell, 2001).

For the present study, the model of Adler and Snibbe (2003), was modified to examine the influence of psychometric factors and the pathways of SES to health outcomes. The study has clinical outcomes but also subjective outcomes of Self-rated oral health, Self-rated general health, and OHRQL. The modified model is presented below (Figure 6).

Figure 6. Theoretical model for the study. Modified from Adler & Snibbe, 2003



2.9 Study Rationale

The literature review, presented earlier in Chapter 2, highlights the evolution of ageing societies and the social gradient in oral health. During the last years a pathfinder study took place in Greece and also examined risk indicators and oral health behaviors in adults and senior citizens (Mamai-Homata et al, 2012) and other studies examined OHRQL in Greek adults (Papagiannopoulou et al, 2012; Tsakos et al, 2001; Damaskinos, 2016; Gkavela, 2019)

The social gradient in physical and mental health was found among Greek adults (Theodosiou & Zangelides, 2006). Likewise, there are no studies examining oral health inequalities and the social gradient of Greek elders in the light of psychometric factors, satisfaction with life, loneliness, cognitive ability and social networks. According to the 2003 European Global Oral Health Project 'Greece has the less indicators for oral health (p.143) and …has no information about oral health determinants (p.144) …and there are gaps about the information in Greece' (European Global Oral Project Final Report, 2003). Agreeing with this statement, Mackenbach (2006) presented the results and timelines for nine countries illuminating their policy development and the social determinants; for Greece he lacked data and said: 'Among the countries included in our analysis, which was carried out in 2002, Greece is the only one that finds itself still in a pre-measurement state' (Mackenbach, 2006, page 231). Thus, more studies need to take place and explain the role of psychometric measures in explaining oral health inequalities and the social gradient.

This study will specifically investigate the potential role of cognitive ability, social networks, loneliness, satisfaction with life and well-being and the social gradient in oral health inequalities, in clinical measures (OHI-S, DMFT, Missing teeth, Remaining teeth) and Self-rated oral and general health, in an older Greek population.

PART 2

Aim - Objectives - Hypotheses

Aim

The overall aim of this research is to explore the impact of complex socioeconomic, psychometric and behavioural factors in oral health inequalities. Furthermore, to establish whether there is a social gradient in clinical and subjective measures of oral health in an older Greek population aged 65 years and over.

Objectives

Objective 1:

To assess whether there is a social gradient between clinical oral health and socioeconomic measures in a Greek older population.

Objective 2:

To assess whether there is a gradient between measures of subjective oral and general health and the socioeconomic status indicators in a Greek older population.

Objective 3:

To assess whether there is a relationship between oral health behaviors and socioeconomic measures in a Greek older population.

Objective 4:

To assess whether the social gradient in oral health status is influenced by psychometric factors, social networks, cognitive ability, life satisfaction, loneliness, general health status, and subjective wellbeing.

Hypotheses

Null Hypothesis H0: there will be no socioeconomic differences and gradients in the examined population for clinical and subjective measures of health; there will be no socioeconomic differences in oral health behaviours of older people. Psychometric factors will not explain inequalities and the gradient.

Alternative Hypotheses

Hypothesis 1: There will be social gradients in clinical measures of oral health, tooth loss, dental caries, and OHI-S among older people in Greece.

Hypothesis 2: There will be social gradients in subjective measures of oral health, Self-rated oral health, and OHRQL, among older people in Greece.

Hypothesis 3: Oral health behaviors will be associated to socioeconomic measures, among older people in Greece.

Hypothesis 4: Psychosocial factors, life satisfaction, loneliness, social networks and cognitive ability, will partly explain the social gradient in oral health, among older people in Greece.

CHAPTER 3
Methods and Material

3.1 Methods and Material

This epidemiological study has an observational, cross-sectional design and seeks to explain the relationship between social indicators and the oral health of aged people living in the urban area of Greater Athens, Greece.

The sample includes adults aged 65 years and over. The sample is not representative of the Greek population as a whole. The reasons for selecting this age group for the study are: There are not many studies in older adults in Greece and there is an intense demographic change and ageing society in Greece.

Study Area and Municipalities

The study took place in two municipalities: Athens, the capital of Greece and Piraeus (see Appendix III and maps). Each municipality has day centres previously called KAPI; recently these day centers in Athens Municipality were renamed and called “Friendship Club’. These clubs are for the older people where they meet, talk, have coffee or tea, a snack and moreover they have visiting doctors, nurses and a social worker. However, Municipality of Piraeus renamed KAPI to “Club of Love and Solidarity”. For methodological reasons and consistency all will be referred as Day Clubs. The municipality of Athens has 20 Day Clubs, distributed within its neighbourhoods. In Piraeus there are nine Day Clubs within its boundaries and older people from the surrounding areas who are citizens of that municipality are allowed to register as members and visit every day, or as often they feel.

Athens and Piraeus are the two municipalities with the highest population, 745,514 and 175,697 respectively.

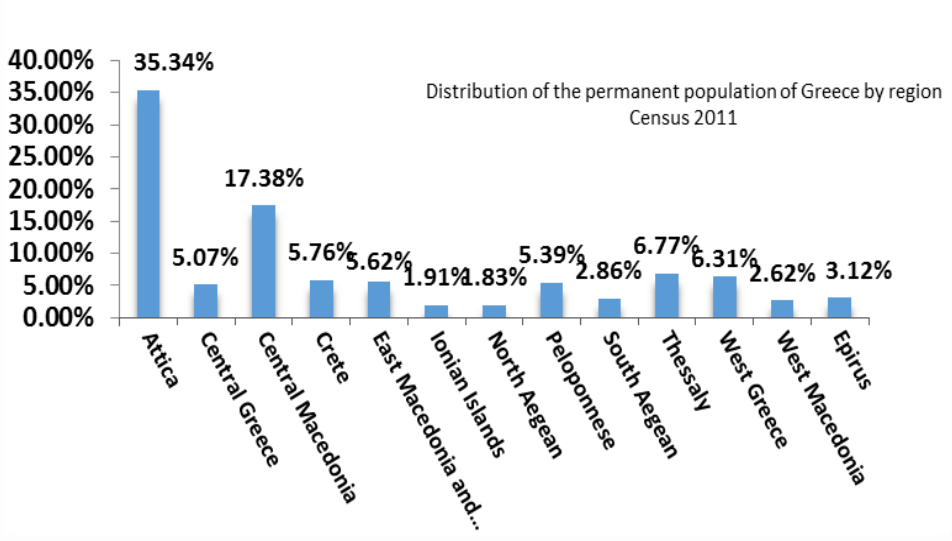
Thus, a total of 29 Day centres in Athens and Piraeus were selected for the study because their members have a wide range of education,

incomes and occupations. Residents of the areas who are members of these Day Clubs were invited to voluntarily participate in the study.

3.2 Sampling Frame and Sample Size

There are no sampling frame readily available and thus difficult and expensive procedures to have a stratified random selection (SRS). According to Forthofer et al. (2006), even if we were able to select SRS, it would be quite expensive and impractical. To eliminate these practical difficulties, the sample selection can be based on geographical area census tract and multistage sample design. Regarding the selection of the area, Greece has 13 administrative regions, one of them being the Prefecture of Attica. According to the preliminary results of census 2011, in Attica lives 35.34 % of the permanent population of Greece (Figure 7).

Figure 7. Distribution of the permanent population of Greece by region (Census 2011)



The selected municipalities of Athens and Piraeus are the two biggest cities, in population size. Moreover, among ranking municipalities according to weighted population, Athens is ranked number one and

Piraeus number two. This is a geographical area-based participant selection method that avoids difficulties of a stratified random selection procedure (Forthofer et al., 2006).

3.2.1. Sample Size Calculation

The sample size calculation is based on the results of the pilot study. All calculations were done separately for all outcome measures, clinical and subjective (tooth loss, caries, DMF index and OHRQL), and for each main explanatory variable (education, income and occupation) for the best and the worst group. To take into account the effect of clustering (Kish, 1965), a design of 1.2 is considered suitable and adequate for this study.

One of formulas for comparison between two means (Kirkwood & Sterne, 2003) to calculate the sample size is the one below:

$$n = \frac{(u+v)^2 (\sigma_1^2 + \sigma_2^2)}{(\mu_1 - \mu_2)^2}$$

n: Minimum sample size per group
u: Power = 80 %, u= 0.84
v: Significant level= 5%, v= 1.96
μ_1: Mean number group 1
μ_2: Mean number group 2
σ_1: Standard deviation for group 1 (lower SES), from pilot stud
σ_2: Standard deviation in group 2 (higher SES), from pilot study

For this research, and for practical reasons *Statulator*, a free online statistical program that conducts statistical analyses, was used for sample calculations for comparing two independent means. Statulator used the input values of a power of 80%, a two-sided level of significance of 5% and equal group sizes for sample size calculation and adjusted the sample size for t-distribution. The results of the pilot study in Municipalities of Kallithea and Psychico helped to estimate the sample size for the main study. Health outcomes were examined for

each explanatory variable (education, personal income and household income). The biggest sample size required was 309, for DMFT according to education (less than lower secondary vs lower secondary or above). [Reference: Dhand, N. K., & Khatkar, M. S. (2014). Statulator: An online statistical calculator. Sample Size Calculator for Comparing Two Independent Means. Accessed 14 October 2019 at http://statulator.com/SampleSize/ss2M.html]

These estimations provided the minimum sample size to detect whether the stated difference exists between the two means (with the required confidence level and power). The sample size according to these estimations was 618. After adjusting the design factor 1.2 for cluster sampling and over-sampling for non-response, the final sample size reached 741.6. Thus, the total sample size should be 742 people.

3.3 Municipalities and Recruitment

Recruitment for the study was from the municipalities of Athens and Piraeus and their Day Clubs. According to the Socioeconomic Atlas of Greece (Maloutas, 2000) these areas and municipalities have great differences according to occupation and job type activity, education and land value (Appendix 1).

3.4 Study Population-Inclusion and Exclusion Criteria

All individuals participating in the study were Greek citizens living in the Greater Athens area, in order to ensure a homogeneous sample that avoids cultural and behavioural differences. Participants were limited to those aged 65 years and over, members of *Day Clubs*, who volunteer to participate in the study.

Participants were included in the study only after successfully completing a pre-test of four simple cognitive screening questions; this pre-test is an indicator that participants are able to communicate and reply accurately and effectively. The four questions were: ‘What is the day’, ‘What is the date’, ‘What is the year’, ‘What is the season’.

For the clinical examination all people were excluded from periodontal examination if they reported taking anticoagulants or with one or more of these problems: infective endocarditis, arthroplasty surgery within the last 6 months; congenital cardiovascular disease; heart operation during the last months and or having prosthetic heart valve.

3.5 Interviews and Questionnaires-Data Collection Instruments

Data were collected through structured, face-to-face interviews and clinical examinations. The interview questions were administered in the same way for all participants. All eligible individuals were clinically examined, as well. The examination procedure was standardized in accordance with WHO guidelines for oral health surveys. Safety measures and all procedures for sterilization were implemented. The examiner also re-examined 10 percent of the participants for intraexaminer variability. The only one examiner/researcher, has been trained and calibrated with a senior staff of Aristotle University of Thessaloniki (Professor Topitsoglou) as the gold standard.

Order of Clinical Examination

The examination started extra orally before the participant removes their dentures and recorded extra-oral appearance and temporomandibular joint assessment, i.e., symptoms and signs. Then oral mucosa and other soft tissue lesions were recorded.

The clinical examination always started clockwise (when looking at the subject from the front), thus from upper right moving to upper left, then to lower left and finally to lower right (Upper right →Upper left → Lower left→ Lower right). The examination started by recording the condition of the crowns of the teeth. While recording the coronal condition the examiner also noted debris. The presence or absence of any plaque was noted out first before cleaning. Having completed the coronal condition recording, then exposed root surfaces were examined with the same order (Upper right →Upper left → Lower left→ Lower right). The use of a WHO CPI probe was necessary for the diagnosis of root caries. Exposed surfaces apical of the cemento-enamel junction

(CEJ) (or when the CEJ has been replaced by a restoration, the apical margin of a restoration) was regarded as the root surface.

Feasibility of the Study

The interviews were applied by three trained interviewers under the supervision of the researcher. The researcher examined all participants. Oral health examination and interviews took place in the same day. According to the experience of the pilot study the total estimation of time needed to conduct the main study, was 8 to 10 months. In this time plan holidays (summer/ Christmas/ Easter and other holidays) and considering additional arrangements and activities (i.e. excursions, festival days for the Day Clubs etc.) by Municipalities and Day Clubs were considered.

3.5.1 Reliability

The design strategies and research methodology for this study was in accordance to the "Practical guide for health researchers" WHO, Regional Publications, Eastern Mediterranean Series 30 (WHO, 2004), in order to reduce sources of error, both systematic and random. Reduction of random error improves the precision of the measurement, whereas reduction of systematic error improves the validity of the measurement.

Training all research interviewers and the examiner was performed before starting the study. The purposes of the training were to ensure that everyone on the team agreed and clearly understood all criteria for the study and be familiar on how to record and fill out recording forms. To ensure internal consistency reliability and comparability of data and to avoid biased answers the interviewers were trained and certain rules for asking questions have been applied. They were instructed to point out to participants that there are no right or wrong answers and that the interview is not a test.

The only one examiner was calibrated with a gold standard examiner in Greece. For this calibration procedure, Professors Kounari and Mamai from the National Kapodistrian University of Athens provided written

material and data for calibration and supported calibration procedures. Calibration took place at the Aristotle University of Thessaloniki and was introduced and applied by Professor Topitsoglou who was the gold standard examiner. The calibration procedure was performed on patients at the Diagnostic Clinic of Aristotle University according to the clinical criteria of the present study. The results of the calibration showed very good agreement for crown caries (k=0.83) and for root caries (k= 0.86).

Reliability estimation could not be carried out for the interviews because of ethical reasons (re-interviews could not be carried out and not be assessed for interview and re-interview reliability estimations). However, reliability for oral health examination was performed, and 10% of the participants were reexamined for accuracy and consistency.

For the scales used in the study we examined reliability and consistency with Cronbach's alpha. Satisfaction with life and Loneliness scales (with three and four items) had good scale reliability (Table 4).

Table 4. Cronbach's alpha

Scale	N	N of	Cronbach's alpha
Satisfaction with life (SWL)	743	5	0.853
Loneliness (3 questions)	743	3	0.843
Loneliness (4 questions)	743	4	0.882

These Cronbach's alpha values in Table 4, are considered good; according to Pavot et al (1991;1993), the Satisfaction with life scale has good internal consistency, with a Cronbach alpha coefficient reported of 0.85.

3.6 Questionnaire and Measures

The questionnaire has been designed so that participation in the study will not be overly time consuming but also not compromise the quality of the results. The questionnaire has 54 questions (see Appendix IV). The questionnaire coverage includes:

- Demographics
- Housing
- Employment/ occupation ISCO -08/ last main occupation
- Income/pensions/ personal income/ household income
- Education/ years of education / higher certificated/ISCED-97
- Cognitive ability/ Mini Mental State Examination
- Social participation
- Social networks
- Psychosocial factors/ loneliness/ satisfaction with life/self-perceived age
- Self-rated general and Self-rated oral health/ OHRQL
- Behaviours/ frequency of brushing/ dental visits/ reason to go to the dentist
- Self-reported social status; subjective social status
- Medication/ diseases/how often exercise/diet/ long standing illness/xerostomia

For translating the questionnaires, the back-translation method was used; questionnaires were translated into the target language by two translators and then translated back into the source language by two independent bilingual translators to the original questionnaire, according to international standards (Sperber, 2004; Medical outcome Trust, 1997).

Each participant had a single code number as the questionnaires were anonymized. For the analysis all anonymized questionnaires were entered in a data base and analyzed using a single code number for each participant.

Income

Income was recorded as personal income and household income per month before and after taxes. Furthermore, personal income was categorized as low, medium and high. The absolute material resource indicator of household income was equalized. Household income was equalized according to OECD 2011 (square root scale). Quintiles were constructed for personal and household income indicators.

Occupation

Occupation classification was according to former last main occupation and the International Classification for Occupation (ISCO-08), which divides jobs into 43-unit groups. These unit groups are summed and clustered into 130 minor groups, 43 sub-major groups and 10 major groups, based on their similar nature and equivalence in terms of the skill level and skill specialization required for the jobs. The top major occupation groups are:

1. Managers
2. Professionals
3. Technicians and associate professionals
4. Clerical support workers
5. Service and sales workers
6. Craft and related trade workers
7. Skilled agricultural, forestry and fishery workers
8. Plant and machine operators and assemblers
9. Elementary occupations
10. Army forces

A small percentage of female participants (4.1%) reported they had never worked. For this small percentage of females, classification was according to the head of household's occupation; this classification for women has been previously used by Mackenbach and Knust (1997). Thus, for single women who never married, classification was performed according to father's ISCO-08 occupation. For married women occupation classification was according to spouse's ISCO-08 occupation classification. For the analysis the ten groups were merged into four: professionals, service and shop keepers, agriculture and craft workers, and manual workers. Three groups were formed as professionals, nonprofessionals nonmanual and manual workers. For the binary analysis occupation was grouped in two categories, as manual vs non manual workers.

Education

Education was recorded as years of education, as higher certificate attained, and as education level according to International Standard

Classification of Education (ISCED-97). Total years of education, highest certificate and ISCED-97 categories were used to examine educational differences. The ISCED-97 categories are:

0=no schooling (pre-primary level of education)
1=primary level of education
2=lower level of education (lower secondary)
3=upper secondary level of education
4= post-secondary, non-tertiary education
5= first stage of tertiary education
6= second stage of tertiary education (leading to an advanced research qualification)

For binary analysis, two groups were formed: less than lower secondary vs. above lower secondary education.

Subjective Social Status

Subjective social status (SSS) was assessed by the McArthur social status scale (represented as a ladder with 10 steps). This social status measure was developed by the MacArthur Network on SES and Health to represent and record an individual's perception of their place on the social ladder, which takes into account multi elements of socioeconomic status and social position. The study participants were shown a picture of the ladder and were asked to answer the question: "Think of this ladder as representing where people stand in the society. At the top of the ladder are the people who are the best-off those who have the most money, the most education, and the most respected jobs. At the bottom of the ladder are the people who are the worst off who have the least money, least education and the least respected jobs or no job. The higher up you are in the ladder, the closer you are to the people at the very top; the lower you are, the closer you are to the people at the very bottom. Where would you place your self on this ladder? Please place a large "X" on the rung where you think you stand at this time in your life, relative to other people in the society".

For the analysis the 10 rungs (steps) were merged and created categorical variables. A binary variable for logistic regression analysis was created; SSS=1 refers to steps 1-4 and SSS=2 refers to steps 5 or

above. For the multi categorical variable the ten steps were merged into 3 categories SSS=1 (low steps 1-4), SSS=2 (middle steps 5-6), and SSS=3 (7 or above).

Self-rated oral health. Self-rated oral health (SROH) was recorded using a 5-point scale. The participants were asked to answer the question "Would you say your oral health is…….? Possible answers were poor, fair, good, very good, and excellent. For the binary analysis, the answers were merged into two categories; excellent, very good and good were grouped together as good; poor and fair were grouped together as poor.

Self-rated health. Self-rated health (SRH) was recorded using a 5-point scale. The participants were asked to answer the question "Would you say your oral health is…….? Possible answers were poor, fair, good, very good, and excellent. For the binary analysis, the answers were merged into two categories; excellent, very good and good were grouped together as good; poor and fair were grouped together as poor.

Other variables

Age. All participants were 65 years or older. For the binary analysis, two groups were formed: 65-74 years and 75-94 years.

Gender was considered in all analyses as binary: male or female.

Marital status was recorded according to self-reported marital status, using four categories: married, widowed, divorced or separated, and single. For the analysis, this variable was recorded into three new groups – married, widowed, and divorced/separated / single, and into a dichotomous variable married vs all others.

Long-standing illness and long-standing illness limited daily activity were scored dichotomously (yes vs no).

Social networks were recorded as the number of family members, children, and friends they communicate and the frequency of this communication by telephone, and how often they meet with family

members, children, and friends. Additionally, close relations were recorded and used in this analysis (referred as social networks).

Loneliness was assessed by the UCLA 3-Item Loneliness scale. This scale includes three items: 'How often do you feel that you lack companionship?' 'How often do you feel left out?' and 'How often do you feel isolated from others? Possible answers are hardly ever, some of the time, and often. This scale was modified by adding one more question "Do you feel loneliness?" However, for the thesis' analysis the UCLA 3-Item Loneliness scale was used to have comparable results with other studies.

Satisfaction with Life (SWL): Satisfaction with life was measured through the Satisfaction with Life Scale (Diener E, et al 1985), which includes five items: 'In most ways, my life is close to my ideal'; 'The conditions of my life are excellent'; ' I am satisfied with my life'; 'So far, I have gotten the important things I want in life'; and 'If I could live my life over and over, I would change almost nothing'. The participants answered using the following 7-point scale: strongly disagree, disagree, slightly disagree, neither agree nor disagree, slightly agree, agree, strongly agree.

Cognitive ability: For cognitive ability Mini Mental State Examination (MMSE) – a copyright scale- was used. The MMSE is a 30-point test and has questions about orientation, memory, attention and calculation, language, design copying. (Folstein et al, 1975). Mini Mental State Examination performance score was used as an indicator of cognitive ability and not as a diagnostic tool for dementia. The higher the MMSE score, the better the cognitive ability. The MMSE test has been validated in the Greek population; Fountoulakis., et al. (2000), found that MMSE score 23/24 as a cut off level for the diagnosis of dementia in Greece, and Solias., et al. (2014), proposed the use of the 25th percentile as a more useful cut off score in order to decrease the false positive results.

Oral Health Related Quality of Life (OHRQL). The instrument used was Oral Impacts on Daily Performance (OIDP).

Oral Hygiene Index-Simplified (OHI-S): The average individual or group debris and calculus scores were combined to produce the OHI-S.

DMFT index and total *Missing teeth* were recorded according to the clinical examination procedure which was standardized in accordance with WHO guidelines (WHO, 1997) for oral health surveys.

Time since retirement: time since retirement was recorded as the years since the person reported being in retirement status.

Xerostomia (subjective) was recorded according to perceptions of dryness in the mouth: "Have you felt any dryness in your mouth during the last 6 months', 'Does your mouth ever feel dry when you are eating a meal' 'At other times of the day?' 'Feel dry at night?' 'Does dryness in your mouth ever cause you any of the following difficulties?' (Possible answers: Difficulty chewing food, swallowing food, taking medication, when speaking, no difficulty, do not know). 'Have you done any of the following to relieve your dry mouth?' (Possible answers: chewed gum to relieve your dry mouth, sucked on hard sweets or mints to relieve your dry mouth? Sipped water or other liquid to help you shallow dry foods? Taken any other product or medication to relieve your dry mouth?' "None").

3.7 Clinical and Subjective Measures

Clinical and subjective health assessments will be used to measure two different dimensions of health. While clinically measured health reflects diseases as defined by health professionals, subjective health reflects multidimensional aspect of health which include social, psychological and economical dimensions (Idler & Benyamini, 1997); poor self-rated health was found to be a useful measure and a strong predictor of consequent mortality (Burstrom & Fredlund, 2001).

3.7.1 Clinical Outcomes

The oral health outcomes were recorded on a chart depicting the prevalence of tooth loss, DMFT, gingival index, plaque index, calculus

assessment, tooth mobility, prosthetic status and soft tissue lesions. (However, periodontal status was not included in the analysis and the results presented in this thesis).

Physical, physiological and clinical measures report any damage or pathological processes i.e. caries, gingivitis, OHI-S. A survival and longevity measure used in dentistry is tooth loss. However, these clinical measures cannot report about functioning, satisfaction with chewing and the psychosocial impact of oral diseases, thus other non-clinical measures were used in this epidemiological study.

The reasons for using both measures (clinical & subjective) are that the study will explore and analyze factors influencing perceptions of oral health, such as socio-demographics, household income, oral health behaviours and psychosocial, and the multidimensional model for health. According to the WHO's health definition, oral health is not only having strong intact teeth but it is also fundamental for well-being and an essential undivided part of general health.

3.7.2 Subjective – Non-Clinical Outcomes

Subjective measures (perceptions, feelings, OHRQL, and behaviours) were recorded according to the individual participants' self-reports. Subjective social status was measured by the McArthur social status scale (10 steps). Self-rated health (Self-rated oral and Self-rated general health) were classified as excellent, very good, good and fair/poor. Self-rated health is a subjective outcome measure widely used in studies and has been associated with level of education, socioeconomic status and ethnicity.

3.8 Ethics

For the study all ethical considerations were of high priority for the study, such as confidentiality, data protection. A written informed consent from the participants was provided. Their participation was voluntarily. Participants were informed from the beginning that that they can withdraw at any time. All participants were informed for the

purpose of the study and they participated by their free consent. Questionnaires were anonymous with only a code number for each participant.

The European Union (EU) data protection was ensured. The research was in line with The National and Kapodistrian University of Athens procedures. All data were locked and stored; all computer files are password protected and participants details anonymized and under the responsibility of the researcher. The study received ethical approval from the Dental School of Athens University (253/27-01-2015).

3.9 Data Analysis

Data analysis included descriptive statistics means, Standard Deviation (SD), ranges and frequency distribution to describe the characteristics of the sample. Data was tested for normality using a Kolmogorov-Smirnov Test, and a Student's T-Test was used for analysis of normally distributed continuous data. The differences in continuous outcomes normally distributed, such as differences in means for decayed, missing and filled teeth, were tested, using a t-test. Categorical outcomes with five or more rating scales were analyzed using chi-square tests. Means, standard deviations and standard errors of the means of these variables were computed within age groups, and other variables. Correlations were examined using the Pearson's correlation and Spearman's Rho correlation tests. Categorical variables were compared using $\chi 2$ test of independence.

Linear regression (or/and Poisson regression) was performed to analyze the relationship between dependent continuous and independent variables or count data for continuous variables. Logistic regression was used for dichotomous oral health outcomes. Multinomial Regression and General Linear Models (GLM) were used for the appropriate dependent variables. Continuous dependent variables were analyzed with GLM and Multinomial logistic regression was used for categorical dependent variables with more than two categories. All assumptions were tested and there were no violations.

According to the theoretical model of the study, as shown in figure 6 (page 62), the explanatory variables of SES were income, education, occupation, subjective social status; these variables were tested for their effects on oral health outcomes (clinical and subjective), Self-rated health (oral and general health), health-related behaviours, social networks and psychosocial factors.

Descriptive statistics, Univariate analysis, Multinomial logistic regression, chi-square and Logistic regression were performed to examine socioeconomic inequalities in clinical measures of oral health. In the analysis we examined DMFT, total missing teeth and OHI-S as the dependent variables. Explanatory variables were income, education, occupation and subjective social status. Dummy variables were created for logistic regression, when necessary. There were no missing data for the examined variables.

First, the distribution of all oral health outcomes, health-related behaviours and all explanatory factors (income, education, occupation and subjective social status), were examined. Second, the adjusted (binary) relationship between oral health and SES were tested. Third, regression models to measure the relationship between oral health and SES, adjusting for age, gender, municipality, and living alone, were conducted.

Furthermore, psychosocial factors, social networks and oral health-related behaviours were introduced to the regression models to assess if this explains the socioeconomic variation in oral health. Associations were considered as significant when $p< 0.05$. Statistical analysis was carried out using the Statistical Package for Social Sciences (SPSS) version 24.0 Programme.

CHAPTER 4

Results

Participants were men and women from two Municipalities. According to the data analysis and demographics of sample characteristics in the examined population, there are differences in the two Municipalities; the results are shown in Tables 5 and 6, below.

Table 5. Sample characteristics and demographics of the study participants in the Municipalities of Athens and Piraeus (N=743)

		N	%
Gender	Male	354	47.6%
	Female	389	52.4%
Municipality	Athens	528	71.1%
	Piraeus	215	28.9%
Age group	65-74	365	49.1%
	75-94	378	50.9%
Living alone	yes	336	45.2%
	no	407	54.8%
Marital status	Married	318	42.8%
	Widowed	358	48.2%
	Divorced	35	4.7%
	Single / never married	32	4.3%
ISCED_97	less than lower secondary	498	67.0%
	above lower secondary	245	33.0%
Occupation	professionals	37	5%
	technicians and associate professionals	47	6.3%
	clerks	59	7.9%
	shop and market sales/service	169	22.7%
	agriculture and craft workers	159	21.4%
	plant and machine operators	272	36.6%
Household income	<800 euro per month	294	39.6%

Personal income	≥800 euro per month	449	60.4%
	<600 euro per month	261	35.1%
	≥600 euro per month	482	64.9%
OHI-S	good oral health index	475	63.9%
	not good oral index	64	8.6%
Remaining teeth	edentulous	204	27.5%
	0 teeth (edentulous)	204	27.5%
	1-10 teeth	143	19.2%
	11-20 teeth	231	31.1%
	>20 teeth	165	22.2%

Table 5 presents the sample characteristics and demographics of the study participants; the prevalent population was from municipality of Athens, female and widowed. The majority reported being in the second household income quintile, having less than lower secondary education, being plant and machinery operators, with good oral health index, and retained between 11 to 20 teeth.

Table 6 shows the demographics for the two municipalities, comparing participants from Athens and Peireuas. There were statistically significant differences for gender, age group, household income, occupation, and remaining teeth.

Table 6. Comparing demographic characteristics in the two municipalities of Athens and Peireuas (N=743)

Variables		Municipality		*p*
		Athens	Peireuas	
Gender	male	225(42.6%)	129(60%)	
	female	303(57.4%)	86(40%)	*p*< 0.001
Age group	65-74	274(51.9%)	91(42.3%)	
	75-94	254(48.1%)	124(57.7%)	*p= 0.018*
Living alone	yes	233(44.7%)	100(46.5%)	
	no	292(55.3%)	115(53.5%)	*p*= 0.652
Marital status	married	220(41.7%)	98(45.6%)	
	widowed	260(49.2)	98(45.6%)	
	other	48(9.1)	19(8.8%)	*p= 0.612*
Education	Less than lower	363(68.8%)	135(62.8%)	
	Lower education or above	165(31.2%)	80(37.2%)	*p= 0.117*
Household income	Bottom quintile	69(13.1%)	68(31.6%)	
	Second quintile	138(26.1)	98(45.6%)	
	Third quintile	87(16.5%)	31(14.4%)	
	Fourth quintile	119(22.5%)	7(3.3%)	
	Top quintile	115(21.8%)	11(5.1%)	*p< 0.001*
Occupation	Professionals/ technicians	99(18.8%)	44(20.5%)	
	Service workers	131(24.8%)	38(17.7%)	
	Craft / agriculture	123(23.3%)	36(16.7%)	
	Plant/machine operators	175(33.1%)	97(45.1%)	*p= 0.005*
Missing teeth	Mean (SD)	19.64 (SD 9.526)	21.00 (SD 9.545)	*p=0.058*
DMFT	Mean(SD)	21.3 (SD 7.970)	22.84 (SD 7.815)	*p= 0.079*
Remaining teeth	0 teeth (edentulous)	143(27.1%)	61(28.4%)	
	1-10 teeth	90(17.0%)	53(24.7%)	
	11-20 teeth	171(32.4%)	60(27.9%)	
	>20 teeth	124(23.5%)	41(19.1%)	*p*< 0.001

4.1 Results for Objective 1

To assess whether there are inequalities and a social gradient between clinical oral health and socioeconomic measures in a Greek older population. Subjective social status (SSS) is positively correlated with income, education and health, and negatively correlated to occupation, gender, municipality, and age. Only income and education have a medium correlation; all other correlations are weak, meaning that variables are independent from another. (Table 7).

The results of examining OHI-S, DMFT, Missing teeth and associations with socioeconomic factors are presented in the next tables. Table 8 shows the results for Logistic regression predicting likelihood of reporting oral hygiene (poor vs. good). The analysis was performed in two different models for each predictor, Model 1 and Model 2. All socioeconomic factors examined were predictors of reporting oral hygiene as poor ($p < 0.05$) (Table 8).

Table 7. Correlations between SES indicators and independent variables

	SSS	Household income	Education	Occupation
Gender	-0.004	-0.222**	-0.265**	0.002
Municipality	-0.035	0.004	0.054	0.070
Age group	-0.095**	-0.081*	-0.080*	0.021
Living alone	0.135**	0.433**	0.168**	-0.079*
Long standing illness	0.054	0.094*	0.078*	-0.009
Diagnosed Heart disease	0.105**	0.016	0.059	-0.089*
Diagnosed Diabetes	0.015	0.046	0.052	0.010
Edentulous/Dentate	0.196**	0.188**	0.180**	-0.112**
SSS	-	0.278**	0.309**	-0.263**
Household income	0.278**	-	0.410**	-0.279**
Education	0.309**	0.410**	-	-0.473**
Occupation	-0.263**	-0.279**	-0.473**	-

**p<0.05, **p<0.01*

Gender (0=male, 1female), municipality (0=Athens, 1=Peireuas), Age (0=65-74, 1=75--94), living alone (0=yes, 1=no), heart disease (0=yes, 1=no), diabetes (0=yes, 1=no)

Spearman's correlation

Logistic regression models were performed to examine OHI-S considering the effect of the explanatory variables of the study; dummy variables were created. The dependent variable OHI-S had values 0 or >0 (good or poor oral hygiene). Household income quintiles, education, occupation and subjective social status were examined in two models: Model 1 was adjusted for gender, municipality, age, and living alone. In Model 2, frequency of brushing teeth or dentures was entered in the analysis, because it is important for oral hygiene. Thus, Model 2 was adjusted for gender, municipality, age, living alone and frequency of brushing teeth. The results of these Logistic models are summarized in Table 8. All models were checked for 'goodness of fit'. In all models' Omnibus test significance was less than 0.05 ($p< 0.05$), and Hosmer & Lemeshow test also supported each model and had p value greater than 0.05 ($p> 0.05$). All socioeconomic factors examined (education, household income, personal income, occupation, and SSS), were predictors of reporting oral hygiene as poor. Subjective social status was used as a binary variable (low steps 1-4 and higher steps 5—10). Occupation was in three categories (professionals, nonprofessionals-non manual, and manual workers).

Table 8. Logistic regression predicting likelihood of reporting oral hygiene poor

	Model	OR	95% CI	*p*
Household income bottom quintile	Model 1	0.486	0.257-0.919	0.026*
	Model 2	0.489	0.258-0.925	0.028*
Personal income bottom quintile	Model 1	0.439	0.275-0.700	0.001**
	Model 2	0.439	0.275-0.701	0.001**
Education less than lower secondary	Model 1	0.538	0.378-0.766	0.001**
	Model 2	0.546	0.383-0.777	0.001**
Occupation (manual)	Model 1	1.703	1.092-2.656	0.019*
	Model 1	1.677	1.075-2.617	0.023*
Subjective Social Status (low; steps 1-4)	Model 1	0.469	0.340-0.647	<0.001***
	Model 2	0.470	0.340-0.649	<0.001***

**p<0.05, **p<0.01, ***p<0.001*

Model 1 adjusted for: gender (male), municipality (Athens), age (65-74y), living alone (yes).

Model 2 adjusted for: gender (male), municipality (Athens), age (65-74y), living alone (yes), and frequency of brushing teeth or dentures.

Clinical outcome of missing teeth (dependent variable)

To examine predictors for missing teeth, income inequalities and the social gradient, income was recoded according to income quintiles. General Linear Models (GLM) was performed to compare differences among the groups examined and variables, according to household income quintiles (bottom quintile, second quintile, third quintile, fourth quintile and top quintile). The results confirm income inequalities and the social gradient which is linear from the bottom, up to the third income quintile. This is established from the results of analysis of variance missing teeth (mean in each quintile), are gradually faded out as the income quintile raises into higher income; ANOVA sum of squares=5339.008 *df* 4, F=15.822, $p<0.001$. Mean value of missing teeth is decreasing as income increases; there was a gradient-linear shape, from the bottom to the top quintile. Post-hoc comparisons using the Tukey HSD test indicated that the mean score (for missing teeth) for those in the bottom quintile (M=23, SD=8.267) and those in the second quintile (M=22.87 and SD= 9.407) had mean scores statistically different from those in the fourth and the top quintile (M=17.92, SD=9.477 and M=16.54, SD=8.943) respectively. Those in the third quintile (M=20.26, SD= 9.417) had mean scores of missing teeth significantly different from those in the top quintile. Those in fourth income quintile had mean scores significantly different from those in the bottom and second quintile; while those in the top income quintile had mean scores significantly different from those in the bottom, second and the third quintile.

The GLM analysis revealed that household income quintiles and education level have a significant impact on the number of missing teeth and revealed the impact of household income (in quintiles) and education level and associations for the number of missing teeth (Table 9). Missing teeth and household income quintiles had a linear pattern of gradient; the higher the number of missing teeth, the lower the household income (Figure 8). Mean number of missing teeth was 20,03 (SD 9.545) in the total sample N=743 (Figure 9).

Table 9. Missing teeth and socioeconomic inequalities according to household income (quintiles) and education level.

	B	Std. Error	95% Wald CI	Wald Chi-Square	df	*p*
Model 1 (Household income)						
Bottom quintile	6.088	1.2613	3.616-8.560	23.298	1	<0.001 ***
Second quintile	4.632	1.0352	2.603-6.650	20.019	1	<0.001 ***
Third quintile	3.187	1.0387	1.151-5.222	9.413	1	0.002 **
Fourth quintile	1.541	0.9396	-0.300-3.383	2.691	1	0.101
Top quintile	0[a]	.	.	.	.	.
Model 2 (Education)						
Education 1	5.042	0.681	3.708-6.376	54.850	1	<0.001 ***
Education 2	0a	.	.	.	.	.

**p<0.05, ** p<0.01, ***p<0.001*

Dependent variable: missing teeth.

a. Set to zero because this parameter is redundant.

GLM analysis

Models 1 and 2: adjusted for gender, municipality, years in pension, long standing illness, living alone, marital status, OHRQL

Figure 8.
Missing teeth according to household income quintiles (N=743)

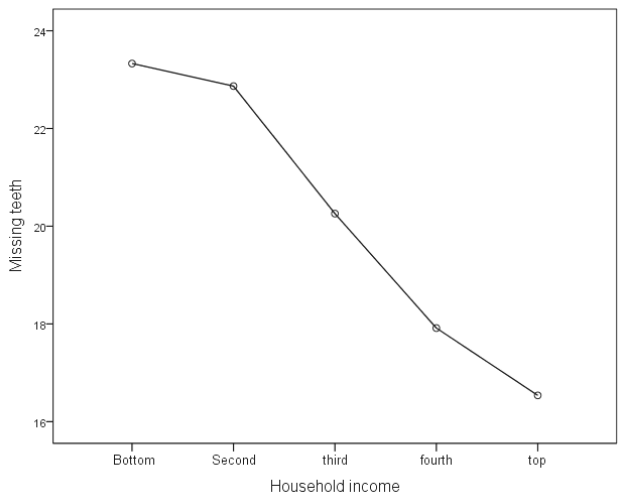
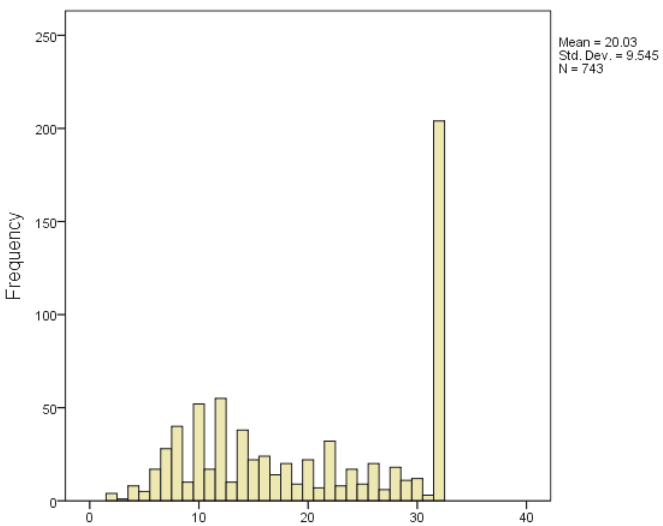


Figure 9.
Missing teeth frequency in the total sample (N=743)



Occupation, Subjective Social Status and Missing teeth

The results of logistic regression for examining missing teeth and occupation and Missing teeth and Subjective Social Status are presented in Table 10; there was a statistically significant difference for missing teeth according to occupation (occupation categories: 1= professional, 2= nonprofessional-non manual, 3=manual workers). For the first category occupation 1, p< 0.001, for occupation 3, *p*= 0.003; there was no statistically significant difference for the second group of occupation (*p*= 0.293). Models adjusted for gender, municipality, age group, and living alone. Subjective social status is also a significant predictor for missing teeth; the lower the SSS, the higher number of missing teeth (*p*< 0.001).

Table 10. Logistic regression. Missing teeth, occupation and Subjective Social Status

	B	Std. Error	Wald	df	*p*	OR	95% CI
Model 1 (Occupation)							
Occupation 1	1.294	0.234	30.675	1	<0.001 ***	3.65	2.308-5.768
Occupation 2	0.250	0.238	1.105	1	0.293	1.29	0.805-2.049
Occupation 3	0.699	0.232	9.063	1	0.003 **	2.01	1.276-3.173
Model 2 (SSS)							
SSS (low steps 1-4)	-1.022	0.243	17.648	1	<0.001***	0.36	0.223-0.580

**p<0.05*, **p<0.01, ***p<0.001*

Models 1 and 2; Adjusted for: Gender (male), Municipality (Athens), Age=65-74y, Living alone (yes)

Occupation: 1=professionals, 2=non-professional non manual, 3=manual workers

Occupation 1=professionals, 2= nonprofessionals non manual, 3= manual workers

Clinical outcome DMFT

Analysis for DMFT and socioeconomic inequalities are presented in Tables 11-15, below.

Generalized Linear Model analysis was performed and calculated the between subject effects for DMFT (dependent variable) by household income, education level, occupation and SSS. For the analysis income was according to Household income equivalized in categories of less than 600 euro, 600-799, 800-999 and 1000 euro and over. Occupation ISCO categories were merged as: 1=professionals, 2=service workers and shop sales; 3=craft and agriculture workers, 4=plant and machine operating workers.

Results in Table 13 revealed household income, and education inequalities for DMFT; the models were adjusted for gender, age, municipality and living alone. The results represented all participants, dentate and edentulous (N=743). However, statistical analysis was performed for dentate participants, as well. There were statistically significant differences for household income and education inequalities for DMFT in dentate participants.

The results of GLM for DMFT, in Table 12 shows that there is no statistically significant effect for municipality in the whole sample (N=743), while there was a statistically significant effect for: gender, age, household income <600, and education levels of no schooling and primary education ($p< 0.001$). Moreover, statistically significant effect was found for living alone ($p= 0.008$), household income 600-799 ($p= 0.016$), lower secondary education level ($p= 0.010$) and upper secondary education ($p= 0.035$). The results of GLM for DMFT, only for dentate participants ($n = 539$), showed a statistically significant effect for municipality ($p= 0.003$), gender, age, and education levels no schooling and primary ($p< 0.001$). Household income had a significant effect only for the first category <600 ($p= 0.09$) (Table 11).

To examine the effect of household income without the effect of education (and education without the effect of income) another analysis was conducted. GLM for DMFT were performed with

household income and education level as the only socioeconomic variable each time in the model. The results are statistically significant for all categories of household income (Table 12) and for all levels of education (Table 13).

Furthermore, the analysis included occupation and SSS as explanatory variables. All models were adjusted for gender, municipality, age group, and living alone, yet again. (Tables 14 and 15). Statistical analysis was performed for occupation to explore differences for DMFT index. Generalized Linear Model for DMFT by occupation and other predictors. The results are statistically significant for DMFT and occupation (p= 0.001). Table 15 shows DMFT by SSS in all participants, and in dentate participants. The model revealed the strong effect of age and Subjective social status for DMFT (p< 0.001) in both dentate and all participants. Furthermore, municipality was statistically significant (p= 0.027) in dentate participants.

Table 11. DMFT inequalities by Household income and education level, in all participants (N=743) and in dentate participants (n=539)

	All participants N=743				*Dentate participants n=539*			
	B	Std. Error	Wald Chi-Square Test	*p*	B	Std. Error	Wald Chi-Square Test	*p*
Gender	3.626	0.576	39.523	<0.001 ***	1.729	0.531	10.613	<0.001 ***
Municipality	-0.510	0.569	0.800	0.371	-1.519	0.512	8.785	0.003 **
Age	-3.201	0.533	36.074	<0.001 ***	-1.719	0.468	13.493	<0.001 ***
Living alone	1.660	0.622	7.128	0.008 **	0.168	0.570	0.088	0.767
Household income <600	3.362	1.033	10.598	0.001 **	2.433	0.935	6.773	0.009 **
Household income 600-799	2.054	0.853	5.794	0.016 *	0.513	0.755	0.462	0.497
Household income 800-999	1.235	0.753	2.689	0.101	0.468	0.628	0.556	0.456
Education 0	8.308	1.137	53.341	<0.001 ***	7.597	0.999	57.767	<0.001 ***
Education 1	5.248	1.000	27.539	<0.001 ***	5.253	0.845	38.647	<0.001 ***
Education 2	2.998	1.166	6.615	0.010 *	3.538	0.967	13.387	<0.001 ***
Education 3	2.391	1.131	4.469	0.035 *	2.309	0.942	6.011	0.014 **

**p<0.05, **p<0.01, ***p<0.001*

Generalized Linear Model for DMFT by gender, municipality, age, living alone, Household income and Education level.
Education ISCED-97: 0 =no schooling, 1=primary, 2=lower secondary, 3= upper secondary

Table 12. DMFT by household income in dentate participants (n= 539), without the effect of education.

	B	Std. Error	Wald Chi-Square Test	*p*
Gender	0.554	0.541	1.051	0.305
Municipality	-1.265	0.542	5.450	0.0.20 *
Age	-2.013	0.595	1.522	<0.001 ***
Living alone	-0.230	0.599	0.147	0.701
Household income <600	4.851	0.941	26.587	<0.001 ***
Household income 600-799	2.826	0.740	14.567	<0.000 ***
Household income 800-999	1.962	0.637	9.488	0.002 **
Household income >999	a	.	.	.

**p<0.05, **p<0.01, ***p<0.001*

Generalized Linear Model for DMFT by gender, municipality, age, living alone, Household income.

a. Set to zero because this parameter is redundant.

Table 13. DMFT by education level in dentate participants (n= 539) without the effect of household income

	B	Std. Error	Wald Chi-Square Test	*p*
Gender	1.609	0.531	9.158	0.002 **
Municipality	-1.522	0.516	8.715	0.003 **
Age	-1.720	0.471	13.316	<0.001 ***
Living alone	0.613	0.501	1.496	0.221
Education 0	8.142	9.430	74.550	<0.001 ***
Education 1	5.603	0.803	48.677	<0.001 ***
Education 2	3.864	0.947	16.654	<0.001 ***
Education 3	2.420	0.943	6.582	0.010 *

**p<0.05, **p<0.01, ***p<0.001*

Generalized Linear Model for DMFT by gender, municipality, age, living alone, Household income and Education level.

Education ISCED-97: 0 =no schooling, 1=primary, 2=lower secondary, 3= upper secondary

Table 14. DMFT by occupation in all participants (N=743) and in dentate participants (n=539).

	All participants (N=743)				*Dentate participants (n=539)*			
	B	Std. Error	Wald Chi-Square Test	*p*	B	Std. Error	Wald Chi-Square Test	*p*
Gender	1.990	0.579	11.825	0.001 **	0.153	0.5300	0.083	0.773
Municipality	-0.261	0.603	0.188	0.665	-1.210	0.543	4.961	0.026 *
Age	-3.885	0.555	48.968	<0.001 ***	-2.076	0.493	17.726	<0.001 ***
Living alone	2.463	0.568	18.768	<0.001 ***	0.545	0.530	1.072	0.300
Occupation 1	-4.400	0.755	33.972	<0.001 ***	-3.935	0.662	35.346	<0.001 ***
Occupation 2	-1.896	0.718	6.969	0.008 **	-1.365	0.648	4.440	0.035 *
Occupation 3	-1.951	0.735	7.055	0.008 **	-1.835	0.661	7.699	0.006 *
Occupation 4	a	.	.	.	a	.	.	.

**p<0.05, ** p<0.01, *** p<0.001*

a. Set to zero because this parameter is redundant.

Generalized Linear Model for DMFT by gender, municipality, age, living alone, and Occupation.

Occupation 1 =professionals, 2= service workers and shop sales, 3= craft and agriculture workers, 4=plant and machine operating workers

Table 15. DMFT by Subjective Social Status (SSS) in all participants and in dentate participants.

	All participants (N=743)				*Dentate participants (n=539)*			
	B	Std. Error	Wald Chi-Square Test	*p*	B	Std. Error	Wald Chi-Square Test	*p*
Gender	1.973	0.575	11.781	0.001 **	0.217	0.536	0.164	0.685
Municipality	-0.347	0.595	0.340	0.560	-1.205	0.544	0.4906	0.027 *
Age	-3.662	0.552	43.981	<0.001 ***	-1.971	0.497	15.718	<0.001 ***
Living alone	2.278	0.566	16.180	<0.001 ***	0.565	0.530	1.135	0.287
SSS 1	4.844	0.786	37.973	<0.001 ***	3.402	0.702	23.459	<0.001 ***
SSS 2	1.946	0.743	6.852	0.009 **	1.488	0.638	5.446	0.020 **
SSS 3	a	.	.	.	a	.	.	.

**p<0.05, **p<0.01, ***p<0.001*

a. Set to zero because this parameter is redundant.

Generalized Linear Model for DMFT by gender, municipality, age, living alone, and SSS.

SSS 1 = low 1-4, SSS 2= middle 5-6, SSS 3= high 7-10

4.2 Results for Objective 2

To assess whether there is a gradient between measures of subjective oral health and the social status indicators in a Greek older population. The results of statistical analysis, performed to examine socioeconomic differences and subjective oral health through logistic regressions models and descriptive statistics, are presented below in Tables 16-21.

Self-rated oral and general health

Tables 16 and 17 show percentages of Self-Rated Oral Health (SROH), Self-Rated Oral Health (SRH), and Satisfaction with life in all participants (dentate and edentulous) for the examined independent variables.

Table 18 shows associations (Cramer's' V) between SROH, SRH, SWL and clinical health, OHRQL and health behaviors in all participants. Long-standing illness, long-standing illness limited daily activity, and remaining teeth associations were statistically significant for the three dependent variables (SROH, SRH, and SWL).

DMFT was statistically significant only for SROH, while reason for dental visits was statistically significant for only SWL. OHRQL was significant for SROH and SRH.

Associations between SROH, and SRH (dependent variables), were statistically significant for all the independent variables examined, except for municipality. Thus, age, gender, SSS, household income, education level and occupation were statistically significant for SROH. For SRH gender, SSS, household income, education level and occupation were statistically significant. For SWL only age, municipality and SSS were statistically significant (Table 18).

Table 16. Self-rated oral health, Self-rated health, and satisfaction with life in dentate and edentulous participants

		SROH poor N (%)		SRH poor N (%)		SWL low N (%)	
		Edentulous	Dentate	Edentulous	Dentate	Edentulous	Dentate
Gender	Male	45 (68.2%)	76 (39.2%)	42 (50.6%)	68 (36.6%)	51 (67.1%)	72 (49.0%)
Municipality	Athens	49 (74.2%)	134 (69.1%)	63 (75.9%)	136 (73.1%)	43 (56.6%)	87 (59.2%)
Long-standing illness	Yes	21 (31.8%)	49 (25.3%)	34 (41.0%)	64 (34.4%)	19 (25.0%)	43 (29.3%)
Limited daily activity	Yes	16 (24.2%)	36 (18.6%)	22 (26.5%)	52 (28.0%)	14 (18.4%)	25 (17.0%)
Age	65-74 years	19 (28.8%)	109 (56.2%)	31 (37.3%)	105 (56.5%)	16 (21.1%)	69 (46.9%)
Living alone	Yes	37 (56.1%)	87 (44.8%)	47 (56.6%)	76 (40.9%)	51 (67.1%)	63 (42.9%)
	Married	21 (31.8%)	85 (43.8%)	29 (34.9%)	80 (43.0%)	19 (25.0%)	69 (46.9%)
Marital status	Widowed	42 (63.6%)	88 (45.4%)	48 (57.8%)	84 (45.2%)	56 (73.7%)	59 (40.1%)
	Single/divorced	3 (4.5%)	21 (10.8%)	6 (7.2%)	22 (11.8%)	1 (1.3%)	19 (12.9%)

Table 17. Self-rated oral health, Self-rated health and satisfaction with life in dentate and edentulous participants

		SROH poor N (%)		SRH poor N (%)		SWL low N (%)	
		Edentulous	Dentate	Edentulous	Dentate	Edentulous	Dentate
Household income (euros/ month)	<600	14 (21.2%)	31 (16.0%)	16 (19.3%)	29 (15.6%)	11 (14.5%)	24 (16.3%)
	600 to 799	26 (39.4%)	57 (29.4%)	26 (31.3%)	58 (31.2%)	40 (52.6%)	40 (27.2%)
	800 to 999	22 (33.3%)	74 (38.1%)	30 (36.1%)	66 (35.5%)	20 (26.3%)	50 (34.0%)
	>999	4 (6.1%)	32 (16.5%)	11 (13.3%)	33 (17.7%)	5 (6.6%)	33 (22.4%)
Subjective social status	Low	43 (65.2%)	75 (38.7%)	48 (57.8%)	73 (39.2%)	59 (40.1%)	53 (69.7%)
Education level	<Lower secondary	57 (86.4%)	143 (73.7%)	66 (79.5%)	133 (71.5%)	93 (63.3%)	67 (88.2%)
Occupation	Manual	58 (87.9%)	166 (85.6%)	73 (88.0%)	156 (83.9%)	120 (81.6%)	74 (97.4%)
	Non manual	8 (12.1%)	28 (14.4%)	10 (12.0%)	30 (16.1%)	27 (18.4%)	2 (2.6%)
Reason for dental visits	Occasionally / when in trouble	65 (98.5%)	164 (84.5%)	80 (96.4%)	155 (83.3%)	127 (86.4%)	74 (97.4%)
	Regularly	1 (1.5%)	30 (15.5%)	3 (3.6%)	31 (16.7%)	20 (13.6%)	2 (2.6%)
Remaining teeth (dentate)	1-10	-	65 (33.5%)	-	65 (34.9%)	-	48 (32.7%)
	11 to19	-	62 (32.0%)	-	46 (24.7%)	-	41 (27.9%)
	20 to 31	-	67 (34.5%)	-	75 (40.3%)	-	58 (39.5%)
OHRQL	Has an impact	34 (51.5%)	95 (49.0%)	35 (42.2%)	66 (35.5%)	47 (32.0%)	27 (35.5%)
	Has no impact	32 (48.5%)	99 (51.0%)	48 (57.8%)	120 (64.5%)	100 (668.0%)	49 (64.5%)
OHI-S (dentate)	Not good	-	68 (35.1)	-	65 (34.99%)	59 (40.1%)	-

Table 18. Associations of Self-rated Oral Health (SROH), Self-rated Health (SRH) and Satisfaction with Life (SWL), clinical, health, OHRQL, Health behavior, demographic and socioeconomic status. (Cramer's V)

	SROH	SRH	SWL
All participants			
Long-standing illness	0.13 **	0.31 **	0.13 **
Limited daily activity	0.14 **	0.31 **	0.08 **
DMF	0.23 *	0.21	0.23
OHI-S	0.05	0.09	0.09
Remaining teeth	0.17 **	0.17 **	0.19 *
OHRQL	0.309 **	0.12 **	0.04
Reason for dental visits	0.04	0.03	0.08 **
Dentate participants			
Age	0.13 **	0.01	0.12 **
Gender	0.15 **	0.16 **	0.08
Municipality	0.07	0.04	0.17 **
Subjective Social Status	0.12 **	0.17 **	0.17 **
Household income	0.14 **	0.16 **	0.12
Education level	0.20 **	0.24 **	0.01
Occupation	0.15 **	0.11 **	0.04

** p<0.05, ** p<0.01, *** p<0.001*

Summary models for socioeconomic factors and SSS, SROH and SRH, and the results of logistic regression models for SROH and SRH for each socioeconomic variable are shown in Table 18. Household income, education level, occupation and subjective social status were predictors and determinants of both SROH and SRH. For all logistic regression models, the Omnibus Tests of Model Coefficients sig was less than 0.05, and the Hosmer and Lemeshow test's significant values were greater than 0.05. Model was adjusted for gender, municipality, age group and living alone.

Table 19 shows significant associations between objective socioeconomic factors (household income, education, occupation) and subjective social status (SSS) predicting SROH and SRH. This Table summarizes the results of Logistic regression for Self-rated oral and Self-rated health (poor vs. good).

Education and SSS were the strongest predictors for SROH and remained significant in the four models. SSS was significant for SRH as well, and remained significant in the examined models (Table 20).

The results for household income, less than 600 per month, were significant only for the first two models; when SWL was introduced in the third model, and SROH in the fourth model, at that point household income was not statistically significant for predicting SROH. However, household income (600-799), remained statistically significant in the four models, predicting SRH, while for SROH household income was significant in the first three models (Table 20).

Table 21 summarizes the results of the logistic regression and predictors of SWL, in dentate participants. In the final logistic regression model for SWL, the independent variables that remained statistically significant were gender (male), municipality (Athens), long-standing illness (yes), SSS (low steps) and loneliness (very often).

Table 19. Predictors of Self-rated Oral Health (SROH) and Self-rated Health (SRH) in dentate participants (N=539)

	SROH (poor vs good)			SRH (poor vs good)		
	OR (95% CI)	SE	p	OR (95% CI)	SE	p
Household Income (a)			0.019 *			0.001 **
<600	0.393 (0.196-0.787)	0.354	0.008 **	0.388 (0.192-0.785)	0.360	0.008 **
600 - 799	0.464 (0.265-0.810)	0.285	0.007 **	0.419 (0.239-0.737)	0.288	0.003 **
800 - 999	0.765 (0.466-1.255)	0.253	0.289	1.011 (0.614-1.667)	0.255	0.965
Education (a)	0.453 (0.303-0.678)	0.206	<0.001***	0.584 (0.392-0.871)	0.203	0.008 **
Occupation (a)	0.50 (0.312-0.801)	0.241	0.004 **	0.617 (0.388-0.980)	0.237	0.041 *
Subjective social status	0.503 (0.343-0.738)	0.196	<0.001 ***	0.496 (0.337-0.729)	0.197	<0.001

**p<0.05, **p<0.01, ***p<0.001*

(a)Model adjusted for age (65-74 years), gender (male), municipality (Athens), living alone (yes).

Education=less than a lower secondary education vs lower secondary or higher

Occupation=manual workers vs non manual workers

Subjective social status= low (steps 1 – 4)

Table 20. Associations between objective socioeconomic factors and Subjective Social Status (SSS) for predicting Self-rated Oral Health (SROH) and Self-rated Health (SRH) (N=743). Results of logistic regression models for associations of objective socioeconomic measures predicting SROH and SRH

	Model	SROH poor vs good			SRH poor vs good		
		OR	95% CI	*p*	OR	95% CI	*p*
Household income	Model 1	0.393	0.196-0.787	0.008 **	0.388	0.192-0.785	0.008 **
<600 euros per month	Model 2	0.493	0.242-1.007	0.052	0.459	0.222-0.951	0.036 *
	Model 3	0.532	0.258-0.1.097	0.088	0.499	0.238-1.046	0.066
	Model 4	0.612	0.291-1.290	0.197	0.562	0.262-1.207	0.140
Household income	Model 1	0.464	0.265-0.810	0.007 **	0.419	0.239-0.737	0.003 **
600-799 euros per month	Model 2	0.521	0.295-0.920	0.025 *	0.458	0.258-0.812	0.008 **
	Model 3	0.535	0.302-0.949	0.032 *	0.468	0.262-0.837	0.010 *
	Model 4	0.623	0.345-1.123	0.115	0.521	0.287-0.948	0.033 *
Education level (less than	Model 1	0.453	0.303-0.678	0.000 ***	0.584	0.392-0.871	0.008 **
lower secondary)	Model 2	0.531	0.349-0.807	0.003 ***	0.669	0.440-1.017	0.060
	Model 3	0.531	0.348-0.812	0.003 **	0.674	0.440-1.031	0.069
	Model 4	0.565	0.365-0.873	0.010 *	0.765	0.494-1.186	0.231
Occupation (manual)	Model 1	0.500	0.312-0.801	0.004 **	0.617	0.388-0.980	0.041 *
	Model 2	0.577	0.356-0.935	0.025 *	0.671	0.416-1.083	0.102
	Model 3	0.592	0.364-0.963	0.035 *	0.692	0.426-1.123	0.136
	Model 4	0.631	0.383-1.040	0.071	0.765	0.465-1.259	0.292

SSS (low; steps 1-4)	Model 1	0.503	0.343-0.738	0.000 ***	0.496	0.337-0.729	<0.001 ***
	Model 2	0.544	0.368-0.803	0.002 **	0.528	0.357-0.783	0.001 **
	Model 3	0.587	0.395-0.872	0.008 **	0.580	0.388-0.867	0.008 **
	Model 4	0.649	0.432-0.977	0.038 *	0.642	0.424-0.972	0.036 *

**p<0.05, **p<0.01, ***p<0.001*

Explanation of Table 20:

Model 1 adjusted for age (65-74), gender (male), municipality (Athens), living alone (yes), and household income (1 = less than 600), household income (2= 600-799).

Model 2 adjusted for age (65-74), gender (male), municipality (Athens), living alone (yes), and household income (1 = less than 600), household income (2= 600-799), and remaining teeth.

Model 3 adjusted for age (65-74), gender (male), municipality (Athens), living alone (yes), and household income (1 = less than 600), household income (2= 600-799), remaining teeth and SWL (1=below average).

Model 4 adjusted for age (65-74), gender (male), municipality (Athens), living alone (yes), and household income (1 = less than 600), household income (2= 600-799), remaining teeth, SWL, and Self-rated general health (for SROH) / SROH (for SRH).

Table 21. Predictors of satisfaction with life in dentate participants (n=539)

	Model 1		Model 2		Model 3	
	OR (95% CI)	*p*	OR (95% CI)	*p*	OR (95% CI)	*p*
Gender (male)	0.628 (0.384-1.025)	0.063	0.653 (0.369-1.076)	0.095	0.564 (0.336-0.947)	0.030 *
Municipality (Athens)	2.294 (1.446-3.639)	<0.001***	2.141 (1.334-3.441)	0.002 **	1.924 (1.178-3.144)	0.009 **
Long-standing illness (yes)			0.420 (0.188-0.940)	0.035 *	0.378 (0.167-0.859)	0.020 *
Remaining teeth (1-10)			0.552 (0.311-0.981)	0.043 *	0.609 (0.341-1.088)	0.094
Subjective social status					0.529 (0.324-0.864)	0.011 *
Loneliness (very often)					0.582 (0.362-0.935)	0.025 *

**p<0.05, **p<0.01, ***p<0.001*

Model 1: adjusted for age, gender, and municipality and living alone, long-standing illness. Model 2: adjusted for age, gender, municipality, living alone, long-standing illness and long-standing illness limited daily activity. Model 3: adjusted for age, gender, municipality, living alone, long-standing illness, limited daily activity, SSS and loneliness.
SSS = low steps 1-4

4.3 Results for Objective 3

To assess whether there is a relationship between oral health behaviors and socioeconomic measures in a Greek older popular-tion. The results of multinomial regression analysis are presented in the next Tables. Table 22 shows the results of regression predicting: (a) the likelihood of dental checkups frequency and reason to visit the dentist. (In the two models the examined significant variables were: household income and education; household income was introduced in the first model (model 1) and then age, municipality and household income had a significant overall effect on the outcome. In model 2, after education was introduced, the results showed that education had also a significant overall effect on the outcome); (b) the likelihood of frequency of tooth brushing and (c) last dental visit and associations with household income and education level. All models were adjusted for gender, age, municipality and living alone.

Results for behavioral factors and socioeconomic measures in the examined population, revealed that household income and education are both predictors for the reason to go to the dentist. Income and education were predictors for reporting frequency of tooth brushing. We examined household income in Model 1 and it was statistically significant ($p=0.004$). In the final model education was introduced in the analysis, and both household income and education were statistically significant ($p=0.040$ and $p=0.001$ respectively). For the time since last visit to the dentist only education ($p=0.017$) was statistically significant. Furthermore, the results of nominal regression analysis showed the impact of occupation for reason to go to the dentist (Table 23) and the impact of occupation and income for the reason to go to the dentist (Table 24). Thus, those in the professional/ managers' occupations were statistically significant different and were more likely to have regular checkups than occasional visits to the dentist or only when in pain. Occupation is also a predictor for frequency of brushing ($p<0.001$); those in professional managers occupations were more likely to report that they brush their teeth or dentures twice or more a day.

Regression analysis showed the impact of household income and a linear gradient; those in the bottom, the second and the third household income quintile were less likely to visit the dentist in a regular checkup (p<0.001). Furthermore, the impact of occupation was also examined but, in this analysis, occupation was categorized as manual vs. non manual. Manual workers were less likely to report regular dental visits (p=0.029) (Table 24).

Regression analysis showed the impact of education; those with no schooling credentials or with basic education were less likely to visit the dentists on a regular basis (p<0.001). The results are as for Subjective social status. Lower subjective social status (steps 1-4) is a predictor for the reason to go to the dentist. Those in the lower steps of perceived social status were more likely to visit the dentist only when in trouble or in pain (p=0.002) (Table 25).

Those in the professionals/ managers' occupations were more likely to report that they brush more than twice a day (p<0.001). Analysis for frequency of brushing teeth or dentures (reference category=more than twice a day) and occupation showed that those in the manual work category were less likely to report that they brush more than twice a day (Table 26). The results of nominal regression analysis showed that Subjective social status is also a predictor for frequency of brushing teeth or dentures (p<0.001). Those perceived their social status as low were less likely to brush more than twice a day. (Table 27).

All models were adjusted for: gender (male), age (65-74y), municipality (Athens) and living alone (yes).

Furthermore, time since last visit to the dentist (reference category=less than 12 months) and occupation was examined. Those in the professional/ managers' occupations were statistically significant and more likely to have visited the dentist during the last 12 months (Table 28).

Table 22. Reason to go to the dentist, frequency of tooth brushing, last visit to the dentist and associations with household income, and education level

	Reason to go to the dentist (a)		Frequency of toothbrushing		Last visit to the dentist (c)	
	Chi-square	*p*	Chi-square	*p*	Chi-square	*p*
Model 1						
Household income	14.832	0.002 **	19.335	0.004 **	14.061	0.120
Model 2						
Household income	4.298	0.231	13.211	0.040 *	10.017	0.349
Education level	25.547	0.001 ***	17.615	0.001 **	10.227	0.017 *

**p<0.05, ** p<0.01, ***p<0.001*

Models 1 and 2 adjusted for: gender, age, municipality, and living alone.

Model 1: gender, age, municipality, and living alone, and household income.

Model 2: gender, age, municipality, and living alone, household income, and education level.

(a) Reference: only when in trouble/ no regular visits

(b) Reference: less than once a day

(c) Reference: >5 years

Table 23. Reason to go to the dentist (reference category=regular checkup) and occupation

		B	Std. Error	Wald	df	*p*	OR	95% CI	
Occasionally	Gender(male)	0.593	0.292	4.112	1	0.043 *	1.809	1.020-	3.207
	municipality (Athens)	-0.983	0.297	10.927	1	0.001 **	0.374	0.209-	0.670
	age (65-74y)	- 0.409	0.283	2.092	1	0.148	0.664	0.382-	1.156
	living alone (yes)	0.188	0.285	0.438	1	0.508	1.207	0.691-	2.109
	Occupation 1	-0.853	0.346	6.093	1	0.014 *	0.426	0.216-	0.839
	Occupation 2	-0.202	0.367	0.302	1	0.583	0.817	0.398-	1.679
	Occupation 3	0.508	0.417	1.483	1	0.223	1.662	0.734-	3.766
When in trouble or pain	Gender (male)	0.308	0.248	1.549	1	0.213	1.361	0.838-	2.211
	municipality Athens	0.006	0.267	0.000	1	0.983	1.006	0.596-	1.698
	age 65-74y	-0.758	0.238	10.128	1	0.001 **	0.469	0.294-	0.747
	living alone (yes)	0.064	0.240	0.071	1	0.789	1.066	0.566-	1.706
	Occupation 1	-1.116	0.284	15.481	1	<0.001 ***	0.327	0.188-	0.571
	Occupation 2	-0.239	0.306	0.608	1	0.436	0.787	0.432-	1.436
	Occupation 3	0.432	0.366	1.391	1	0.238	1.540	0.751-	3.158

Reference category: regular check up

Nominal regression analysis

**p<0.05, **p<0.01, ***p<0.001*

Occupation 1= professionals/managers, occupation 2= nonprofessionals non manual workers, occupation 3= manual workers

Table 24. Reason to go to the dentist, and the impact of household income quintiles and occupation (Reference category=when in trouble or in pain).

Reason to go to the dentist		B	Std. Error	Wald	df	*p*	OR	95% CI	
Regular check up	household income (bottom)	-1.769	0.468	14.277	1	<0.001 ***	0.170	0.068-	0.427
	household income (second)	-1.347	0.368	13.416	1	<0.001 ***	0.260	0.127-	0.535
	household income (third)	-1.304	0.390	11.209	1	0.001 **	0.271	0.126-	0.582
	household income (fourth)	-0.312	0.300	1.077	1	0.299	0.732	0.406-	1.319
	occupation (manual)	-0.496	0.264	3.531	1	0.060	0.609	0.363	1.022
	occupation (non-manual)	0a	.	.	.	.	.	.	.
Occasionally	household income (bottom)	-0.891	0.424	4.423	1	0.035 *	0.410	0.179-	0.941
	household income (second)	-0.464	0.330	1.977	1	0.160	0.629	0.329-	1.201
	household income (third)	-0.330	0.334	0.975	1	0.323	0.719	0.374-	1.383
	household income (fourth)	0.397	0.287	1.903	1	0.168	1.487	0.846-	2.611
	occupation (manual)	-0.507	0.232	4.779	1	0.029 *	0.602	0.382-9.49	0.949
	occupation (non-manual)	0a	.	.	.	.	.	.	.

Reference category: when in trouble or pain

Model adjusted for: gender, age, municipality, and living alone.

a. This parameter is set to zero because it is redundant.

Nominal Regression analysis

**p<0.05, **p<0.01, ***p<0.001*

Table 25. Reason to go to the dentist, according to education level and Subjective social status

Reason to go to the dentist (a)		B	Std. Error	Wald	df	*p*	OR	95% CI	
Regular check-up	ISCED-97 =0	-2.239	0.436	26.339	1	<0.001 ***	0.107	0.045-	0.251
	ISCED-97=1	-1.904	0.351	29.493	1	<0.001 ***	0.149	0.075-	0.296
	ISCED-97=2	-0.840	0.399	4.425	1	0.035 *	0.432	0.197-	0.944
	ISCED-97=3	-0.736	0.396	3.458	1	0.063	0.479	0.221-	1.040
	SSS (steps 1-4)	-0.827	0.270	9.407	1	0.002**	0.437	0.258-	0.742
	SSS (steps 5-10)	b							
Occationally	ISCED-97=0	-0.252	0.445	0.320	1	0.571	0.778	0.325-	1.858
	ISCED-97=1	-0.053	0.398	0.018	1	0.894	0.949	0.435-	2.068
	ISCED-97=2	0.151	0.460	0.107	1	0.743	1.163	0.472-	2.866
	ISCED-97=3	0.307	0.452	0.463	1	0.496	1.360	0.561-	3.296
	SSS (steps 1-4)	0.174	0.201	0.750	1	0.386	1.191	0.802-	1.767
	SSS (steps 5-10)	b							

Reference category: when in trouble or in pain

**p<0.05, **p<0.01, ***p<0.001*

(a)Model adjusted for: gender (male), municipality (Athens), age (65-74y), living alone (yes)

(b) This parameter is set to zero because it is redundant

Nominal Regression analysis

Table 26. Frequency of brushing teeth or dentures (reference category more than twice a day) and occupation

		B	Std. Error	Wald	df	*p*	OR	95% CI	
Less than once a day	gender= male	2.063	0.435	22.508	1	<0.001 ***	7.870	3.356-	18.454
	municipality= Athens	0.161	0.410	0.155	1	0.694	1.175	0.527-	2.622
	age= 65-74y	0.589	0.379	2.407	1	0.121	1.802	0.856-	3.790
	Living alone= yes	-0.133	0.393	0.115	1	0.734	0.875	0.405-	1.889
	Occupation 1	-1.995	0.508	14.824	1	<0.001 ***	0.142	0.052-	0.383
	Occupation 2	-1.100	0.531	4.288	1	0.038 **	0.333	0.118-	0.943
	Occupation 3	-0.333	0.588	0.321	1	0.571	0.717	0.226-	2.268
Once a day	gender= male	1.490	0.369	16.277	1	<0.001 ***	4.436	2.151-	9.148
	municipality= Athens	0.199	0.344	0.334	1	0.563	1.220	0.622-	2.393
	Age =65-74y	0.318	0.314	1.028	1	0.311	1.374	0.743-	2.541
	living alone=yes	0.221	0.319	0.480	1	0.488	1.247	0.668-	2.330
	Occupation 1	-1.935	0.415	21.761	1	<0.001 ***	0.144	0.064-	0.326
	Occupation 2	-0.995	0.449	4.905	1	0.027 *	0.370	0.153-	0.892
	Occupation 3	-0.114	0.517	0.049	1	0.825	0.892	0.324-	2.455
Twice a day	gender= male	0.777	0.387	4.038	1	0.044 *	2.174	1.019-	4.638
	municipality= Athens	0.135	0.360	0.140	1	0.709	1.144	0.565-	2.319
	age= 65-74y	0.740	0.328	5.089	1	0.024 *	2.097	1.102-	3.990
	Living alone= yes	0.090	0.333	0.074	1	0.786	1.095	0.570-	2.103
	Occupation 1	-1.150	0.435	7.008	1	0.008 **	0.316	0.135-	0.742
	Occupation 2	-0.218	0.467	0.218	1	0.641	0.804	0.322-	2.010
	Occupation 3	-0.073	0.545	0.018	1	0.894	0.930	0.320-	2.706

Nominal regression. Reference category: more than twice a day
**p<0.05, **p<0.01, ***p<0.001*

Table 27. Frequency of brushing teeth or dentures (reference category=more than twice a day) and subjective social status (SSS)

		B	Std. Error	Wald	df	*p*	OR	95% CI	
Less than once a day	gender male	1.937	0.425	20.763	1	<0.001 ***	6.936	3.015-	15.955
	Municipality Athens	0.115	0.403	0.082	1	0.775	1.122	0.509-	2.471
	age 65-74y	0.581	0.374	2.415	1	0.120	1.788	0.859-	3.723
	Living alone= yes	-0.228	0.389	0.342	1	0.775	1.122	0.371-	1.708
	SSS 1	1.851	0.562	10.830	1	0.001 **	6.364	2.114-	19.160
	SSS 2	0.569	0.444	1.644	1	0.200	1.767	0.740-	4.216
Once a day	gender male	1.364	0.358	14.494	1	<0.001 ***	3.910	1.938-	7.889
	municipality Athens	0.179	0.337	0.284	1	0.594	1.196	0.618-	2.315
	Age 65-74y	0.309	0.307	1.013	1	0.314	1.362	0.746-	2.486
	living alone=yes	0.094	0.315	0.089	1	0.765	1.099	0.593-	2.036
	SSS 1	2.075	0.479	18.769	1	<0.001 ***	7.965	3.115-	20.363
	SSS 2	0.821	0.345	5.668	1	0.017 **	2.273	1.156-	4.4667
Twice a day	gender male	0.683	0.377	3.286	1	0.070	1.980	0.946-	4.144
	municipality Athens	0.160	0.354	0.204	1	0.652	1.173	0.586-	2.349
	age 65-74y	0.695	0.323	4.634	1	0.031 *	2.003	1.064-	3.770
	Living alone= yes	0.010	0.330	0.001	1	0.976	1.010	0.529-	1.929
	SSS 1	1.370	0.498	7.578	1	0.006 **	3.934	1.484-	10.431
	SSS 2	0.470	0.361	1.697	1	0.976	1.010	0.789-	3.248

Nominal regression. Reference category: more than twice a day

**p<0.05, **p<0.01, ***p<0.001*

Table 28. Time since last dental visit to the dentist (reference category= less than 12 months) and occupation

		B	Std. Error	Wald	df	*p*	OR	95% CI	
1-2 years	Occupation 1	-0.546	0.259	4.438	1	0.035 *	0.579	0.348-	0.963
	Occupation 2	-0.329	0.251	1.718	1	0.190	0.719	0.440-	1.177
	Occupation 3	-0.072	0.257	0.079	1	0.779	0.930	0.562-	1.540
3-5 years	Occupation 1	-0.817	0.291	7.902	1	0.005 **	0.442	0.250-	0.781
	Occupation 2	-0.791	0.285	7.723	1	0.005 **	0.454	0.260-	0.792
	Occupation 3	-0.580	0.294	3.897	1	0.048 *	0.560	0.315-	0.996
>5 years	Occupation 1	-0.979	0.369	7.039	1	0.008	0.376	0.182-	0.774
	Occupation 2	-0.403	0.315	1.635	1	0.201	0.668	0.360-	1.240
	Occupation 3	-0.208	0.325	0.409	1	0.522	0.812	0.429-	1.536

Nominal regression. Reference category is: less than 12 months.

**p<0.05, ** p<0.01, ***p<0.001*

Model adjusted for: gender (male), municipality (Athens), age (65-74), living alone (yes).

Occupation categories: 1= professionals, 2= non professionals non manual, 3= manual workers.

4.4 Results for Objective 4

To assess whether the social gradient in oral health status is influenced by psychometric factors, cognitive ability, social networks, and general health status, life satisfaction, and loneliness. For continuous dependent variables GLM analysis was performed. Other statistical methods used were Multinomial and Bivariate Logistic Regression. Prevalence ratios, Odds Ratios, and 95% confidence intervals (PR, Odds Ratios, 95% CI) were calculated from logistic regression models. Covariates were gender, age, municipality, living alone, and long-standing illness. The insertion of psychosocial variables in the prediction equation was planned to test whether objective and subjective measures of SES used in the research were affected by psychological and psychosocial factors.

Figure 10. Household income and Self-rated oral health (SROH)

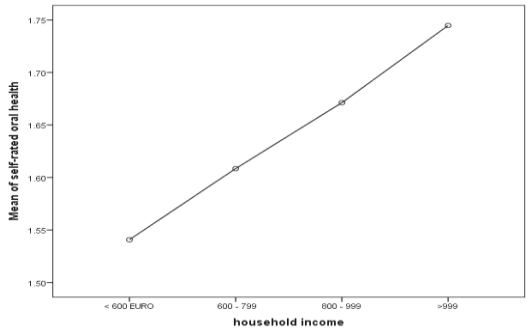
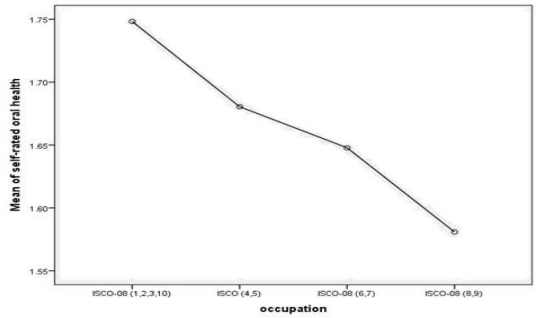


Figure 11. Relationship of Self-rated oral health (mean) and occupation (ISCO-08)



Figures 10 & 11, show a linear relationship for self-rated oral health (SROH) and household income and occupation. The higher the income level, and better jobs, the better SROH.

Table 29. Distribution of the study sample, according to the number of retained and missing teeth (standard deviation and interquartile range in parenthesis) by gender, brushing frequency, and reason to go to the dentist

		Remained Teeth								Missing Teeth*	
		≥ 21		15-20		1-14		0		Mean	Median
		n	%	n	%	n	%	n	%	(SD)	(IR)
Gender	Male	81	22.9	68	19.2	82	23.2	123	34.7	21.23 (9.86)	22.0 (20.0)
	Female	101	26.0	95	24.4	112	28.8	81	20.8	18.94 (9.13)	17.0 (17.0)
**p<0.001[a]*											
Frequency of brushing teeth or dentures											
Less than once a day		16	19.5	16	19.5	21	25.6	29	35.4	21.67 (9.34)	20.5 (20.0)
Once a day		93	22.1	94	22.4	108	25.7	125	29.8	20.66 (9.51)	20.0 (20.0)
Twice a day		59	31.4	44	23.4	50	26.6	35	18.6	17.93 (9.25)	15.0 (16.0)
More than twice a day		14	26.4	9	17.0	15	28.3	15	28.3	19.96 (10.22)	21.0 (23.0)
**p=0.004[b]*											
Reason to go to the dentist											
Regular check up		50	48.5	30	29.1	18	17.5	5	4.9	13.31 (7.32)	12.0 (8.0)
Occasionally		36	25.0	34	23.6	36	25.0	38	26.4	19.63 (9.54)	18.0 (21.0)
When in trouble or pain		96	19.4	99	20.0	140	28.2	161	32.5	21.54 (9.36)	22.0 (20.0)
**p* <0.001b											

[a] based on independent samples T test

[b] based on GLM analysis

Table 30. Distribution of the study sample, according to the number of retained and missing teeth (Standard deviation and interquartile range in parenthesis) by mouth dryness, personal income, and occupation

	Remained Teeth								Missing Teeth*	
	≥ 21		15-20		1-14		0		Mean	Median
Dryness in mouth last 6 months										
Yes	67	19.3	79	22.8	94	27.1	107	30.8	20.96 (9.35)	20.0 (20.0)
No	115	29.0	84	21.2	100	25.3	97	24.5	19.22 (9.65)	17.0 (20.0)
**p=0.013a*										
Personal income (euros)										
<600	53	20.3	55	21.1	77	29.5	76	29.1	21.08 (9.17)	22.0 (20.0)
≥600 and <800	61	19.7	69	22.3	84	27.1	96	31.0	21.03 (9.43)	21.0 (20.0)
≥800	68	39.5	39	22.7	33	19.2	32	18.6	16.63 (9.58)	12.0 (18.0)
**p<0.001[b]*										
Occupation										
Professionals	62	43.4	28	19.6	25	17.5	28	19.6	16.34 (9.66)	12.0 (15.0)
Services and Shop keepers	33	19.5	48	28.4	45	26.6	43	25.4	20.17 (8.92)	18.0 (20.0)
Craft and Agricultural workers	41	25.8	35	22.0	41	25.8	42	26.4	19.62 (9.52)	18.0 (21.0)
Manual workers	46	16.9	52	19.1	83	30.5	91	33.5	22.13 (9.31)	24.0 (18.0)
**p* <0.001[b]										

[a] *based on independent samples T test*

[b] *based on GLM analysis*

Table 31. Descriptive statistics (mean, median. standard deviation) of missing teeth, cognitive ability (MMSE), age, and years of education. Pearson correlation of these variables with missing teeth

	mean	median	Standard deviation	Pearson r with Missing Teeth	*p*
missing teeth	20.03	19.00	9.545	-------	
cognitive ability (MMSE)	24.83	25.00	2.047	-0.328	<0.001 ***
age	74.84	75.00	6.055	0.428	<0.001 ***
years of Education	7.03	6.00	3.893	-0.289	<0.001 ***

Table 32. Generalized Linear Model for missing teeth by gender, reason to go to the dentist, age, MMSE, and total years of education

Dependent variable	Independent variables	Categories	b	SE (b)	Wald Chi-Square test	*p*
Missing Teeth	constant		0.657	6.9523	0.009	0.925
	cognitive ability		-0.590	0.1890	9.732	0.002 **
	gender	male	2.150	0.6684	10.344	0.001 **
		female	baseline			
	reason to go to the dentist	regular check up	-4.824	0.9094	28.134	<0.001 ***
		occasionally	-0.906	0.7711	1.382	0.240
		when in trouble or pain	baseline			
	age (years)		0.492	0.0551	79.724	<0.001 ***
	years of Education		-0.427	0.0928	21.235	<0.001 ***

*p<0.05, **p<0.01, ***p<0.001

Statistical analyses and measurements for clinical outcome 'missing teeth'

The statistical analyses were conducted in two stages. First, the potential effect of the MMSE score, gender, personal income, occupation, years of education, brushing frequency, and reason for dental attendance, and mouth dryness, on the number of missing teeth was investigated bivariate. T test and Pearson's r correlation coefficient were conducted due to the normal distribution of the data. Second, Generalized Linear Model (GLM) was applied to investigate the relationship between the aforementioned predictors and the outcome variable. Significant confounders, as well as interactions were retained in the models. Deviance residuals were calculated in order to evaluate the model's goodness-of-fit. Model assumptions were tested using q-q plots for normality and residual plots versus predicted values or independent variables for homoscedasticity and linearity. Given the nature of the data, all plots were satisfactory not showing severe deviations from the ideal. All reported probability values (p-values) were based on two-sided tests and compared to a significant level of 5%.

Distribution of the study sample, according to the number of retained and missing teeth by gender, brushing frequency, reason to go to the dentist, mouth dryness, personal income, and occupation is presented in Table 29. According to independent samples t test, males and individuals with mouth dryness for more than 6 months, had significantly more missing teeth. Additionally, participants who brushed their teeth or dentures less than once a day, visited the dentist only when they had trouble/pain, had worked as manual workers, and with lower income, had also significantly less teeth (GLM analysis, Table 32). Further, the number of missing teeth was significantly negatively correlated with the MMSE score and the years of education, but significantly positively correlated with the age of the participants (Pearson's r test, Table 31).

The model indicated a significant gender effect (Wald test=10.344, p<0.001) with males loosing 2.15 teeth on average more than females. Regarding the reason of dental attendance, people going to the dentist when in trouble or pain demonstrated approximately 4.8 on average more teeth loss than going regularly (Wald test=28.134, p<0.001). However, the difference with those going occasionally was not significant (Wald test=1.382, p=0.240). Age contributed to tooth loss with 0.5 lost teeth approximately per year (Wald test=79.724, p<0.001). One unit increase in MMSE score make us expect 0.6 approximately less teeth lost on average (Wald test=9.732, p=0.002). Finally, one year more in total education year's results in 0.4 approximately less teeth lost on average (Table 32). The results of logistic regression analysis for remaining teeth and MMSE score were statistically significant. The lower the number of remaining teeth, the lower the MMSE score (p<0.001). All socioeconomic measures are positively associated with the number of missing teeth. Household income, education level, occupation and SSS remained statistically significant in the final model for remaining teeth and cognitive ability but with a reduced effect.

Statistical analysis for DMFT and OHI-S was also performed to estimate the likely effect of MMSE score and socioeconomic inequalities. The results of the statistical analysis revealed the impact of MMSE (p<0.05). For DMFT, when MMSE (p<0.001) was introduced in the model, then education, income, occupation and SSS, all socioeconomic measures' effect was attenuated. For OHI-S, when MMSE (p<0.001) was introduced in the model, then all socioeconomic measures' significant impact was diminished.

Furthermore, analysis for socioeconomic influences were examined to assess their impact on behavioural factors. Frequency of brushing, reason for dental visits and time since last dental visits were examined and Multinomial logistic regression was applied. Those in bottom and second income quintile were statistically significant different and more likely to brush once a day or less than once a day. Those in the bottom

and second household income quintiles were less likely to report that they brush more than twice a day (Table 33).

Those with household income less than 800 euro per month were less likely to brush twice a day and more likely to brush less than once a day (p=0.003), as shown in Table 34. In this regression analysis for examining frequency of brushing and household income, income was in two categories; less than 800 euro vs. 800 or more. The results also revealed gender differences. Males were more likely to report brushing frequency less than once a day (p=0.023).

Frequency of brushing and occupation were then, examined; Models 1 and 2, was adjusted for gender, municipality, age, living alone and longstanding illness. The results showed that occupation has an impact on frequency of brushing. Those in higher status occupations (professionals and non-professional non-manual) were more likely to brush twice or more than twice a day (Table 35).

When in Model 2, loneliness and Satisfaction with life were introduced, then the effect of occupation was faded out for those brushing twice a day, but remain strong for those brushing more than twice a day, in the professionals and non-professional non-manual occupations (Table 35).

Then, frequency of brushing and Subjective social status was examined (Table 36). Furthermore, the impact of Satisfaction with life and loneliness were also examined. In Table 36, Model 1, Subjective social status found to be a predictor for frequency of brushing and those with low SSS were more likely to brush less than once a day (p=0.001). In Model 2, loneliness and SWL were introduced in the model, SSS remained significant and those with low SSS were more likely to brush less than once a day (p=0.008) (Table 36).

Table 33. Frequency of brushing teeth or dentures and household income

		B	Std. Error	Wald	df	*p*	OR	95% CI	
Less than once a day	Bottom quintile	2.256	0.704	10.280	1	0.001 **	9.548	2.404-	37.927
	Second quintile	1.579	0588	0.723	1	0.007 **	4.851	1.534-	15.345
	Third quintile	0.133	0.589	0.051	1	0.821	1.142	0.360-	3.620
	Fourth quintile	-0.208	0.545	0.146	1	0.702	0.812	0.279-	2.361
	Top quintile	0 (b)							
Once a day	Bottom quintile	1.301	0.590	4.854	1	0.028 *	3.672	1.154-	11.679
	Second quintile	1.352	0.497	7.405	1	0.007 **	3.865	1.460-	10.233
	Third quintile	0.571	0.466	1.500	1	0.221	1.770	0.710-	4.411
	Fourth quintile	0.706	0.428	2.717	1	0.099	2.025	0.875-	4.686
	Top quintile	0 (b)			1				
Twice a day	Bottom quintile	1.190	0.619	3.695	1	0.055	3.289	0.977-	11.071
	Second quintile	0.987	0.526	3.521	1	0.061	2.682	0.957-	7.516
	Third quintile	0.567	0.489	1.347	1	0.246	1.764	0.676-	4.598
	Fourth quintile	0.262	0.457	0.330	1	0.566	1.300	0.531-	3.183
	Top quintile	0 (b)							

(a)Reference category: more than twice a day

(b)This parameter is set to zero because it is redundant

**p<0.05, **p<0.01, ***p<0.001*

Model adjusted for gender (male), municipality (Athens), age (65-74), living alone (yes)

Table 34. Frequency of brushing teeth or dentures and Household income (less than 800-euro vs 800 or more)

		B	Std. Error	Wald	df	*p*	OR	95% CI
Once a day	Gender=male	-0.631	0.277	5.181	1	0.023 *	0.532	0.309- 0.916
	Municipality=Athens	0.054	0.267	0.041	1	0.840	1.055	0.625- 1.782
	Age 65-74y	-0.307	0.255	1.450	1	0.229	0.736	0.447- 1.212
	Living alone=yes	0.592	0.303	3.807	1	0.051	1.808	0.997- 3.276
	Household income	-0.548	0.287	3.659	1	0.056	0.578	0.330- 1.014
Twice a day	Gender=male	-1.475	0.297	24.736	1	<0.001***	0.229	0.128- 0.409
	Municipality=Athens	0.021	0.290	0.005	1	0.941	1.022	0.579- 1.804
	Age 65-74y	-0.059	0.274	0.046	1	0.830	0.943	0.552- 1.612
	Living alone=yes	0.598	0.325	3.384	1	0.066	1.818	0.962- 3.438
	Household income <800	-0.910	0.312	8.530	1	0.003 **	0.403	0.219- 0.741

Reference category: less than once a day

**p<0.05, **p<0.01, ***p<0.001*

Table 35. Frequency of brushing teeth or dentures and last main occupation

		Model 1			Model 2		
Tooth brushing		*p*	OR	95% CI	*p*	OR	95% CI
Once a day	occupation 1	0.980	1.099	0.502- 2.027	0.136	2.258	0.774- 6.593
	occupation 2	0.778	1.099	0.568- 2.127	0.191	1.956	0.715- 5.352
	occupation 3	0.530	1.230	0.645- 2.344	0.076	3.149	0.887- 11.178
Twice a day	occupation 1	0.037 **	2.244	1.051- 4.790	0.724	1.251	0.362- 4.325
	occupation 2	0.017 **	2.407	1.172- 4.943	0.617	1.350	0.417- 4.370
	occupation 3	0.512	1.282	0.611- 2.690	0.047 *	4.141	1.018- 16.835
More than twice a day	occupation 1	<0.001 ***	7.010	2.585- 19.007	<0.001***	6.237	2.282- 17.050
	occupation 2	0.040 **	2.975	1.049- 8.435	0.046 *	2.909	1.020- 8.298
	occupation 3	0.586	1.377	0.435- 4.363	0.625	1.335	0.419- 4.259

The reference category is: less than once a day

**p<0.05, **p<0.01, ***p<0.001*

Model 1= adjusted for gender (male), municipality (Athens), age (65-74), living alone (yes) and long-standing illness (yes)

Model 2= adjusted for gender (male), municipality (Athens), age (65-74), living alone (yes) and long-standing illness (yes), loneliness, and Satisfaction with life.

Occupation categories: 1= professionals, 2= non-professional non-manual, 3= manual workers

Table 36. Frequency of brushing teeth or dentures and Subjective Social Status (SSS)

		Model 1			Model 2		
Frequency of tooth brushing		*p*	OR	95% CI	*p*	OR	95% CI
Once a day	SSS low	0.485	1.287	0.634-2.613	0.350	1.419	0.682-2.953
	SSS medium	0.500	1.263	0.641-2.488	0.376	1.366	0.685-2.727
	SSS top (a)						
Twice a day	SSS low	0.218	0.616	0.285-1.331	0.607	0.811	0.364-1.805
	SSS medium	0.779	0.902	0.437-1.859	0.789	1.106	0.527-2.321
	SSS top (a)						
More than twice a day	SSS low	0.001 **	0.159	0.053-0.480	0.008 **	0.216	0.069-0.674
	SSS medium	0.193	0.560	0.234-1.340	0.450	0.708	0.290-1.732
	SSS top (a)						

The reference category is: less than once a day

**p<0.05, **p<0.01, ***p<0.001*

Multinomial Logistic Regression

(a) This parameter is set to zero because it is redundant

Model 1 = adjusted for gender (male), municipality (Athens), age (65-74), living alone (yes) and long-standing illness (yes).

Model 2= adjusted for gender (male), municipality (Athens), age (65-74), living alone (yes) and long-standing illness (yes), loneliness, and SWL.

Self-rated Oral Health and Self-rated Health

Logistic regression was performed for self-rated oral health and self-rated health and the impact of income, education, occupation and SSS. Logistic regression predicting likelihood of self-rated oral health reveals that those in the bottom and second household income quintiles are more likely to perceive their oral health as poor (Model 1; *p*=0.009 and *p*=0.013 respectively). When Satisfaction with life was introduced in the model, household income remained significant (Model 2; p= 0.021 and p=0.032) for the lower income quintiles (bottom and second quintiles). Satisfaction with life and long-standing illness were also statistically significant for self-rated oral health. Differences for rating subjective oral health as poor were statistically significant, for those in the bottom and second income quintiles (Table 37). In the last Model (Model 3), loneliness was introduced in the analysis to examine the effect of loneliness on SROH. Even after loneliness was introduced in the model, those in the bottom and second household income quintiles remained statistically significant and were more likely to report their SROH as poor, as well as Satisfaction with life. However, loneliness was not statistically significant and did not impact SROH as poor (Table 37).

The analysis for SROH and occupation revealed that occupation had a significant impact on predicting SROH; those in the higher status occupations (professionals, and non-professional non-manual occupations), were less likely to report poor SROH. In model 2, Satisfaction with life was introduced and then the impact of occupation remained statistically significant only for the first category (professionals). Satisfaction with life had a significant effect on SROH as well (*p*=0.001). In the last model (model 3) loneliness was introduced to examine the effect of loneliness on SROH. Even after loneliness was introduced in the model, the impact of occupation (professionals), and SWL remained statistically significant and had an impact on SROH. Those in professional managerial occupations who reported being more satisfied from life were less likely to perceive their SROH as poor. However, loneliness was not significant in this model analysis (Table 38).

Logistic regression predicting likelihood for self-rating oral health and Subjective social status analysis was also performed in three models. Subjective social status was statistically significant in Model 1 (p=0.003) and remained significant after SWL and Loneliness was introduced in the model. In the final model SSS and SWL were statistically significant and impact SROH (Table 39).

Then Self-Rated Health was examined for social inequalities and the impact of loneliness and Satisfaction with life. Household income in all three models was statistically significant and a predictor for SRH. Satisfaction with life and Loneliness were also significant and predictors for SRH. Thus, in the final model, with a Household income less than 800 euro per month, being less satisfied from life and feeling loneliness more were predictors for SRH as poor. All models were adjusted for gender, age, municipality, living alone, and long-standing illness (Table 40).

In the analysis for predicting SRH and household income inequalities, social networks were also examined. In the final model, Household income and social networks were statistically significant and predictors for SRH as poor (p=0.034 and p=0.037, respectively) (Table 41).

For SRH and education inequalities the analysis revealed a gradient in linear pattern (Table 42). In this analysis, Education level and SWL ($p<0.001$) were predictors and impact SRH. Education level, remained significant even after SWL was introduced in the model (Model 2).

Results of Logistic regression predicting likelihood of reporting SRH and the impact of education level and Social networks are presented in Table 43. Education remained statistically significant in the final model when loneliness was introduced in the model. In the final model, both, education level and loneliness impact SRH. Those in the lower education level with none or limited social networks were more likely to report their SRH as poor. Models were adjusted for gender (male), Municipality (Athens), age group (65-74), Long-standing illness (yes), and living alone (yes) (Table 43).

Statistical analysis of Logistic regression predicting likelihood of reporting SRH as poor and the impact of education level and loneliness, are presented in Table 44. Education level was according to the International Standard Classification of Education (ISCED-97). The results were statistically significant, and in a linear pattern, for the first three levels of education according to ISCED-97 (Table 44). However, additionally analysis was performed using a dummy variable for education level (binary variable education less than lower secondary vs. above lower secondary). The results were in agreement with the previous results for ISCED-97 education classification and SWL, social networks and loneliness and their effect on Self-rated health (poor). All examined variables (education, Satisfaction with life, social networks and loneliness) were statistically significant and education level's effect remained significant in the final model. All models were adjusted for gender, age, municipality, living alone, and long-standing illness. The effect of education on Self-rated health, remained statistically significant even after other predictors were entered in the model; Satisfaction with life (SWL), Social networks and loneliness score (Table 45).

Additionally, Logistic regression analysis was applied for SRH, occupation, Satisfaction with life, and social networks. The results of logistic regression predicted the likehood of Self-rated health as poor (vs. good) and the impact of education, loneliness, Satisfaction with life, and social networks (Table 46). All three models were adjusted for gender, municipality, age, longstanding illness and living alone. Occupation was statistically significant and impact SRH, only for those in the first group of occupation (professionals/managers) in the first model; in the second model, SWL was introduced and entered the model. SWL was statistically significant and a predictor for SRH, while the effect of occupation was diminished, in the second model. Those with satisfaction with life low score were more likely to report poor SRH ($p<0.001$). The effect of occupation on Self-rated health was statistically significant only for those in Occupation group 1 (managers and professionals). This effect is significant and remained present even after social network variable was introduced in the model. Those in better jobs were the least likely to report poor Self-rated health ($p=0.042$). Social networks also contribute to the model

and those with fewer close social relations were statistically significant more likelihood to report Self-rated health as poor (p=0.038). The effect of Occupation on Self-rated health is significant only for those in the 1st group of occupation (better jobs). This effect is present but marginal, when loneliness entered the model. Those in the professional category of occupations were less likely to report poor Self-rated health (p = 0.048). Loneliness also contributes to the model and those with the lower scores for loneliness were statistically significant more possible to report poor Self-rated health (p <0.001) (Table 46).

Then, Logistic regression analysis for SRH was performed and included Subjective social status among other variables. The results of logistic regression for SRH and SSS in three models are in Table 47. In Model 1, gender (p=0.032), and long-standing illness (p<0.001), were statistically significant. In Model 2, gender (p=0.025) and longstanding illness (p<0.001) remained significant and Subjective social status as well (p<0.001) (Table 47). The results of logistic regression and predicting likehood of Self-reporting health as poor (vs. good) and the impact of Subjective social status, SWL, social networks and loneliness are in Table 48. Details for the models are presented below. All models adjusted for gender (male), municipality (Athens), age (65-74), longstanding illness (yes) and living alone (yes).

For Satisfaction with life a dummy variable was created based on Dieners' explanations for the Satisfaction with life scale (Diener et al, 1985). The top category has 30-35 (very high score) meaning that they are highly satisfied. The next category is those with scores from 25-29 (high scores); the third category is the average score 20-24. The fourth category -is the slightly below average- with scores 15-19 and those with this range of score that have feelings of dissatisfaction; usually these people have many problems in their everyday life that hardly feel satisfaction. The fifth category has scores 10-14 (dissatisfied) and these persons are dissatisfied with their lives. The last category has scores from 5 to 9, and are extremely dissatisfied with their lives. For binary analysis we merged the three lower scores as (not satisfied or less satisfied) scores <20 and the rest categories as the high scores group ≥20 (satisfied).

Finally, regression analysis was performed examining the potential effect of MMSE on SRH and SROH and socioeconomic measures. The results revealed that MMSE impact perceptions of SRH and SROH (p<0.001). In the final model for SRH, inequalities and cognitive ability, the impact of education, income (household and personal) and occupation were diminished, while the impact of SSS was attenuated. For SROH, in the final model, when MMSE was introduced in the model, the impact of education and income decreased, the impact for occupation was diminished, while Subjective Social Status retained its impact (p<0.001).

Table 37. Self-rated oral health and household income quintiles.
Logistic regression predicting likelihood of Self-rated oral health as poor and other variables

	Model 1			Model 2			Model 3		
Self-rated oral health	*p*	OR	95% CI	*p*	OR	95% CI	*p*	OR	95% CI
gender (male)	0.684	0.932	0.664-1.308	0.843	0.966	0.686-1.360	0.694	0.933	0.661-1.318
municipality (Athens)	0.664	1.079	0.766-1.520	0.929	0.984	0.693-1.397	0.957	0.990	0.697-1.407
age (65-74y)	0.492	0.893	0.648-1.232	0.308	0.844	0.609-1.169	0.293	0.839	0.606-1.163
long standing illness (yes)	0.001 **	0.538	0.370-0.782	0.005 **	0.577	0.394-0.844	0.004 **	0.573	0.391-0.840
living alone (yes)	0.479	1.152	0.778-1.705	0.450	1.165	0.783-1.734	0.312	1.230	0.823-1.840
Bottom quintile	0.009 **	0.439	0.237-0.813	0.021 **	0.479	0.257-0.893	0.029 **	0.497	0.266-0.930
Second quintile	0.013 *	0.523	0.314-0.872	0.032 **	0.566	0.337-0.951	0.045 *	0.587	0.349-0.988
Third quintile	0.581	0.861	0.507-1.463	0.696	0.899	0.526-1.536	0.749	0.916	0.535-1.568
Fourth quintile	0.309	0.780	0.484-1.258	0.375	0.804	0.497-1.301	0.382	0.807	0.498-1.306
SWL (<20)				0.001 **	0.414	0.248-0.690	0.003 **	0.455	0.270-0.768
Loneliness							0.096	0.723	0.493-1.060

Reference category: poor

**p<0.05, **p<0.01, ***p<0.001*

Table 38. Logistic regression predicting likelihood of self-rating oral health as poor and occupation; Associations between Self-rated oral health (poor), occupation, loneliness and Satisfaction with life.

	B	Std. Error	Wald	df	*p*	OR	95% CI	
Model 1								
Occupation 1	0.750	0.231	10.534	1	0.001 **	2.118	1.346-	3.332
Occupation 2	0.427	0.209	4.168	1	0.041 *	1.533	1.017-	2.310
Occupation 3	0.271	0.211	1.651	1	0.199	1.311	0.867-	1.982
Model 2								
Occupation 1	0.692	0.234	8.741	1	0.003 **	1.998	1.263-	3.160
Occupation 2	0.414	0.211	3.856	1	0.050	1.514	1.001-	2.289
Occupation 3	0.259	0.213	1.473	1	0.225	1.295	0.853-	1.967
SWL	-0.885	0.261	11.507	1	0.001 **	0.413	0.247-	0.688
Model 3								
Occupation 1	0.700	0.235	8.887	1	0.003 **	2.014	1.271-	3.193
Occupation 2	0.406	0.212	3.681	1	0.055	1.501	0.991-	2.272
Occupation 3	0.275	0.214	1.650	1	0.199	1.316	0.865-	2.002
SWL	-0.762	0.269	8.014	1	0.005 **	0.467	0.275-	0.791
Loneliness	-0.087	0.047	3.417	1	0.065	0.916	0.835-	1.005

**p<0.05, **p<0.01, ***p<0.001*

Models adjusted for: gender (male), municipality (Athens), age (65-74), living alone (yes) and long-standing illness (yes) (*) Model adjusted for gender, municipality, age, long-standing illness, and living alone.

Reference category: poor

Occupation categories:1=professionals; 2=non-professionals non manual workers; 3= manual workers

Table 39. Logistic regression predicting likelihood for Self-rating oral health (poor), loneliness, Satisfaction with Life (SWL), and Subjective Social Status (SSS). Predictors for Self-rated Oral Health (SROH) and Subjective Social Status (SSS)

	B	Std. Error	Wald	df	*p*	OR	95% CI	
Model 1								
SSS (low 1-4 steps)	-0.687	0.234	8.622	1	0.003 **	0.503	0.318-	0.796
Model 2								
SSS (low steps 1-4)	-0.518	0.242	4.580	1	0.032 **	0.596	0.371	0.957
SWL (score <20)	-0.827	0.267	9.591	1	0.002 **	0.437	0.259	0.738
Model 3								
SSS (low 1-4 steps)	-0.494	0.243	4.133	1	0.042 *	0.610	0.379	0.982
SWL (<20)	-0.727	0.273	7.108	1	0.008 **	0.483	0.283	0.825
Loneliness (high score)	-0.343	0.196	3.062	1	0.080	0.710	0.484	1.042

** p<0.05, **p<0.01, ***p<0.001*

Models adjusted for: gender (male), municipality (Athens), age (65-74), living alone (yes) and long-standing illness (yes)

Reference category: poor

Table 40. Logistic regression predicting likelihood of reporting Self-Rated Health (SRH) (poor vs good), and household income.
Predictors for SRH (poor), household income, Satisfaction with Life (SWL) and loneliness.

	B	Std. Error	Wald	df	*p*	OR	95% CI	
Model 1								
Household income <800 euro	-0.453	0.202	5.048	1	0.025 **	0.636	0.428	0.944
Model 2								
Household income <800 euro	-0.383	0.205	3.477	1	0.062	0.682	0.456-	1.020
SWL (<20)	-1.068	0.269	15.804	1	<0.001 ***	0.344	0.203-	0.582
SWL (≥ 20)	-0.627	0.244	6.618	1	0.010 *	0.534	0.331	0.861
Model 3								
Household income <800 euro	-0.330	0.207	2.544	1	0.111	0.719	0.479	1.078
SWL (<20)	-0.886	0.275	10.371	1	0.001 **	0.412	0.240	0.707
SWL (≥20)	-0.509	0.248	4.216	1	0.040 *	0.601	0.370	0.977
Loneliness (high score)	-0.630	0.207	9.279	1	0.002 **	0.532	0.355	0.799

**p<0.05, **p<0.01, ***p<0.001*

Models adjusted for: gender (male), municipality (Athens), age (65-74), living alone (yes) and long-standing illness (yes)

Table 41. Logistic regression likelihood of reporting Self-rated Health (SRH) (poor vs good), Household income, and Social networks.

	B	Std.	Wald	df	*p*	OR	95% CI	
Gender (male)	0.342	0.177	3.721	1	0.054	1.407	0.995-	1.991
Municipality (Athens)	-0.091	0.184	0.245	1	0.621	0.913	0.636-	1.310
Age (65-74)	-0.144	0.170	0.716	1	0.397	0.866	0.621-	1.209
Long-standing illness (yes)	-1.564	0.200	61.059	1	<0.001 ***	0.209	0.141-	0.310
Living alone (yes)	0.302	0.204	2.195	1	0.138	1.353	0.907-	2.019
Household income <800	-0.428	0.202	4.471	1	0.034 *	0.652	0.439-	0.969
Social networks	0.067	0.032	4.358	1	0.037 *	1.069	1.004-	1.138

**p<0.05, **p<0.01, ***p<0.001*

Model adjusted for: gender (male), municipality (Athens), age (65-74), living alone (yes) and long-standing illness (yes).

Table 42. Logistic regression predicting likelihood of reporting Self-rated health (poor vs good), and the impact of long-standing illness, education and SWL (Models 1-2).

	B	Std. Error	Wald	df	*p*	OR	95% CI	
Model 1 (a)								
Long-standing illness (yes)	-1.595	0.202	62.218	1	<0.001	0.203	0.137-	0.302
ISCED-97 =0	-1.178	0.372	10.035	1	0.002 **	0.308	0.149-	0.638
ISCED-97=1	-0.841	0.343	6.027	1	0.014 **	0.431	0.220-	0.844
ISCED-97=2	-0.960	0.395	5.921	1	0.015 **	0.383	0.177-	0.830
ISCED-97=3	-0.331	0.407	0.663	1	0.416	0.718	0.324-	1.594
Model 2 (a)								
Long-standing illness (yes)	-1.523	0.206	54.757	1	<0.001	0.218	0.146-	0.326
ISCED-97=0	-1.146	0.371	9.522	1	0.002 **	0.318	0.154-	0.658
ISCED-97=1	-0.767	0.341	5.045	1	0.025 **	0.465	0.238-	0.907
ISCED-97=2	-0.953	0.394	5.854	1	0.016 **	0.386	0.178-	0.834
ISCED-97=3	-0.324	0.407	0.634	1	0.426	0.723	0.326-	1.606
SWL (<20)	-1.092	0.270	16.346	1	<0.001	0.335	0.198-	0.570

**p<0.05, **p<0.1, **p<0.001*

(a) Model adjusted for: gender (male), municipality (Athens), age (65-74), living alone (yes), long-standing illness (yes).

Education ISCED-97: 0 =no schooling, 1=primary, 2=lower secondary, 3= upper secondary

Table 43. Logistic regression predicting likelihood of reporting Self-rated health (poor), and the impact of education and social network.

	B	Std.	Wald	df	*p*	OR	95% CI	
Gender (male)	0.226	0.184	1.506	1	0.220	1.253	0.874-	1.797
Municipality (Athens)	-0.083	0.186	0.201	1	0.654	0.920	0.640-	1.324
Age (65-74)	-0.169	0.172	0.970	1	0.325	0.844	0.603-	1.182
Long-standing illnesss (yes)	-1.599	0.203	61.898	1	<0.001 ***	0.202	0.136-	0.301
Living alone (yes)	0.107	0.175	0.376	1	0.540	1.113	0.790-	1.568
ISCED-97=0	-1.129	0.371	9.257	1	0.002 **	0.323	0.156-	0.669
ISCED-97=1	-0.789	0.343	5.303	1	0.021 **	0.454	0.232-	0.889
ISCED-97=2	-0.923	0.395	5.460	1	0.019 **	0.397	0.183-	0.862
ISCED-97=3	-0.284	0.407	0.489	1	0.484	0.753	0.339-	1.670
Social networks	0.066	0.032	4.161	1	0.041 *	1.068	1.003-	1.138

**p<0.05, **p<0.01, ***p<0.001*

Model adjusted for: gender (male), municipality (Athens), age (65-74), living alone (yes), long-standing illness (yes).
Education ISCED-97: 0 =no schooling, 1=primary, 2=lower secondary, 3= upper secondary

Table 44. Logistic regression predicting likelihood of reporting SRH (poor), and the impact of education and loneliness

	B	Std.	Wald	df	*p*	OR	95% CI	
Gender (male)	0.177	0.185	0.915	1	0.339	1.194	0.830-	1.716
Municipality (Athens)	-0.109	0.187	0.342	1	0.559	0.896	0.621-	1.293
Age (65-74)	-0.209	0.174	1.449	1	0.229	0.811	0.577-	1.140
Long-standing illness (yes)	-1.615	0.205	62.171	1	<0.001 ***	0.199	0.133-	0.297
Living alone (yes)	0.251	0.181	1.932	1	0.165	1.285	0.902-	1.832
ISCED-97=0	-1.054	0.377	7.831	1	0.005 **	0.349	0.167-	0.729
ISCED-97=1	-0.767	0.347	4.879	1	0.027 **	0.465	0.235-	0.917
ISCED-97=2	-0.937	0.400	5.496	1	0.019 **	0.392	0.179-	0.858
ISCED-97=3	-0.276	0.412	0.449	1	0.503	0.759	0.339-	1.701
Loneliness	-0.759	0.203	13.926	1	<0.001 ***	0.468	0.314-	0.697

**p<0.05, **p<0.01, ***p<0.001*

Model adjusted for: gender (male), municipality (Athens), age (65-74), living alone (yes), long-standing illness (yes).

Education ISCED-97: 0 =no schooling, 1=primary, 2=lower secondary, 3= upper secondary

Table 45. Logistic regression likelihood for reporting Self-rated health (poor vs good), SWL, social networks, loneliness, and education

	B	Std. Error	Wald	df	*p*	OR	95% CI	
Model 1 (a)								
Education (b)	-0.388	0.184	4.430	1	0.035 *	0.679	0.473-	0.974
SWL	-0.1067	0.267	15.918	1	<0.001 ***	0.344	0.204-	0.581
Model 2 (a)								
Education (a)	-0.423	0.183	5.350	1	0.021 *	0.655	0.458-	0.938
Social networks	0.068	0.032	4.459	1	0.035 *	1.070	1.005-	1.139
Model 3 (a)								
Education (b)	-0.380	0.185	4.214	1	0.040 *	0.684	0.476-	0.983
Loneliness	-0.775	0.202	14.75	1	<0.001 ***	0.41	0.310	0.684

**p<0.05, **p<0.01, ***p<0.001*

(a)Model adjusted for: gender (male), municipality (Athens), age (65-74), living alone (yes), long-standing illness (yes)

(b) Education= less than lower secondary

Table 46. Logistic regression predicting likelihood of Self-rated health (poor), occupation, loneliness, Satisfaction with life and social networks

	B	Std. Error	Wald	df	*p*	OR	95% CI	
Model 1								
Occupation 1	0.477	0.241	3.922	1	0.048 *	1.611	1.005-	2.584
Occupation 2	0.095	0.220	0.185	1	0.667	1.099	0.714-	1.691
Occupation 3	-0.043	0.221	0.038	1	0.846	0.958	0.622-	1.476
Loneliness	-0.796	0.202	15.595	1	<0.001***	0.451	0.304-	0.671
Model 2								
Occupation 1	0.410	0.241	2.899	1	0.089	1.507	0.940-	2.416
Occupation 2	0.114	0.219	0.270	1	0.603	1.121	0.729-	1.721
Occupation 3	-0.087	0.223	0.153	1	0.696	0.917	0.592-	1.418
SWL (<20)	-1.071	0.269	15.871	1	<0.001 ***	0.343	0.202-	0.580
SWL (≥20)	-0.632	0.244	6.722	1	0.010 *	0.531	0.330-	0.857
Model 3								
Occupation 1	0.485	0.238	4.145	1	0.042 *	1.624	1.018-	2.591
Occupation 2	0.104	0.218	0.227	1	0.634	1.109	0.724-	1.699
Occupation 3	-0.027	0.220	0.015	1	0.902	0.973	0.632-	1.498
Social networks	0.067	0.032	4.327	1	0.038 *	1.069	1.004-	1.138

**p<0.05, **p<0.01, ***p<0.001*

Models adjusted for gender (male), municipality (Athens), age (65-74), long standing illness (yes), and living alone (yes).

Occupation 1= professionals, 2= non-professionals non manual, 3= manual workers.

Table 47. Predictors for Self-rated health (poor), and the impact of social networks, and Subjective Social Status (SSS)

	B	Std.	Wald		df	*p*	OR	
Model 1								
Gender (male)	0.375	0.175	4.584	1	0.032 *	1.456	1.032-	2.052
Municipality (Athens)	-0.094	0.183	0.267	1	0.606	0.910	0.636-	1.302
Age (65-74)	-0.117	0.168	0.482	1	0.488	0.890	0.640-	1.237
Long-standing illness (yes)	-1.579	0.198	63.428	1	<0.001 ***	0.206	0.140-	0.304
Living alone (yes)	0.044	0.171	0.065	1	0.798	1.045	0.747-	1.461
Model 2								
Gender (male)	0.397	0.177	5.012	1	0.025 *	1.488	1.051-	2.106
Municipality (Athens)	-0.101	0.186	0.293	1	0.588	0.904	0.628-	1.302
Age (65-74)	-0.163	0.171	0.911	1	0.340	0.849	0.607-	1.188
Long-standing illness (yes)	-1.563	0.201	60.284	1	<0.001 ***	0.210	0.141-	0.311
Living alone (yes)	0.130	0.174	0.559	1	0.455	1.139	0.810-	1.601
SSS	-0.698	0.171	16.691	1	<0.001 ***	0.498	0.356-	0.696
Model 3								
Gender (male)	0.393	0.178	4.884	1	0.027 *	1.482	1.045-	2.100
Municipality (Athens)	-0.092	0.186	0.246	1	0.620	0.912	0.633-	1.314
Age (65-74)	-0.155	0.172	0.821	1	0.365	0.856	0.612-	1.198
Long-standing illness (yes)	-1.573	0.203	60.274	1	<0.001 ***	0.208	0.140-	0.309
Living alone (yes)	0.159	0.175	0.822	1	0.365	1.172	0.832-	1.652
SSS	-0.674	0.172	15.409	1	<0.001 ***	0.510	0.364-	0.714
Social networks	0.062	0.032	3.664	1	0.056	1.064	0.999	1.133

**p<0.05, **p<0.01, *** p<0.001*

Table 48. Logistic regression predicting likelihood of reporting self -rated health (SRH) (poor vs good), and Subjective Social Status (SSS)

	B	Std.	Wald	df	*p*	OR	95% CI	
Model 1								
Gender (male)	0.436	0.180	5.885	1	0.015 **	1.546	1.087-	2.199
Municipality (Athens)	-0.216	0.190	1.286	1	0.257	0.806	0.555-	1.170
Age (65-74)	-0.227	0.174	1.714	1	0.190	0.797	0.567-	1.120
Long standing illness (yes)	-1.506	0.204	54.580	1	<0.001 ***	0.222	0.149-	0.331
Living alone (yes)	0.172	0.176	.958	1	0.328	1.188	0.841-	1.678
SSS (low steps 1-4)	-0.600	0.175	11.807	1	0.001 **	0.549	0.390-	0.773
SWS (score <20)	-0.975	0.272	12.828	1	<0.001***	0.377	0.221-	0.643
Model 2								
Gender (male)	0.328	0.180	3.336	1	0.068	1.388	0.976-	1.974
Municipality (Athens)	-0.117	0.188	0.386	1	0.535	0.890	0.615-	1.286
Age (65-74)	-0.203	0.173	1.370	1	0.242	0.817	0.582-	1.146
Long-standing illness (yes)	-1.583	0.204	60.120	1	<0.001 ***	0.205	0.138-	0.306
Living alone (yes)	0.312	0.182	2.948	1	0.086	1.366	0.957-	1.949
SSS (low 1-4 steps)	-0.663	0.173	14.685	1	<0.001 ***	0.516	0.367-	0.723
Loneliness	-0.770	0.203	14.416	1	<0.001 ***	0.463	0.311-	0.689

**p<0.05, **p<0.01, ***p<0.001*

Model 1: gender, municipality, age, long-standing illness, living alone, SSS, SWL.

Model 2: gender, municipality, age, longstanding illness, living alone, SSS, loneliness.

Finally, logistic regression was performed to assess the impact of a number of factors on the likelihood that responders would self-report health or oral health as poor. All models examined were statistically significant. The stronger predictor for self-reported health as poor was Subjective social status and Satisfaction with life (Table 48).

Further regression analysis was performed to examine the likely impact of self-rated general health (SRH) on clinical (DMFT, OHI-S) and subjective measures of oral health (SROH) and social gradient inequalities. The results revealed that SRH is statistically significant and a predictor for all the examined oral health outcomes ($p<0.001$) except for OHI-S ($p>0.05$). In the statistical analysis for OHI-S (poor vs good oral hygiene) all socioeconomic measures remained statistically significant in the final model ($p<0.005$.)

The results presented in this section are according to the study's objectives, all statistical methods used were appropriate for each variable, and all assumptions were met. In the following chapter, results from this thesis will be discussed.

CHAPTER 5

Discussion

The aim of this thesis was to explore the impact of complex socioeconomic, psychometric and behavioural factors and the social gradient concerning clinical and subjective measures of oral health, in Greek older adults. Health and inequalities in the social and economic conditions are of major concerns in almost all countries. These socioeconomic inequalities and the social gradient affect health and oral health outcomes and harvest health inequalities. The results of the present study confirm the existence of health inequalities, in clinical and subjective measures of oral health, and self-reported health, and the social gradient according to income, education, occupation and subjective social status in the examined population. These results are in accordance with the results of other studies; unequal distribution of income and inequality in occupation and education contribute to differences in health outcomes and care, revealing the gap between the more affluent and privileged and less affluent. There are gradient inequalities in health and oral health (Morita I et al, 2007; Stewart R et al, 2008; Mackenbach JP et al, 1997; Knust AE 1996; Bartley M, 2004; Damaskinos et al, 2016; 2018; Gkavela 2019).

This study examined the impact of psychometric factors and confirms inequalities and the social gradient in oral health in clinical and subjective measures, in Greece. Oral health (clinical and subjective) and SRH in older Greek adults visiting Day Clubs have significant differences according to education, income, occupation and SSS. Psychometric factors have a significant impact on SROH and SRH, and contribute to explaining inequalities and the gradient and subjective health variability. Statistically significant differences are present for all the examined outcome variables and the explanation variables. Associations between oral hygiene (OHI-S) and household income is statistically significant. This is in accordance with the results of Gkavela (2019), who found income statistically significant (p<0.001) and a predictor of OHIS in Greek adults 65 years and older (Gkavela, 2019).

The present study's results, confirmed the existence of gradient inequalities in oral health and in self-rated general health. These associations were examined by three objective socioeconomic measures (income, education, occupation) and by one subjective measure, the subjective social status (SSS) or MacArthur social status scale; all health outcome measures examined are statistically significant for household income, education, occupation and SSS, exposing the social gradient. Subjective social status is the strongest predictor and a valid subjective measure for examining health inequalities and the social gradient.

Missing teeth and personal and household income have significant associations and a gradient. The analysis discovered a linear relationship for missing teeth and household income quintiles; thus, the social gradient has a linear shape. Gender, years in pension, marital status, OHRQL, and cognitive ability have an effect on missing teeth, as well. Education, occupation and SSS are also significant predictors for missing teeth and their associations with the number of missing teeth are statistically significant. For those who reported being manual workers, less educated, in the lower steps of the social ladder (SSS), and in having less money were more possible to have a higher number of missing teeth. These results are in agreement with other cross-sectional studies that found tooth loss associated to income and education level (Sanders, 2007; Sadeghi et al, 2012; Ramraj et al, 2013; Luchi et al, 2013; Capurro and Davidsen, 2017; Jayasvastin et al, 2019).

The study's findings confirmed the study's objectives and found socioeconomic gradient inequalities. For DMFT index, the results are significant for household income, education level, occupation, and SSS. All explanatory variables are significantly associated with DMFT, in the examined population. The results are significant for all participants in the analysis and remained statistically significant when only dentate participants were included. Thus, those with higher income, higher level of education, in non-manual occupations and with higher subjective social status are more likely to have less decayed, missing and filled teeth (DMFT), adjusted for gender, age, municipality and living alone. The DMFT index has a significant statistical association with SROH, while the OHI-S index has no statistical association with SROH, SRH and

SWL. Levels of association of OHRQL are statistically significant for both SROH and SRH. The analysis revealed pattern of socioeconomic variability in SROH and SRH; socioeconomic factors are related to perceptions of health. These results confirmed the objectives, and supported the alternative hypotheses of the study. In agreement with the present study's results are the results from two studies in Brazil, where poor SROH was associated with low socioeconomic status and less frequent use of dental services (Luchi et al, 2013; Bastos et al, 2019).

Self-rated oral health and Self-rated health are significantly associated to household income, education level, occupation, and SSS. Household income, education, occupation and SSS are all predictors and determinants of SRH and SROH. Subjective social status has the strongest association and a significant effect for predicting both SROH and SRH. Self-rated oral health and Self-rated health have no statistically significant differences according to municipality; however, there are statistically significant associations between SRH according to gender, SSS, household income, education level, and occupation. For SROH age, gender, SSS, household income, education level and occupation are statistically significant. Education level and SSS are the strongest predictors for SROH.

Satisfaction with life (SWL) is significantly associated to longstanding illness, and limited daily activity, the number of remaining teeth and reason for dental visits. It is interesting to report the results about household income, SROH and SRH and the impact of SWL; Income inequalities in SROH are present for those with less than 600 euro per month as household income; however, when SWL entered the model, then household income is no more significant for those with higher income, but not for those with a household income 600-799 euro per month. The higher the income, the higher the education level, better jobs and higher subjective social status then the better SROH and SRH. Oral health behavior differences (reason to go to the dentist, time since last visit to the dentist, frequency of brushing teeth or dentures) and socioeconomic inequalities are present in the examined population and partly explain the gradient. There are gender differences in oral health behaviors; women have better oral hygiene habits, brush more, and

visit the dentist for regular check-ups, compared to men's habits. This is in accordance with a previous study in Greece in a younger adult population (Mamai-Homata, et al, 2016); furthermore, OHI-S (poor oral hygiene) was associated with age (p=0.0011) and if dental visit was in less than 12 months (p=0.005) in Greek elders (Gkavela, 2019).

Frequency of brushing teeth or dentures less than once a day is statistically significant different from those, they report frequency of brushing twice a day, by occupation, household income, and education level. Frequency of brushing less than once a day and SSS is statistically significant for those they report low subjective social status. The effect of SWL and loneliness in the final model did not impact these significant associations of frequency of brushing and SSS.

Psychometric factors in the study partly explain socioeconomic inequalities, the social gradient, and subjective health differences. Cognitive ability, social networks, SWL and loneliness, impact health outcomes and contribute to clarification of health inequalities. There is a socioeconomic pattern for number of missing teeth and cognitive ability partly explained the number of missing teeth. The influence of SWL and loneliness in SRH and gradient inequalities are strong and diminish the effect of household income in the model. Those rating their health as poor are more likely to have a household income less than 800 euro per month, but SWL and loneliness have a stronger effect on these perceptions, and partly explain the gradient. On the other hand, social network has strong impact on SRH but in the final model both household income and social network are significant predictors for SRH. Those with less money and the less close contacts are more likely to report SRH as poor. Education level has statistically significant associations with SRH and these associations remain significant even after SWL and loneliness entered the model. Education remained significant in all three models and this confirms education as a strong predictor for SRH. SWL and loneliness also partly explain the socioeconomic gradient in health.

The study's results are in agreement with those from the Spanish National Health Survey; Capurro and Davidsen (2017), reported that for adults with lower education, LOWER income and manual workers, had

higher odds of reporting poor SROH; they also reported that behavioural and psychosocial variables could partly explain associations (Capurro and Davidsen, 2017). Similarly, in the present study gradient inequalities in SROH and SRH were influenced by loneliness, SWL, social networks and cognitive ability.

Self-rated oral health and socioeconomic inequalities and the gradient are present in the examined elderly population. Those with less money, lower education, and manual workers are more likely to perceive their oral health as poor. Income pattern inequalities remained statistically significant in the final model when SWL and loneliness were introduced. SWL had a strong impact on SROH; Low score for SWL Is a predictor for poor SROH, and partly explains the gradient. Unlike this pattern for socioeconomic differences, SROH by occupation is related and has statistically significant differences for occupations that are considered best. Occupation has a strong impact for SROH for the first two occupation groups; those with the best jobs (professionals/ managers) and those nonprofessionals and non-manual workers; however, there are no differences for the third occupation group (manual workers). Those who work as professionals/ managers and those who are non-professionals non manual workers, are less likely to report SROH as poor. Yfantopoulos et al, 2014 examined SROH inequalities in three different age groups and found that less education and lower income levels were predictors for lower levels of self-rated oral health (Yfantopoulos et al, 2014). This is in agreement with the present study's results.

Satisfaction with life is also a strong predictor for SROH and the effect of occupation for professionals/ managers remained significant only for those in the first occupation group, professionals/managers. Satisfaction with life has also a significant effect in the final model. Thus, those who their last main occupation was in the first occupation group (professionals/ managers) and report SWL score above 20, are more likely to perceive their SRHO as good. The results confirm inequalities and occupational gradients in SRH; however, these inequalities are partly explained by SWL, Loneliness and social networks.

Subjective social status has a significant impact on SROH that remained untouched by the effect of SWL. Thus, those who perceived their subjective social status as low (steps 1-4), are more likely to perceive their SROH as poor in all three models; in the final model SWL and SSS remained statistically significant.

The study results revealed a significant association between tooth loss and cognitive ability. Participant's age, income and years of education were also significantly correlated with tooth loss. Increasing the cognitive ability score by one then we expect a decrease in missing teeth by 0.6 and if we have one more year of education then we expect missing teeth to decline by 0.4. Those who brushed their teeth or dentures less than once a day and visited the dentist only when they had pain or a problem had significantly more missing teeth. There was also an occupation and income effect thus those being manual workers with lower income experienced significantly more missing teeth; the profile for the socioeconomic gradient in missing teeth is linear.

In accordance with the results of the present study, are the results of studies that also used MMSE test for cognitive ability. The results of these studies showed tooth loss associated with MMSE score; the higher the number of missing teeth the lower the MMSE score in Japanese elders (Okamoto N et al, 2010; Saito Y & Sugawara N, 2013). Similarly, lower MMSE scores were associated with increased risk of tooth loss and reported in a cohort study of community dwelling men, members of the U.S. department of Veterans Affairs, 28-70 years old. In older men MMSE scores were predicted by rates of tooth loss. Those results showed that the risk for low scores in MMSE test increased by 9% to 12% for each tooth lost in a decade (Kaye EK et al, 2015). The MMSE score has also been associated to tooth loss in Indonesian elders (Asia A et al, 2015).

Takeshita et al (2016) in a cross-sectional study in Japan examined occlusal force and cognitive function in older Japanese. Cognitive function was measured with the Japanese version of the Montreal Cognitive Assessment (MoCA-J) and oral status and function were assessed by the number of remaining teeth, periodontal pocket depth, and maximal occlusal force. Multiple regression analysis showed that

occlusal force was significantly related to cognitive function after controlling for possible predictors (age, sex, socioeconomic status, medical condition, and handgrip strength). The number of remaining teeth and periodontal pocket depth were not significantly associated with cognitive function; however, maximal occlusal force was positively associated with cognitive function (Takeshita et al, 2016). In the present study remaining teeth were significantly associated to cognitive ability (p<0.001) and inequalities remained; however, all socioeconomic measures reduced their impact. Tooth loss is negatively associated with cognitive function and education (Cerrutti-Coplin, 2018; Damaskinos, 2018).

Another study that used the MMSE score but also a clinical diagnosis of dementia, in Swedish elders, showed that education and age levels largely explained associations of missing teeth and cognitive impairment. The Health 2000 Health Examination Survey in Finland examined oral health and cognitive impairment (using the shortened version of MMSE) in adults 55 years or older, and found statistically significant differences with more carious and missing teeth or being edentulous without wearing a denture in those cognitively impaired (Syrjala et al, 2007). Similarly, a study from China examined the association between tooth loss and cognitive function in elders 60 years or above found that the number of missing teeth was significantly associated with cognitive impairment (Luo J, et al 2015). Holst (2008), found in a 30year long study in Norwegian adults that the existence of oral health inequalities and the social gradient in edentulism impacted on the functional dentition of 20 or more natural teeth. She concluded that in Norwegian population edentulism was a result of accumulated indices of oral diseases and limited access to dental care either because of economic barriers or unavailability of dental care (Holst, D, 2008).

Analyses of the National Health and Nutrition Examination Survey (NHANES, 1999-2002), in the USA, examined dental care utilization as a covariate and the link between cognitive functioning and tooth loss, and there was a strong association of dental care utilization and tooth loss (Wu B et al, 2008), and the level of cognitive functioning with dental utilization (Bu B, et al, 2007). In the present study we also found that lower scores of cognitive functions have been associated with

worse oral health status, and the impact of cognitive function on tooth loss merged when there were regular dental visits. However, in the present study participants are both edentulous and dentate seniors 65 years and older, while in the studies of Wu et al (2007; 2008; 2016), participants had at least one tooth and were 60 years and older. Age was reported of greater correlation with cognitive function than with the number or remained teeth (Delwel et al, 2020; Lexomboon et al, 2012); however, in the present study age and cognitive function have the same power (p<0.001) in predicting the number of remained teeth. Lee and Choi (2019) reported that dementia was less common in subjects with periodontitis but was more common in those with removable dentures, suggesting that tooth loss may be conductive to development of dementia.

A study by Manski et al (2016), examined disparities in dental attendance among older adult populations in the USA, data from Health and Retirement Study (HRS), and in European countries, data from the Survey of Health and Retirement in Europe (SHARE). It was found that income and education had stronger correlation with dental use, than dental insurance had. This result is partly in agreement with the results of the present study, in which education had a significant effect on tooth loss. Furthermore, the present study's results partly agree with the results of a previous research in Greece by Mamai-Homata et al, (2012), where education was the only significant predictor for tooth loss in adults (Mamai-Homata et al, 2012).

In the present study cognitive ability impact and partly explains oral health inequalities. It is interesting that cognitive ability diminished the effect of all socioeconomic measures for OHI-S. This result is not in accordance with the results of Singh-Manoux et al (2005) who examined the role of cognitive ability and health inequalities using data from the Whitehall II study and found that although cognitive ability is related to health, yet cannot clarify or explain social inequalities in health (Singh-Manoux et al, 2005).

Additionally, the results of the present study of DMFT inequalities and cognitive ability, exposed that all socioeconomic measures' impact was attenuated by the effect of cognitive ability, while for SROH the results

revealed that cognitive ability impact perceptions of SRH and SROH (p<0.001). In the final model for SRH inequalities and cognitive ability, the impact of education, income (household and personal income) and occupation were diminished, while the impact of SSS was reduced. For SROH, the impact of education and income decreased and the impact for occupation was diminished, while the impact of SSS retained its impact (p<0.001) by the effect of cognitive ability. These results partly agree with the results of Sabbah et al (2009) who also reported that cognitive ability partly explained socioeconomic inequalities in oral health in the US population (Sabbah et al, 2009); however, there are noticeable differences in the methodology used by Sabbah et al (2009) who analyzed data from the NHANES in younger adults 20-59 years old and cognitive ability was examined by other memory tests and not by MMSE test.

In the present study, socioeconomic measures, clinical and psychometric factors affecting SROH and self-rated general health and satisfaction with life in elders, were examined. There are associations between household income, education level, occupation, subjective social status and clinical measures of health, and SROH and SRH, in Greek elders in Athens and Piraeus. All three objective socioeconomic measures used in the study are predictors of SROH and SRH (p< 0.01); SSS, a subjective socioeconomic measure, found to be also a predictor for SROH and SRH (p< 0.01). However, the objective socioeconomic measures aren't predictors for SWL. The results contradict the claims of Daraei and Mohajery (2013) who found a positive correlation between socioeconomic status and satisfaction with life in India female domestic workers.

The thesis's results indicate that gender, municipality, long-standing illness, Subjective social status and loneliness, are predictors of SWL. It is interesting to highlight that remaining teeth is a significant predictor of SROH (p= 0.01), SRH (p= 0.01), and SWL (p= 0.05), while municipality and reason for dental visits are statistically significant predictors only of SWL (p= 0.01). The results for remaining teeth and socioeconomic status (income and education) are in agreement with the results of Kim et al, (2016) and Park et al (2019) from the Korean National Health and Nutrition Examination Survey 2010 -2012 & 2012-2013 (Kim et al, 2016;

Park et al, 2019) that reported remaining teeth in older people positively associated with education and income; and partly agree with the results of Gkavela (2019), who found that the number of remaining teeth was associated to education (p=0.004) but not to income. However, being edentulous was associated with education (p=0.011) and income (p=0.024) (Gkavela, 2019).

Self-rated health and the presence of a gradient among Greek adults was reported by Theodosiou and Zangelides in 2009 (Theodosiou and Zangelides, 2009). A recent study in Greek adults examined SRH and SSS and found that age and the presence of chronic disease affect SRH and that the higher the perceived SSS, the higher the odds of reporting good SRH (Charonis et al, 2017). A study that examined SRH, socioeconomic status (objective measures) and indebtedness in Greek adults found that males and younger individuals with a higher SES had a higher probability of reporting better SRH (Kyriopoulos I-I et al, 2016), which is in agreement with the results of the present study. Daniilidou et al (2004), in a study of Greek adults (aged 18 years and over), found that SRH was influenced by income, education, age and gender; however, variables such as physical activity and psychometric factors were not used in that study (Daniilidou et al, 2003). In the present study, there is no significant relationship between age and SRH; however, gender is significantly associated with SRH and SROH. Women are more likely to perceive their SRH and SROH as poor (p<0.001.)

Long-standing illness and long-standing illness that limited daily activity are significantly associated with SRH in the present study; these results are in accordance with previous studies worldwide that revealed that socioeconomic measures (income, education, occupation) were determinants of SRH (Franks P et al, 2003; Hong et al 2004; Fernandez DLHK & Leon DA, 1996; Hirdes JP & Forbes WF, 1993), and mortality (Dowd JB & Zajacova A, 2007; Benyamini Y et al, 2004; Pappas et al, 1993; Idler EL & Angel RJ, 1990). In the present study, the stronger predictor for self-rated health as poor, is subjective social status and Satisfaction with life. There is as a gradient in linear pattern for Self-rated health and education level; education level remained significant even after Satisfaction with life was introduced in the model. Inequalities and the gradient exist for household income as well.

Household income, loneliness and social networks are statistically significant and predictors for Self-rated health as poor.

The results of the European Project "Enabling Autonomy, Participation, and Well-Being in Older Age: The Home Environment as a Determinant for Healthy Aging' based on Latvian and Swedish data showed that poor perceived mobility was associated with poor SRH, while education was a determinant for SRH only for the Latvian sample. Age was not a significant determinant for either population (Harschel AK et al, 2015). The results of the present study showed that for dentate participants, age is significantly associated with SROH and SWL; however, the findings for SRH and age are not significant, in accordance with the Latvian and Swedish data, as reported by Harschel et al, 2015. In the present study, education, income and occupation are statistically significantly associated with both SROH and SRH. Income inequalities in SRH were also reported in Japan; at the prefecture level, the association between income and SRH was especially strong (Shibuya K et al, 2002); in Russia, education, material deprivation and perceived control were related to SRH (Bobak et al, 1998).

In the present study, SROH (poor vs good) was predicted by education, occupation, SSS and household income. Mejia et al (Mejia G et al, 2014) examined SROH and social inequality among Australians (Australia's National Survey of Adult Oral Health, 2004-2006) and found that those who reported an annual income less than 20,000 Aus. $ and those who were less educated or unemployed were more likely to report poor oral health; this finding is in accordance with our results, However, an income of 20,000 Aus.$ (~12.482 euros) is much higher than 800 euros per month (approximately 900 euros per year); one (I) Aus. $ equals about 0.62 euros). Greece is a country in economic recession with reduced pensions and salaries because of the Memorandum. Additionally, a more recent study in Australia reported that poor SROH and income inequality in Local Government Areas (LGAs) had no associations among Australians (Singh A, et al 2018). However, the present study's results are in agreement with a study form Sweden; socioeconomic measures were strongly associated with SROH (OR 1.76) and SRH (OR 3.95) in Swedish adults; these results remained significant after controlling for age (mean age 53.4 years), gender and lifestyle

variables (Hakeberg and Boman, 2018). Another cross-sectional study had similar results with the present study's results and found socioeconomic gradients in dental health among adults, in Spain; however, this study (data from the 2006 Spanish National Health Survey) did not include SROH in their logistic regression analysis and they focused on younger adults 30-64 years (Capurro and Davidson, 2017). The present study 's results are in agreement with the results of Jayasvasti et al, 2019, in a cross-sectional study about SROH status in Myanmar. They found that tooth loss, less frequent dental care attendance, and lower education were associated with poor SROH (Jayasvasti et al, 2019).

The present study exposes that participants with no teeth (edentulous) are more likely to report poor SROH, poor SRH and low SWL scores. This is not in line with the results of Northridge et al (Northridge ME et al, 2012), who found that edentulous participants reported better SRH than the dentate participants. The present study's results are in agreement with Gkavela's results that being edentulous is associated with education and income (Gkavela, 2019).

Additionally, the present study's results are in agreement with Farmer's et al 2016, results regarding education and income inequalities in a study in Canada. SROH was examined (using a nationally representative Canadian survey), and poor SROH was found to be inversely related to education and income; both socioeconomic measures were evenly balanced with the gradients (Farmer J et al, 2016). In the present study, the participants were 65 years old or older (65-94 years), and those in the 74-94-year-old group had significant income and educational gradient inequalities compared to the younger group of 65-74-year-olds. A study in England, Wales and Northern Ireland found oral health inequalities in the UK adult population that tended to diminish with age; for those aged 65 years and over, these inequalities were not statistically significant (Guarnizo-Herreno CC et al, 2014). The results of the present study show that inequalities do not fade with age in the examined population. In the literature, there is conflicting evidence regarding whether inequalities in health diminish or persist in older age (Celeste RK, & Fritzell J, 2018; Benzeval M et al, 2011; Merlo J et al, 2003).

The present study's results are useful for policy makers, health planning and welfare; all can gain experience and focus on oral health and general health. Because older people have transition events affecting their lives (loss of a partner, widowed, retirement, and health problems), they are more vulnerable to financial crisis and may face hardship (Petersen PE et al, 2010; WHO 2009).

Unequal distribution and diffusion of income and inequality in occupation and education contribute to differences in health outcomes and care, revealing the gap between the more affluent and privileged and less affluent (Knust, 1996; Mackenbach et al 1997; Morita et al, 2007a; 2007b; Stewart et al, 2008; Bartley 2004; Damaskinos et a, 2018). This is important for a country like Greece; a country in a deep economic and social crisis; this financial crisis is also a public health crisis and has impacted on people's daily life, and oral health inequalities and health disparities have increased (Damaskinos & Economou, 2012; Damaskinos et al, 2016). Increasing number of Greeks have reported neglecting their health, and they avoided health or dental examinations either because could not afford to pay the cost or because of the distance to the clinics and travel expenses (Damaskinos et al, 2016; Simou & Koutsogeorgou, 2014; Damaskinos et al, 2018). Unfortunately, a safety net for those frail or in great need does not exist. This emphasizes the need for strategies and upstream public health policies and interventions to eradicate disparities in oral health and social disparities within the country and inequalities in oral health care across other countries, as this is one among others of global oral health objectives for the year 2020 (Moyses, 2012; Hobdell et al, 2003; Damaskinos et al, 2018). Furthermore, there is a need to implement national guidelines and a plan to promote equity in health and awareness of the importance of oral health on general health with emphasis in cognitive ability, loneliness, social networks and Satisfaction with life, and the impact of social differences in health outcomes.

Limitations

The study has some limitations because of its design. This is a cross-sectional study with an observational study design in which the outcome and exposures are examined at the same time, which makes causal relationships difficult to conclude; thus, the results should be treated with caution. However, the strengths of the study are the use of multilevel sampling procedures, stratified and clustering methods according to postal codes, municipalities and Day Clubs. Moreover, this research was especially designed to explore factors affecting the oral health of elders aged 65 years and older, applying multivariate analysis to control confounding as much as possible. The participants were elders aged 65-94 years (males and females), both clinical and subjective measures were used, and psychometric factors were also considered. This cross-sectional study could be used as a baseline for a future cohort study.

Conclusions

The main results of the present study are the existence of the social gradient in oral health of older adults from two municipalities of Attica region (Municipality of Athens and Municipality of Piraeus). Socioeconomic factors impact perceptions of health and show inequalities and educational, income and occupation gradients. Education, occupation, household income, personal income, and subjective social status are predictors for Self-rated Oral Health (SROH) and Self-rated Health (SRH), and are statistically significantly associated with both SROH and SRH. Oral health hygiene, missing teeth, DMFT and SROH and SRH in older Greek adults visiting Day Clubs have significant differences according to income, education, occupation and SSS. Associations between oral hygiene (OHI-S) and household income is statistically significant. Similarly, these associations are statistically significant for education, occupation and SSS. Subjective social status is the strongest predictor, and verified to be a valid measure for examining health inequalities.

This study examined and reported relationships between oral health, social gradient inequalities and social networks, loneliness, SWL, subjective social status (SSS) and oral health, cognitive ability and oral health; SRH and objective and subjective SES; SRH and oral health indicators.

Gender, years in pension, marital status, OHRQL, social networks, loneliness, satisfaction with life and cognitive ability (MMSE test) have an effect on oral health. Education, income, occupation and SSS are also significant predictors for missing teeth and their associations with the number of missing teeth are statistically significant. Participants who reported last main occupation as being manual workers, less educated, in the low steps of the social ladder (SSS), and with less money were more likely to have a higher number of missing teeth.

There are socioeconomic inequalities and a social gradient for DMFT index; the results are significant for household income, education level, occupation, and SSS. All explanatory variables are significantly associated with DMFT, in the examined population. The results for

income gradients remained statistically significant even when only dentate participants were included in the analysis. Thus, those with more money, higher level of education, in non-manual occupations and with higher subjective social status are more likely to have less decayed, missing and filled teeth (DMFT). Educational and occupational gradients are constant and in a linear shape for DMFT. Income gradients also in a linear pattern were also revealed when DMFT and household income was examined without the effect of education. Gradient inequalities were also apparent for DMFT and subjective social status (SSS).

However, the association between oral health (DMFT, OHI-S, SROH) and SRH and social gradient inequalities was less powerful after adjustment for cognitive ability.

Tooth loss is associated with cognitive ability (MMSE score) in elders, visiting Day Clubs in Athens and Piraeus, Greece. In the examined population those with higher scores of MMSE test experienced fewer missing teeth. Also, those who were older, males, with less years of education, lower income, and felt dryness in the mouth had significantly more missing teeth. Similarly, the number of remaining teeth is positively associated to cognitive ability. The higher the number of remaining teeth the higher the cognitive ability.

Cognitive ability attenuated the effect of socioeconomic inequalities and partly explained social inequalities and the gradient in the examined population. Oral health behaviors and especially frequency of brushing teeth or dentures less than once a day, visits to the dentist only when in trouble or in pain are associated with the number of missing teeth; furthermore, those who were manual workers with lower education and lower income experienced significantly more missing teeth. The social gradient in oral health exist and its shape varies according to the indicators and health outcomes examined.

Psychometric factors have a significant impact and contribute to explaining inequalities and the social gradient; cognitive ability, Satisfaction with Life (SWL), loneliness and social network impact and partly explained inequalities and the social gradient.

Suggestions for Future Research

This thesis explores socioeconomic inequalities and the social gradient in oral health outcomes (clinical and subjective) and wellbeing of older Greek adults. The use of objective and subjective measures of socioeconomic measures as explanatory variables are essential in health epidemiology and inequalities' studies. Psychometric and other factors used in the study partly explained the social gradient. It would be interesting for future studies in the elderly and retired people to contend in psychometric factors and other independent variables such as time since retirement and leisure time. Future research is needed to further investigate the association between tooth loss and cognitive ability, social networks, SWL and loneliness in older people, in Greece, in order to design and implement the appropriate dental public health measures for this high-risk population group. For practical and economic reasons and time needed for this study, the design was cross-sectional. It would be interesting to plan and apply a prospective cohort study to observe a large group of individuals and record exposure to risk factors.

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Appendices

Appendix 1

Note for G20 group

The Members of the G20 are: Argentina. Australia, Brazil, Canada, China, France, Germany India, Indonesia, Italy, Japan, Republic of Korea, Mexico, Russia, Saudi Arabia, South Africa, Turkey, the United Kingdom, the United States and the European Union.

The study area - Socioeconomic differences

Figure APP1.1.
The Greater Athens area

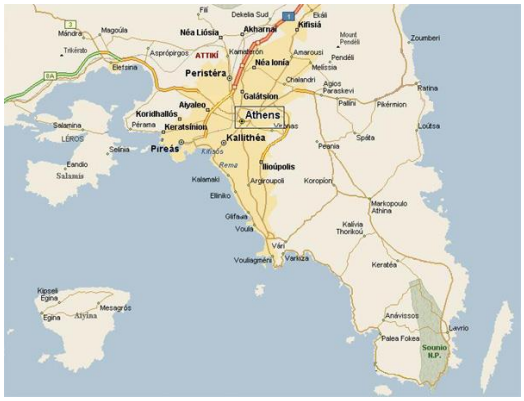


Figure APP1.2.
The Greater Athens area

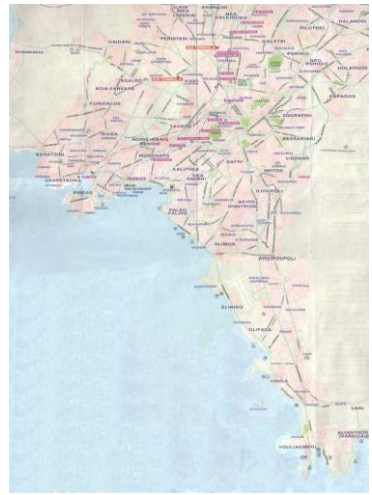


Figure APP1.3. Socio-economical map of Athens Greater Area according to education (Maloutas 2002)

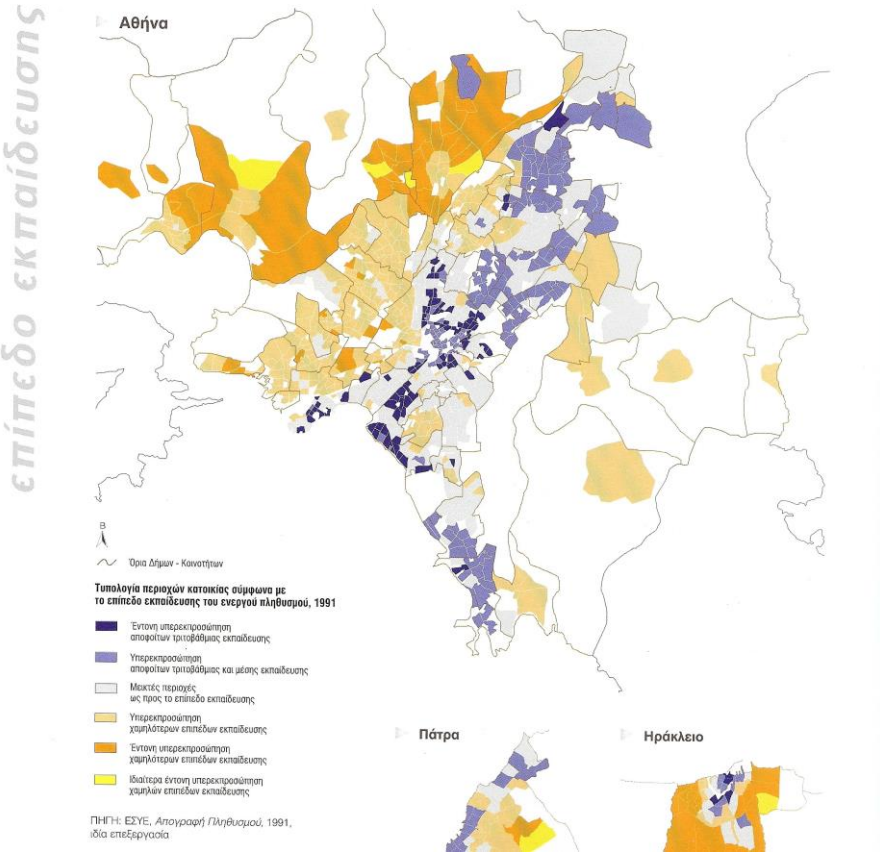


Figure APP1.4. Socio-economical map of Athens Greater Area according to occupation (Maloutas 2002)

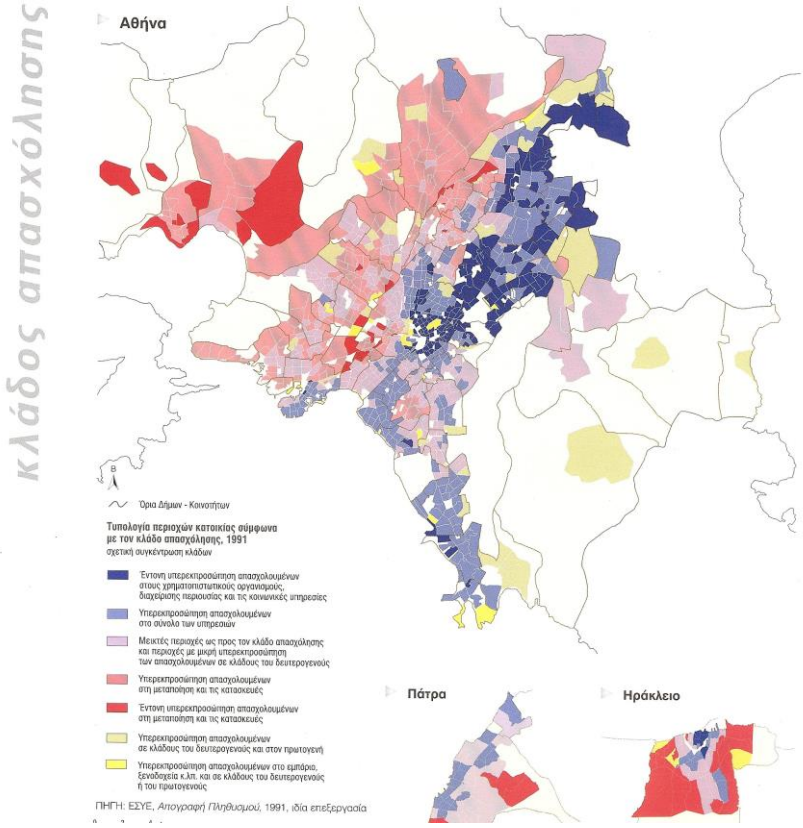


Figure APP1.5. Socio-economical map of Athens Greater Area according to value of new properties (Maloutas, 2002)

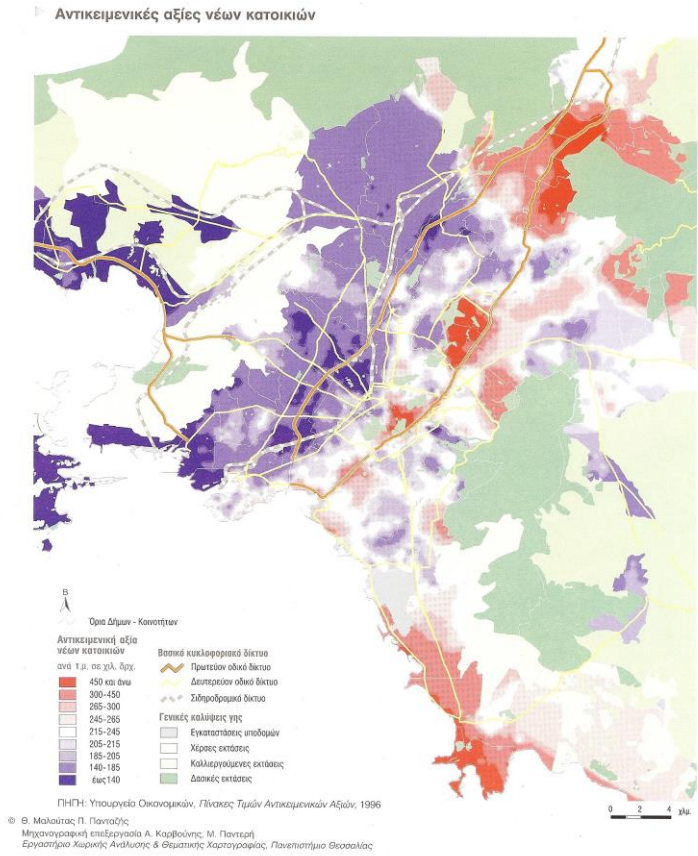


Table APP.1.1: Population Projections for Greece

POPULATION PROJECTIONS 2007 - 2050

Medium scenario

	Life expectancy at 65 males	Life expectancy at 65 females	Mean age of the population	Population aged 0-14 (%)	Population aged 15-64 (%)	Population aged 65+ (%)	Population aged 75+ (%)
2007	17,53	19,66	41,63	14,3	67,1	18,6	8,1
2008	17,64	19,76	41,85	14,3	67,1	18,6	8,4
2009	17,75	19,86	42,04	14,3	67,1	18,6	8,7
2010	17,86	19,96	42,23	14,3	66,9	18,8	9,1
2011	17,97	20,05	42,47	14,3	66,7	19,0	9,3
2012	18,08	20,15	42,66	14,3	66,4	19,3	9,6
2013	18,19	20,25	42,85	14,3	66,1	19,6	9,7
2014	18,30	20,34	43,02	14,3	65,9	19,7	9,9
2015	18,41	20,44	43,19	14,4	65,8	19,8	10,0
2016	18,52	20,54	43,41	14,4	65,5	20,1	10,3
2017	18,63	20,63	43,59	14,4	65,3	20,3	10,2
2018	18,74	20,73	43,77	14,4	65,2	20,5	10,2
2019	18,85	20,83	43,94	14,3	65,1	20,6	10,1
2020	18,96	20,92	44,12	14,2	64,9	20,9	10,2
2021	19,06	21,02	44,33	14,1	64,7	21,1	10,3
2022	19,17	21,11	44,52	14,0	64,6	21,4	10,5
2023	19,28	21,21	44,70	13,9	64,4	21,7	10,7
2024	19,39	21,31	44,88	13,7	64,3	22,0	10,8
2025	19,50	21,40	45,05	13,6	64,1	22,3	10,9
2026	19,60	21,50	45,27	13,4	63,9	22,7	11,1
2027	19,71	21,59	45,45	13,3	63,7	23,0	11,3
2028	19,81	21,68	45,64	13,1	63,6	23,3	11,4
2029	19,92	21,78	45,81	13,0	63,4	23,6	11,6
2030	20,03	21,87	45,99	12,9	63,2	24,0	11,8
2031	20,13	21,97	46,19	12,8	62,9	24,3	12,0
2032	20,24	22,06	46,37	12,7	62,5	24,8	12,3
2033	20,34	22,15	46,55	12,6	62,1	25,3	12,5
2034	20,44	22,24	46,71	12,6	61,6	25,8	12,7
2035	20,55	22,33	46,86	12,6	61,2	26,2	13,0
2036	20,65	22,42	47,04	12,5	60,8	26,7	13,3
2037	20,75	22,51	47,19	12,5	60,3	27,1	13,6
2038	20,85	22,60	47,34	12,6	59,9	27,6	13,8
2039	20,95	22,69	47,47	12,6	59,4	28,0	14,1
2040	21,05	22,78	47,60	12,6	58,9	28,5	14,3
2041	21,14	22,86	47,73	12,6	58,5	28,9	14,6
2042	21,23	22,94	47,85	12,7	58,0	29,3	15,0
2043	21,33	23,02	47,97	12,7	57,5	29,8	15,4
2044	21,42	23,11	48,07	12,8	57,0	30,2	15,7
2045	21,51	23,19	48,17	12,8	56,6	30,6	16,1
2046	21,60	23,27	48,28	12,9	56,1	31,0	16,5
2047	21,68	23,34	48,37	12,9	55,7	31,4	16,8
2048	21,77	23,42	48,46	12,9	55,4	31,7	17,1
2049	21,85	23,49	48,53	13,0	55,1	31,9	17,4
2050	21,94	23,57	48,61	13,0	54,9	32,1	17,8

Source: National Statistics in Greece
http://www.statistics.gr/eng_tables/s201_spo_5_ts_07_50_14_y_en.pdf

Table APP.1.2. Municipalities of Greater Athens Area-Municipalities' Population weighted

Municipality	**Population**	**Weight**	
Penteli	4829	1,0	1
Ekali	5190	1,1	1
Nea Penteli	6156	1,3	1
Filothei	7310	1,5	2
Likovrisi	8116	1,7	2
Nea Halkidona	10112	2,1	2
Neo Psichico	10848	2,2	2
Psychico	10901	2,3	2
Imittos	11139	2,3	2
Drapetsona	12944	2,7	3
Papagou	13207	2,7	3
Tauros	14963	3,1	3
Agios Ioannis Rentis	15060	3,1	3
Neas Erythreas	15439	3,2	3
Helliniko	16740	3,5	3
Melissia	19526	4,0	4
Pefki	19887	4,1	4
Kamatero	22234	4,6	5
Moschato	23153	4,8	5
Dafni	23674	4,9	5
Nea Filadelfeia	24112	5,0	5
Vrilissia	25582	5,3	5
Perama	25720	5,3	5
Kaisariani	26419	5,5	5
Metamorfosis	26448	5,5	5
Agia Varvara	30562	6,3	6
Holargos	32166	6,7	7
Agioi Anarguroi	32957	6,8	7
Arguroupolis	33158	6,9	7
Alimos	38047	7,9	8
Kifisias	43929	9,1	9
Herakleion	45926	9,5	10
Haidari	46276	9,6	10

Petroupoli	51064	10,6	11
Agia Paraskeui	56836	11,8	12
Galatsi	58042	12,0	12
Vironas	61102	12,7	13
Palqio Faliro	64759	13,4	13
Agios Dimitrios	65173	13,5	13
Nea Ionia	66017	13,7	14
Koridalos	67456	14,0	14
Amarousion	69470	14,4	14
Halandri	71684	14,8	15
Nea Smirni	73986	15,3	15
Aigaleo	74046	15,3	15
Heliooupolis	75904	15,7	16
Keratsini	76102	15,8	16
Zografou	76115	15,8	16
Helion	78122	16,2	16
Glyfada	80409	16,7	17
Nikaia	93086	19,3	19
Kallithea	109609	22,7	23
Peristeri	137918	28,6	29
Peireuas	175697	36,4	36
Athens	745514	154,4	154
Total	3130841		

Source: Census 2001; Ministry of Interior 2014

Day Clubs are characterised by their postal code, the population in the municipality live in nearby affluent and/or less-affluent surrounding neighbourhoods. Because the study includes the total number Day Clubs in the municipality (each with a different postal code), people from the entire spectrum of the society according to income, education and occupation are likely to participate. Municipalities of Peireuas and Athens have both areas with higher income and areas with less well off, and this is necessary to examine and search for inequalities in health and oral health.

Appendix 2

Pilot Study

Briefly, the pilot study was undertaken in two municipalities of the Greater Athens area to test the feasibility of the procedures and to estimate the sample size for the main study. Moreover, the pilot was desirable, to test language difficulties with the study questionnaires, and the time needed for the clinical examination and administration of questionnaires. The practical issues raised by the research were also checked, as the examiner and the interviewers had to be familiar with the procedures related to clinical examination and questionnaires. The interviewers were trained for the interview process and for recording data.

The pilot study also served as a means of testing organizational procedures in each Day Club, checking the working group's quality assurance and the examiner's and interviewers' ability to communicate with people and within the group and, finally, addressing issues such as instrument sterilization.

The pilot study, cross sectional epidemiological study, took place in two municipalities of Attica area. Municipalities of Kallithea and Neo Psychico, both have Day Centers and gave permission to visit them and conduct the pilot study. These municipalities were selected because they have a wide spectrum of society, with different education, occupation and income levels.

Kallithea Municipality is an area between Athens and Peireuas; considered to be quite affluent, but also has areas inhabited by less affluent people. According to the Socioeconomic Map of Greece (Maloutas, 2000 pp. 53-55), it is an area with many occupations and a mixture of educational levels, thus making the area suitable for the pilot study. Municipality of Kallithea has four Day Centers distributed within its boundaries. Each one is in a different neighborhood with a different postal code.

The Municipality of Kallithea has four, Day Clubs, however, for the pilot study, only three were visited. Municipality of Psychico has the second highest mean income of all municipalities, while Kallithea has lower mean income and stands below the middle. Sociodemographic characteristics of the sample (Municipalities of Kallithea and Psychico) are in Table APP2.1.

Recruitment: People visiting Day Clubs were informed of the study and those interested submitted their names to a list of interested prospective participants. Inclusion and Exclusion Criteria: Inclusion and exclusion criteria were the same as for the main study. Ethical considerations were the same as for the main study.

Research Procedure

In accordance with the protocol of the study, after the Municipality of Kallithea and Municipality of Psychico granted permission for the pilot study, the researcher P.D. contacted and visited the Day Clubs and made the necessary arrangements. The social workers at the Day Clubs were helpful; an advertisement for the study was placed on the boards for each Day Club; the social workers and the municipality's administrative personnel helped to inform attendees at the Clubs of the study. They helped to ensure that prospective participants understood that they would participate only after they had a thorough understanding of the aim of the study and that they were participating of their own free will. Information leaflets were circulated to people aged between 65 years and above, who attended the Day Clubs.

Table APP2.1. Sample characteristics. Participants in pilot study

Demographics		N	%
Gender	male	43	46.24%
	female	50	53.76%
	Total	93	100%
Municipality	Kallithea	70	75.27%
	Psychico	23	24.73%
	Total	93	100%
Age	65-74	65	69.9%
	≥75	28	30.1%
	Total	93	100%
Years of Education	0	21	22.6%
	6	25	26.9%
	>6	47	51.5%
	Total	93	100%
Personal income	<600	39	41.9%
	600-799	28	30.1%
	≥800	26	28%
	Total	93	100%
Household income	<600	12	12.9%
	600-799	17	18.3%
	≥800	64	68.8%
	Total	93	100%
Marital status	Married one or more times	50	53.8%
	widowed	34	36.6%
	other	9	9.6%
	Total	93	100%

Participants were informed again about the study before the interview and dental examination, and they only participated, after giving consent and signing the informed consent form. After consent was stablished, participants were interviewed using the structured questionnaire. The three interviewers were trained and calibrated by P.D. and the procedure was standardized. In order to ensure privacy, the interviews and dental examinations took place in a private area usually used by the

nurse/ physician of the Day Club. All participants were happy with the procedure and there were no complaints.

The results revealed statistically significant differences for loneliness (p=0.001), and missing teeth (p=0.010) according to personal income per month, while for Satisfaction with life the results were marginal (p= 0.048). There were statistically significant differences for education and Self-rated oral and general health, and subjective social status, but no significant differences for frequency of brushing teeth or dentures. There were statistically significant correlations for education level and Self-rated health and for subjective social status. The strength of the correlation was small for Self-rated health (rho=0.026), Self-rated oral health (rho=0.250), while correlation between education level and subjective social status was strong (rho=0.333). Furthermore, there were no significant correlations for frequency of brushing (p=0.044) and education level. Cognitive ability associated to clinical and subjective measures of oral health. All variables examined had statistically significant differences: DMFT (p=0.03), Frequency of brushing teeth or dentures (p=0.002), OHI-S (p= 0.029), Self-rated health (p=0.001), Self-rated oral health (p=0.03), OHRQL (p=0.04), and Subjective social status (p=0.01). Only for variable 'missing teeth' statistical difference was marginal (p=0.56). People living in municipality of Kallithea had higher mean values for loneliness score, missing teeth, DMFT index, and OHI-S than those living in Neo Psychico. These differences were statistically significant and only for OHI-S the difference was marginal, p= 0.49.

The results of the pilot study were useful and beneficial for the main study, for sample size estimations and testing the feasibility of this research. The main results of the pilot study revealed inequalities and the social gradient in both clinical and subjective measures of oral health, for Greek older people. To our knowledge the results of this pilot study, are the first to report the social gradient in oral health in both clinical and subjective measures. Education, income and cognitive ability partly explained explain the gradient in this older adult population.

Results of the Pilot study

Statistical analysis for the pilot study was performed using the Statistical Package for Social Sciences (SPSS) version 20.0. Data analysis included descriptive statistics means, SD, ranges and frequency distribution. The differences in continuous outcomes normally distributed, such as differences in means for decayed, missing and filled teeth, was tested, using t-test. Categorical outcomes with five or more rating scales were analyzed using chi-square tests.

Means, standard deviations and standard errors of the means of these variables were computed within age groups: 65-74 and 75 or above. There was an analysis of the distribution of all oral health outcomes, and health-related behaviours with the explanatory factors. The results of the pilot study are presented below in the next tables. In Table APP2.2. shows income inequalities and statistically significant differences in the examined municipalities for loneliness and missing teeth.

***Table APP2.2.** Personal income per month and frequencies, SD, SE of variables, Satisfaction with life, loneliness and missing teeth*

	Personal income	Mean	SD	SE	F	df	*p*
Satisfaction with Life	<600	17.11	6.61	1.09	3.01	2	0.048 *
	600 to 799	14.77	5.84	1.25			
	>799	12.80	4.38	1.13			
	Total	15.54	6.17	0.72			
Lonliness	<600	8.38	2.82	0.46	9.74	2	0.001 **
	600 to 799	5.59	2.28	0.49			
	>799	5.93	2.40	0.62			
	Total	7.05	2.89	0.34			
Missing teeth	<600	23.41	10.04	1.65	4.95	2	0.010 **
	600 to 799	18.95	10.83	2.36			
	>799	13.36	10.62	2.83			
	Total	20.15	10.95	1.29			

**p<0.05, ** p<0.01, *** p<0.001*

The results (Table APP2.2) revealed statistically significant differences loneliness (*p*=0.001), and missing teeth (*p*=0.010) according to personal

income per month, while for Satisfaction with life the results were marginal (*p*= 0.048).

There were statistically significant differences for education and Self-rated oral and general health, and subjective social status, but no significant differences for frequency of brushing teeth or dentures. There were were statistically significant correlations for education level and Self-rated health and for subjective social status as shown in Table APP2.3.

Table APP 2.3. Correlation between education level and perceived general health, frequency of brushing teeth or dentures, Self-rated oral and general health and have natural teeth

Spearman's rho	1	2	3	4	5
1. Education	-	0.044	0.250*	0.026*	0.333*
2. Frequency of teeth brushing		-	0.142	0.197	0.245*
3. Self-rated oral health			-	0.431*	0.459*
4. Self-rated health				-	0.479*
5. Subjective social status					-

*p<0.05, **p<0.01, ***p<0.001

The strength of the correlation was small for Self-rated health (rho=0.026), Self-rated oral health (rho=0.250), while correlation between education level and subjective social status was strong (rho=0.333). Furthermore, there were no significant correlations for frequency of brushing (p=0.044) and education level (Table APP2.3).

Table APP 2.4. Associations of cognitive ability (MMSE) and health outcomes

	df	F	*p*
DMFT	2	3.53	0.03*
Missing Teeth	2	0.59	0.56
Frequency of brushing teeth or dentures	2	4.04	0.02 *
OHI-S	2	1.26	0.29
Self-rated health	2	5.25	0.01 *
Self-rated oral health	2	3.63	0.03 *
OHRQL	2	3.43	0.04 *
Subjective Social Status	2	5.37	0.01 *

**p<0.05, **p<0.01, ***p<0.001*

Cognitive ability associated to clinical and subjective measures of oral health and the results are summarized above (Table APP2.4). All variables examined had statistically significant differences: DMFT (*p*=0.03), Frequency of brushing teeth or dentures (*p*=0.002), OHI-S (*p*= 0.029), Self-rated health (*p*=0.001), Self-rated oral health (*p*=0.03), OHRQL (*p*=0.04), and Subjective social status (*p*=0.01). Only for variable 'missing teeth' statistical difference was marginal (*p*=0.56).

Table APP2.5. Associations between place of residence and life satisfaction, loneliness, missing teeth, DMFT and oral hygiene level (OHI-S)

	Municipality	N	SD	SE	t	df	*p*
Loneliness	Kallithea	70	3.07	0.40	2.00	59	0.047 *
	Psychiko	23	2.08	0.43			
Missing Teeth	Kallithea	70	10.9	1.43	3.62	46	0.001 **
	Psychiko	23	8.28	1.81			
DMFT	Kallithea	70	8.45	1.11	3.61	46	0.001 **
	Psychiko	23	6.48	1.42			
OHI-S	Kallithea	70	0.48	0.06	0.69	91	0.491
	Psychiko	23	0.29	0.06			

People living in municipality of Kallithea had higher mean values for loneliness score, missing teeth, DMFT index, and OHI-S than those living in Neo Psychico. These differences were statistically significant and only for OHI-S the difference was marginal, *p*= 0.49 (Table APP2.5).

Appendix 3

This section includes some more results for the main study. In the next table's results for medication, diseases diagnosed, hospitalization, health behaviours and physical exercise, fruits and salad consumption are presented.

Table APP3.1. Frequencies for "doctor diagnosed a disease", medication, and hospitalization

	N (%)		N (%)
Cardiovascular disease disease	173(23.3%)	Osteoporosis	155(20.9%)
High blood pressure	375(50.5%)	Asthma	46(6.2%)
High blood cholesterol	212(28.5%)	Peptic ulcer	54(7.3%)
Thyroid disease	96(12.9%)	Diabetes /high blood sug.	152(20.5%)
Lung disease	40(5.4%)	Hospitalized	89(12%)
Arthritis	235(31.6%)	Medication	690 (92.9%)

Table APP3.1, shows frequencies of elders that doctor diagnosed a disease, taking at least one medication per week, and if they were hospitalized, during the last 12 months. Those that reported being healthy with no disease reached 140 (18.8%). Frequencies for health behaviours and physical activity show that 63.5% walk at least 20 minutes every day and only 6.9% exercise or walk rarely (Table APP3.2). Frequencies for health behaviours and physical exercise by gender are presented in Table APP3.3.

Table APP3.2. How often do you exercise (walking at least for 20 minutes)?

	N	%
Everyday	472	63.5%
More than once a week	72	9.7%
Once a week	148	19.9%
Rare	51	6.9%
Total	743	100%

Table APP3.3. Frequencies for exercise by gender (Walking at least for 20 minutes)

		N	%
Male	Everyday	235	66.4%
	More than once	20	5.6%
	Once a week	78	22%
	Rare	21	5.9%
	Total	354	100%
Female	Everyday	237	60.9%
	More than once	52	13.4%
	Once a week	70	18.0%
	Rare	30	7.7%
	Total	389	100%

Cramer's V= 0.140, N= 743, p=0.002

Table APP3.4. How often do you come to the Day Club? (By gender)

		N	%
Male	Every day	278	78.5%
	Two or three times a	44	12.5%
	Once a week	25	7.1%
	Less than once a week	7	1.9%
	Total	354	100%
Female	Every day	164	42.2%
	Two or three times a	168	43.2%
	Once a week	41	10.5%
	Less than once a week	13	4.1%
	Total	389	100%

Cramer's V =0.391 (N=743), p<0.001

Table APP3.4 show frequencies for visiting the Day club, in males and females. Differences are statistically significant by gender (Cramer's V, p<0.001).

The present study also examined nutritional behaviours, healthy eating and food categories consumption frequencies. The problem has two possibilities; income inequality thus less healthy food; however, elders is more likely to have difficulties with chewing because of more missing teeth, and thus the choice of food count on soft food easy to chew, and drinks. Table APP3.5 show preferences and choices for food and drinks.

Table APP3.5. Did you eat (…different choices of food) yesterday?

Food consumption			
		N	%
Medium portion of salad	Yes	289	38.9%
	No	450	61.9%
Raw salad or cooked vegetables (not potatoes)	Yes	225	30.3%
	No	518	69.7%
Cooked legumes i.e. lentils, beans etc.	Yes	205	27.6%
	No	538	72.4%
Vegetable or chicken soup or food with	Yes	249	33.5%
	No	494	66.5%
Average handfuls of very small fruit	Yes	82	11.0%
	No	661	89.0%
Small fruit, such as plums, clementine, or apricots	Yes	198	26.6%
	No	545	73.4%
Medium fruit, such as apples, pears, bananas,	Yes	540	72.7%
	No	203	27.3%
Half of a large fruit, such as grapefruit	Yes	59	7.9%
	No	84	92.1%
Average slices of a very large fruit melon,	Ye	56	7.5%
	No	87	92.5%
Tablespoons of frozen or tinned fruit	Yes	14	1.9%
	No	729	98.1%
Tablespoons of dried fruit, such as raisins or	Yes	7	0.9%
	No	736	99.1%
Dishes made mainly from fruit, such as fruit salad	Yes	11	1.5%
	No	732	98.5%
Small glass of fruit juice	Yes	33	4.4%
	No	710	95.6%

Appendix 4

This section refers to questionnaires used in the study: Questionnaire in English language and questionnaire in Greek. The OIDP questionnaire is included in the previous questionnaires. The MMSE test is a copyright item; it was reproduced by special permission of the Publisher, Psychological Assessment Resources, Inc., 16204 North Florida Avenue, Lutz, Florida33549, from the Mini Mental State Examination, by Marshal Folstein and Susan Folstein, Copyright 1975, 1998, and 2001 by Mini Mental LLC, Inc. Published 2001 by Psychological Assessment Resources, Inc. Furthermore, this Appendix includes the dental chart for recording oral health status of the study.

<u>English Questionnaire</u>

EPIDEMIOLOGICAL STUDY IN DAY CLUBS

A1. Participant's Research ID NUMBER _____

A2. Date _____

A3. Interviewer_____

A4. Municipality _____

Instructions to the interviewer

Ensure that the participant has signed the informed consent form.
Explain again that they may stop or withdraw at any time during or after the interview.

Introduce the questionnaire to the person who is going to participate:

1. The questionnaire should take about 25 minutes to complete.
2. All the information collected will be held in complete confidence. Your personal details will not be passed to any government department, business, the media, or members of the public.
3. I would also like to emphasise that we are interested in your personal views and opinions on issues we will ask you about. For example, about nutrition and diet habits, oral health behaviour, and how you rate your health. These questions are not indented to be a test of your knowledge.
4. Ask: Are you ready to start the interview/ questionnaire?

IF THE ANSWER IS **YES** GO TO NEXT PAGE.
IF THE ANSWER IS **NO**, DO NOT PROCEED TO THE NEXT PAGE. GIVE THE SUBJECT TIME TO BECOME READY, THEN ASK Question 4AGAIN.

I would like to begin by asking some questions about you and your background.

1 Gender: 1=Male……2=Female…

2 Place of birth……If not born in ATHENS/ PIREUAS, go to Q2A
2A: When moved to Athens/ Peireuas…….
2B: Area living…….
2C: KAPI…….....
2D: Municipality…….

3. How old are you? ……..... (Number) **3A.** Year of birth ……..

4. *Marital status*
1= Single, never married
2= Married one or more times
3= Divorced/ Separated
4= Widowed
5= Partner

4A. Apart from you, how many other people live in your household? ……..
None, One, Two, etc.

5. Do you have living children? 1=YES 2=NO
If Yes go to **Q 5A.**
If No go to **Q6.**

5A. How many?.....If Yes go to **5B.**

5B. Do you have grandchildren?
1= Yes If Yes → **5C** GIVE NUMBER……
2= No

6. Total years of education
How many years of schooling do you have?……

For the next question, be ready to show Card 1 (Education)

7 Please look at Card 1. What is the highest school leaving certificate or school degree that you have obtained?

1. Comprehensive school
2. Grammar school (not fee paying)
3. Fee paying grammar school
4. Sixth Form College/Tertiary College
5. Public or other private school
6. Elementary school
7. Secondary modern/ secondary school
8. Technical school (not College)

95. No degree yet/ still in school
96. None
97. Other type (also type) IF other type or abroad go to Q8.

8. What other school leaving certificate(s) have you obtained?.....

8B. Further education
Please look at Card 2. Which degrees of higher education or vocational training do you have?

1. Nurse's training school
2. College of further/ higher education
3. College or training establishment
4. Polytechnic
5. University

95. Still in higher education or vocational training
96. None
97. Other (also abroad) IF other or abroad, go to Q9

9. Which other degree of higher education or vocational training do you have?.....

10. Partner's: Years of Education……
10A. What is the highest school leaving certificate or school degree he or she obtained?.....
10B. Degree of further education or occupational training…….

11. Housing: Do you live in:
1=Own house/ flat
2=Rent house / flat
3=With other people - rent free

4=Other…….
5=Live alone-someone else pays the rent

12. Housing: Has your home have Central Heating?
1= Yes
2= No

Now I will ask some questions about your occupation/retirement

13. In general, how would you describe your current situation?

1. Retired
2. Employed or self-employed
3. Unemployed
4. Permanently sick or disabled
5. Homemaker/ Housewife
6. Other…….
7. Receive pension from husband/wife
8. Receive OGA Pension

14. *Years in pension*
In which year did your last main job end?.....

15. How many years did you been working in your last main job?
……

16. What was your job title?.....

17. For which reason(s) did you retire?
1=Normal age for retirement
2=Personal health problems
3=Health problems of a family member
4=Moved from another country
5=Other reason

18. Last main job of *partner*:……
18A. Your Father's main job ……

The next question is about your personal income per month How much per month …….

19. *Personal* Income per month AFTER TAXES Total…….
1=Less than 600 euros
2=Between 600 euros and 799 euros
3=Between 800 euros and 999 euros
4=Between 1000 euros and 1200 euros
5=Between 1201 euros and 1500 euros
6=Between 1501 euros and 2000 euros
7=Between 2001 euros and 3000 euros
8=More than 3001 euros
9=Other……

20. Before any taxes and contributions, what was your approximate income for employment/ pension last year?.....

21. *Total* household income per month - after taxes……
1=Less than 600 euros
2=Between 600 euros and 799 euros
3=Between 800 euros and 999 euros
4=Between 1000 euros and 1200 euros
5=Between 1201 euros and 1500 euros
6=Between 1501 euros and 2000 euros
7=Between 2001 euros and 3000 euros
8=More than 3001 euros
95=Other……

At this point, I would like to ask some questions about your health, but first I would like to start with a general discussion. Here I have some questions for you:

22. *Mini mental state examination (This question will be answered in a separate sheet, as they will have to do a drawing). Have the MMSE test ready.*

Beliefs and Perceived health: I would like to hear your opinion about:
a) Your general health (perceived health) and b) retirement

23. Health in general
Would you say your health is…?
1=Excellent
2=Very good
3=Good
4=Fair
5=Poor

24. Retirement has been a relief or a concern?

1=A relief
2=A concern
3=Neither a relief nor a concern
4=Both a relief and a concern

25. Do you have any long-standing illness, disability, or infirmity?
(One that has troubled you over a period of time, or that is likely to affect you over a period of time):

1=YES IF YES GO TO Q25
2=NO IF NO GO TO Q26

26. *Does this long-standing illness, disability, or infirmity* limit your daily activities?
(This is a health problem or disability that limits the kind or amount of work you could do, should you want to?)

1=YES
2=NO

<u>Have Card 3 ready for the next question</u>

27. Please look at this card (Card 3): Has your doctor told you have any illness?

27.1 A heart attack, including myocardial infarction or coronary thrombosis or any other heart problem including congestive heart failure.
27.2 High blood pressure or hypertension
27.3 High blood cholesterol
27.4 A stroke or cerebral vascular disease
27.5 Thyroid disease
27.6 Diabetes or high blood sugar
27.7 Chronic lung disease such as chronic bronchitis or emphysema
27.8 Asthma
27.9 Arthritis, including osteoarthritis, or rheumatoid arthritis
27.10 Osteoporosis
27.11Cancer or malignant tumour, including leukaemia or lymphoma, but excluding minor skin cancers
27.12 Stomach or duo dental ulcer, peptic ulcer
27.13 Parkinson disease
27.14 Cataracts
27.15 Hip fracture or femoral fracture
27.16 Psychological
96. None
97. Condition other; not yet mentioned

28. Other conditions
What other conditions you have had.....

29. Do you currently take drugs at least once a week for medical problems?
1=Yes
2=No

Show Card 4 for the next question

29A. Please look at the card (Card 4) with the drugs

1. Anticoagulants
2. Aspirin
3. Drugs for high blood cholesterol
4. Drugs for high blood pressure
5. Drugs for coronary or cerebrovascular diseases
6. Drugs for other heart diseases
7. Drugs for asthma
8. Drugs for diabetes
9. Thyroid disease
10. Drugs for joint pain or for joint inflammation
11. Drugs for other pain (e.g., headache, back pain, etc)
12. Drugs for sleep problems
13. Drugs for anxiety or depression
14. Drugs for osteoporosis
15. Drugs for heartburn/indigestion
16. Drugs for chronic bronchitis
96. None
97. Other drugs not yet mentioned

29B. Name other drugs……

29C. How many drugs per week?
None
One to two
Three to five
More than five

30. Hospital care
During the last year have you been admitted to a hospital overnight?
1= Yes 2= No If Yes, for how many days and reason:
30A. Days…….
30B. Reason……

Now I will ask some questions about your oral health. Please tell me about your teeth:

31. Do you have natural teeth? 1=YES 2=NO

31A. Do you use dentures? 1=YES 2=NO

31B. In relation to dental health, which of the following applies to?
1= No natural teeth and dentures
2= Both natural teeth and dentures
3= Only natural teeth
4= Neither natural teeth nor dentures

32A.	**32B.**
You are:	*You are:*
Edentulous in upper jaw	Edentulous in lower jaw
1 Yes	1 Yes
2 No	2 No

33. How often do you brush your teeth or dentures?
1=Never
2=Less than once a day
3= Once a day
4= Twice a day
5= More than twice a day
6= Other

34. How long has it been since your last visit for dental care?
1=Within the past 12 months
2=1–2 years
3=3–5 years
4=More than 5 years
5=Never received dental care

35. Reason/ In general do you go to the dentist:
1=Regularly for routine control or prevention
2=Occasionally
3=Only when in trouble or pain

36. *Problems during last 12 months*
During the past year, have you had problems with your teeth? Dentures(s) (plate)?
1= Yes 2= No

37.
Oral health in general: (Remember to define oral health: gum-teeth-mouth)
Would you say your oral health is?
5=Excellent
4=Very good
3=Good
2=Fair
1=Poor

38. *OIDP 10 items*
Quality of life perceived oral health - Frequency and severity of impact affecting your life**:**

Activity	Difficulty with activity? Yes=1 No=2	Difficulty on a regular basis	Difficulty only for part of period	C On a regular basis how often?	D Only for part of period	E Effect of this difficulty on everyday life
37.1 Eating	1 2	1→C	2→D			
37.2 Speaking	1 2	1→C	2→D			
37.3 Cleaning	1 2	1→C	2→D			
37.4 Light physical activity	1 2	1→C	2→D			
37.5 Going out	1 2	1→C	2→D			
37.6 Relaxing	1 2	1→C	2→D			
37.7 Sleeping	1 2	1→C	2→D			
37.8 Smiling	1 2	1→C	2→D			
37.9 Emotional stability	1 2	1→C	2→D			
37.10 Social contacts	1 2	1→C	2→D			

Please tell me if you exercise (Explanation: walking for at least 20 minutes for shopping, or to go to the Day Centre)

39. How often do you walk for at least 20 minutes?

1. Every day
2. More than once a week
3. Once a week
4. One to three times a month
5. Hardly ever, or never
6. Other

Now I will ask some questions about your nutrition

40. Using the measures below, how much of the following did you eat *yesterday*? Please read the whole list before answering. For each food type write '0' if none eaten. (Medium or Regular portion =1)

1. Salad (cereal bowls full)
2. Tablespoons of vegetables (raw, cooked, frozen, or tinned) including peas and greens. Do not include potatoes.
3. Tablespoons of pulses (legumes) such as baked beans, red kidney beans, or lentils.
4. Tablespoons of other dishes manly made from vegetables or pulses/legumes, such as vegetable lasagne, vegetable soup, fish soup, or chicken soup with vegetables

41. Using the measures below, how much of the following did you eat *yesterday*? Please read through the whole list before answering. For each food type, write '0' if none eaten:

1. Average handfuls of very small fruit, such as grapes or strawberries
2. Small fruit, such as plums, clementine, or apricots
3. Medium fruit, such as apples, pears, bananas, or oranges
4. Half of a large fruit, such as grapefruit
5. Average slices of a very large fruit, such as melon, or watermelon
6. Tablespoons of frozen or tinned fruit
7. Tablespoons of dried fruit, such as raisins or apricots
8. Tablespoons of other dishes made mainly from fruit, such as fruit salad or fruit pies
9. Small glasses of fruit juice

42 *Xerostomia -Q1:*

Have you felt any dryness in your mouth during the last 6 months?

1=Yes →If Yes: Go to Q**42A**

2=No → If No: Go to Q**43**

42 A *Xerostomia –Q2:*
1.Does your mouth ever feel dry when you are eating a meal? Yes No
2.At other times of the day? Yes No
3. Feel dry at night? Yes No

42 B *Xerostomía –Q3:*
Does dryness in your mouth ever cause you any of the following difficulties?
1=Difficulty chewing food
2=Difficulty swallowing food
3=Difficulty taking medication
4=No difficulty
5=When speaking
9=Do not know/ I cannot say

42 C *Have you done any of the following to relieve your dry mouth?*
1=Chewed gum to relieve your dry mouth?
2=Sucked on hard sweets or mints to relieve your dry mouth?
3=Sipped water or other liquid to help you shallow dry foods?
4=Taken any other product or medication to relieve your dry mouth?
5=None

Now, I would like to ask some questions about *your family and your friends*:

43 Do you have a husband, wife, or partner with whom you live?
1=Yes If yes go to Q**44**
2=No If no go to Q**45**

44. How close is your relationship with your spouse or partner?
1=Very close
2=Quite close
3=Not very close
4=Not at all close

Before asking Q45.1, please check the first page about living children (Do you have any children?) Yes/ No

45.1 How often do you see / meet up with or speak on the telephone with your children? CHILDREN

45.1_1 See / meet up		45.1_.2 Speak on the telephone	
Three or more times a week	1	Three or more times a week	1
Once or twice a week	2	Once or twice a week	2
Once or twice a month	3	Once or twice a month	3
Every few months	4	Every few months	4
Once or twice a year	5	Once or twice a year	5
Less than once a year	6	Less than once a year or never	6

45.2 How often do you see / meet up with or speak on the telephone with your relatives? RELATIVES

45.2_1 See / meet up		45.2_.2 Speak on the telephone	
Three or more times a week	1	Three or more times a week	1
Once or twice a week	2	Once or twice a week	2
Once or twice a month	3	Once or twice a month	3
Every few months	4	Every few months	4
Once or twice a year	5	Once or twice a year	5
Less than once a year	6	Less than once a year or never	6

45.3 How often do you see / meet up with or speak on the telephone with your friends? FRIENDS

45.3_1 See / meet up		45.3_.2 Speak on the telephone	
Three or more times a week	1	Three or more times a week	1
Once or twice a week	2	Once or twice a week	2
Once or twice a month	3	Once or twice a month	3
Every few months	4	Every few months	4
Once or twice a year	5	Once or twice a year	5
Less than once a year	6	Less than once a year or never	6

46. How many of your children would you say you have a close relationship with?
None
One to three
Three to five
Five to seven
Seven to ten
More than ten
Other……

47 How many of your friends would you say you have a close relationship with?
None
One to three
Three to five

Five to seven
Seven to ten
More than ten
Other……

48 How many of your relatives would you say you have a close relationship with?
None
One to three
Three to five
Five to seven
Seven to ten
More than ten
Other……

49. How often, if at all, do you engage in any of the following activities?

Go to the cinema/ theatre	*1 2 3 4 5 6 7 8 9*
Eat out of the house with friends/ family in a tavern	*1 2 3 4 5 6 7 8 9*
Eat out of the house as a guest in a home	*1 2 3 4 5 6 7 8 9*
Go to a coffee shop / ouzeri	*1 2 3 4 5 6 7 8 9*
Go to neighbours' or friends' homes for coffee?	*1 2 3 4 5 6 7 8 9*
Invite your friends to your home for coffee?	*1 2 3 4 5 6 7 8 9*
Come to Day Club?	*1 2 3 4 5 6 7 8 9*

Circle the chosen answer

1. Every day
2. Three times a week
3. Once a week
4. Twice a month
5. About once a month
6. Every few months
7. About once or twice a year
8. Less than once a year
9. Never

50 Do you go to church?

1. Yes If *Yes* go to Q**50A**
2. No If *No* go to Q**51**

50A How often do you go to church?

1. Once a week
2. Twice a month
3. About once a month
4. Every few months
5. About once or twice a year
6. Less than once a year
7. Never
8. Other…….

51 Loneliness scale 3 items and modified with the fourth 4 item

Loneliness	*Hardly ever or never* =1	*Some of the time=2*	*Often* =3
51.1 How often do you feel you lack companionship?			
51.2 How often do you feel left out or isolated from others?			
51.3 How often do you feel in tune with people around you?			
51.4 How often do you feel lonely?			

52

Satisfaction with life	7 Strongly agree	6 Agree	5 Slightly agree	4 Neither aggre or disagree	3 Slightly disagree	2 Disagree	1 Strongly disagree
52.1 In most ways, my life is close to my ideal							
52.2 The conditions of my life are excellent							
52.3 I am satisfied with my life							
52.4 So far, I have got the important things I want in life							
52.5 If I could live my life again, I would change almost nothing							

53 *Perceived old age*
How old do you *feel you are?.....(*GIVE A NUMBER)

54 The ladder.
Where would you place yourself on this ladder?
Think of those at the top of this ladder as the people who are the best off - They have the most education and money and the most respected jobs. Then think of those at the bottom as people with less education and money and the least respected jobs, or even with no job.
The higher up you are on this ladder, the closer you are to the people at the very top; the lower you are, the closer you are to the people at the very bottom.

Now, place a big mark 'X 'on the rung where you think you stand at this time in your life (relative to the other people living in Greece).

This is the last question. I would like to thank you very much for your time.

Thank you for your participation in this research project which will help gain knowledge about older adults' oral health and perceptions of health.

Researcher: Popie Damaskinos
Preventive and Community Dentistry, School of Dentistry, University of Athens, 2014
Professor: H. Koletsi Kounari

EPIDEMIOLOGICAL STUDY IN DAY CLUBS

GREEK VERSION_QUESTIONNAIRE

A1. Participant's Research ID NUMBER _____

A2. Date_____

A3. Interviewer _____

A4. Municipality_____

Οδηγίες πρός τον ερευνητή

Βεβαιωθείτε ότι οι συμμετέχοντες έχουν υπογράψει το έντυπο ενημερωμένης συγκατάθεσης.

Εξηγείστε και πάλι ότι μπορεί να σταματήσει ή να αποσυρθεί από τη μελέτη σε οποιαδήποτε στιγμή της συνέντευξης.

Δώστε μια σύντομη παρουσίαση του ερωτηματολογίου στο πρόσωπο που πρόκειται να απαντήσει. Πέστε:

1. Περίπου 35 λεπτά χρειάζονται για να συμπληρωθεί το ερωτηματολόγιο.
2. Όλες οι απαντήσεις σας είναι εμπιστευτικές. Σας ευχαριστούμε και πάλι για τη βοήθειά σας και τη συμμετοχή σας στην έρευνα.
3. Θα σας ρωτήσω και για τις προσωπικές σας απόψεις γιατί μας ενδιαφέρει η γνώμη σας. Για παράδειγμα, για τη διατροφή σας, για τις συνήθειες σας στη στοματική υγιεινή και πώς εσείς αξιολογείτε την υγεία σας. Αυτές οι ερωτήσεις δεν είναι έλεγχος γνώσεων.
4. Τώρα ρωτήστε: Είστε έτοιμος/η να αρχίσουμε;

Εάν η απάντηση είναι **ΝΑΙ** προχωρήστε στην επόμενη σελίδα. Εάν η απάντηση είναι **ΟΧΙ** μην προχωρήσετε στην επόμενη σελίδα.

Δώστε λίγο χρόνο να προετοιμαστεί και μετά ξαναρωτήστε την ερώτηση 4.

Θα ήθελα να αρχίσω με μερικές ερωτήσεις για εσάς και την οικογένειά σας.

1. Άνδρας = 1 Γυναίκα = 2

2. Τόπος γέννησης……
(εάν δεν γεννήθηκε στην Αθήνα): **2A:** Πότε ήρθατε στην Αθήνα;……

2B:Περιοχή κατοικίας……

2C. ΚΑΠΗ .....

2D. ΔΗΜΟΣ.....

3. Πόσων ετών είστε; ……..(αριθμός) **3^{A}** έτος γέννησης.....

4. Οικογενειακή κατάσταση
1= Ανύπανδρος/ Δεν παντρεύτηκα ποτέ
2= Παντρεμένος / Μία ή περισσότερες φορές
3= Διαζευγμένος/ Χωρισμένος σε διάσταση
4= Χήρος/α
5= Ζώ με σύντροφο

4A. Εκτός από εσάς; Πόσα άλλα άτομα μένουν μαζί σας στο σπίτι; ……
Κανένα, ένα, Δύο κλπ.

5. Έχετε παιδιά που ζουν; ΝΑΙ=1 ΟΧΙ=2
Εάν ΝΑΙ πήγαινε στην **5A**
Εάν ΟΧΙ πήγαινε στην **6**

5A. Πόσα (παιδιά ζώντα); .....Εάν ΝΑΙ πήγαινε στην **5B.**

5B. Έχετε εγγόνια; 1= ΝΑΙ 2 = ΟΧΙ

Εάν ΝΑΙ **5C** Δώστε αριθμό……

6. Πόσος είναι ο συνολικός αριθμός χρόνων σε σχολεία/ εκπαίδευση;

……

Έτοιμοι να δείξετε την κάρτα 1 εκπαίδευση

7. Ποιο είναι το υψηλότερο πιστοποιητικό ή απολυτήριο από σχολείο που έχετε αποκτήσει;

1.Δημοτικό δημόσιο
2.Δημοτικό ιδιωτικό
3.Γυμνάσιο δημόσιο
4.Γυμνάσιο ιδιωτικό
5.Γενικό ή Επαγγελματικό Λύκειο (ΤΕΛ, ΤΕΕ, Πολυκλαδικό ή 6 τάξιο Γυμνάσιο)
6.ΙΕΚ
7.Τεχνικό Σχολείο (όχι Κολλέγιο/ΤΕΙ)
95. Κανένα πτυχίο/ Ακόμη στο σχολείο
98. Τίποτα
99. Κάτι άλλο ή στο εξωτερικό .....

Εάν κάτι άλλο ή στο εξωτερικό προχώρησε στην **8**

8. Ποιό άλλο πτυχίο πήρατε; .....

Ποιό δίπλωμα/πτυχίο ανώτερης εκπαίδευσης πήρατε;

1. Διετής νοσηλευτική σχολή
2. ΤΕΙ
3. ΑΕΙ , Ανώτατες Στρατιωτικές
4. Μεταπτυχιακά MS c, MBA
5. Διδακτορικό
95. Ακόμη στην ανώτερη εκπαίδευση ή στην επαγγελματική κατάρτιση
96. Κανένα
97. Άλλο (ή εξωτερικό)

Εάν άλλο/ ή εξωτερικό προχώρησε στην **9**

9. Άλλο δίπλωμα ανώτερης εκπαίδευσης ή επαγγελματικής κατάρτισης;
……

10. Ο/ Η σύντροφός σας: Συνολικά χρόνια εκπαίδευσης……..
10Α. Ποιο είναι το υψηλότερο πιστοποιητικό ή απολυτήριο από σχολείο που έχει αποκτήσει;
.....

10Β. Πτυχίο ανώτερης εκπαίδευσης ή επαγγελματικής κατάρτισης.....

11. Κατοικία: Μένετε σε:

1 =Ιδιόκτητο σπίτι / Ιδιόκτητο διαμέρισμα
2 =Ενοικιαζόμενο σπίτι / Ενοικιαζόμενο διαμέρισμα
3 =Μαζί με άλλους- χωρίς να πληρώνω ενοίκιο
4 =Άλλο……
5 =Μένω μόνος/η κάποιος άλλος πληρώνει το ενοίκιο

12. Κατοικία: Το σπίτι σας έχει κεντρική θέρμανση;
1 =ΝΑΙ
2 =ΟΧΙ

Τώρα θα σας ρωτήσω σχετικά με το επάγγελμα/ και τη συνταξιοδότησή σας

13. Γενικά πώς θα περιγράφατε τη σημερινή σας κατάσταση;

1=Συνταξιούχος από ιδία εργασία
2= Εργαζόμενος ή Αυτοαπασχολούμενος (συμπεριλαμβάνεται η εργασία για οικογενειακή απασχόληση)
3= Άνεργος
4= Μόνιμα ασθενής ή ανάπηρος
5= Φροντίζοντας το σπίτι ή την οικογένεια/ Οικιακά
6=Άλλο (καθορίστε)……..
7= Λαμβάνω σύνταξη από το/τη σύζυγο
10 = Λαμβάνω σύνταξη ΟΓΑ

14. Ποιο έτος σταματήσατε να εργάζεσθε; .....

15. Πόσα χρόνια εργαζόσασταν στην τελευταία κύρια εργασία σας**;**
…… **Last main job ISCO-88**

16. Ποια η ονομασία της **εργασίας** σας; .....

17. Για ποιο λόγο συνταξιοδοτηθήκατε;.....

1= κανονικά , όριο ηλικίας
2= λόγοι υγείας (ιδίου)
3= λόγοι υγείας μέλους της οικογένειας
4= επιστροφή στην Ελλάδα
5= έκλεισε το εργοστάσιο
6= άλλοι λόγοι

18. Ποια ήταν/ είναι η τελευταία κύρια εργασία της/ του **συντρόφου** σας;……

18Α. Ποια ήταν η κύρια εργασία του **πατέρα** σας;.....

Το Προσωπικό μηνιαίο εισόδημα σας ανά μήνα είναι?……..

19. ***Προσωπικό εισόδημα*** *ανά μήνα (μετά από τους φόρους)*
Σύνολο σε ευρώ…….....

1 = Λιγώτερο από 600 euro
2 = Μεταξύ 600 euro και 799 euro
3 = Μεταξύ 800 euro και 999 euro
4 = 1000 euro και 1199 euro
5 = 1200 euro και 1500 euro
6 = 1501 euro και 2000 euro
7 = 2001 euro και 3000 euro
8 = Περισσότερα από 3001 euro
95 = άλλο……..

20. Πριν από τους φόρους ποιο ήταν το εισόδημά σας κατά το προηγούμενο έτος;
…… ……

Συνολικό εισόδημα στο νοικοκυριό

21. Σύνολο εισοδήματος στο νοικοκυριό –εάν υπάρχει άλλη σύνταξη- άλλοι πόροι- μηνιαίως, μετά από τους φόρους; …….....

1 = Λιγώτερο από 600 euro
2 = Μεταξύ 600 euro και 799 euro
3 = Μεταξύ 800 euro και 999 euro
4 =1000 euro και 1199 euro
5 =1200 euro και 1500 euro
6 =1501 euro και 2000 euro
7 = 2001euro και 3000 euro
8 = Περισσότερα από 3001 euro
95 = άλλο……..

Τώρα θα ήθελα να σας ρωτήσω μερικές ερωτήσεις για την υγεία σας. Πρώτα όμως θα κάνουμε μια γενική συζήτηση και έχω κάποιες ερωτήσεις για σάς. Ετοιμάστε το MMSE

22. *Mini mental state examination (Αυτή η ερώτηση θα απαντηθεί σε ξεχωριστό χαρτί γιατί θα χρειαστεί να κάνουν ένα σχέδιο). Έχετε το MMSE test έτοιμο.*

(5-6 λεπτά περίπου)

Απόψεις και υποκειμενική αντίληψη για την υγεία. *Για παράδειγμα θα* ήθελα να μάθω τη γνώμη σας για την υγεία σας και πώς βλέπετε τη συνταξιοδότηση

23. Γενική Υγεία . Θα λέγατε ότι η υγεία σας είναι
5=Άριστη
4=Πολύ καλή
3=Καλή
2=Μέτρια
1=Κακή

24. Η συνταξιοδότηση ήταν για εσάς

1=Ανακούφιση
2=Ανησυχία
3=Ούτε ανακούφιση ούτε ανησυχία
4=Και τα δύο. Και ανακούφιση και ανησυχία

25. Κάποιοι άνθρωποι υποφέρουν από χρόνια ή μακράς διάρκειας προβλήματα υγείας. Με τον όρο μακράς διάρκειας εννοούμε ότι ταλαιπωρεί για καιρό ή είναι πιθανό να προσβάλλει για καιρό.
Εσείς, έχετε κάποιο μακράς διάρκειας πρόβλημα υγείας, ασθένεια, ανικανότητα, ή αναπηρία;
1 =ΝΑΙ Εάν ΝΑΙ προχωρήστε στην **26**
2 =ΟΧΙ Εάν ΟΧΙ προχωρήστε στην **27**

26. Αυτή η ασθένεια, σε ποιο βαθμό/ έκταση σας περιόρισε τις καθημερινές δραστηριότητες σας ή αυτά που θέλατε να κάνετε;
1 =ΝΑΙ σοβαρά περιορισμένες
2 =ΟΧΙ περιορισμένες δραστηριότητες

27. Σας παρακαλώ να κοιτάξετε αυτή την κάρτα3. Πέστε μου εάν ο γιατρός σας είπε ότι έχετε κάποια ασθένεια από αυτές;

1 =Έμφραγμα, καρδιακή προσβολή, θρόμβωση στεφανιαίων ή άλλη καρδιακή νόσος όπως χρόνια καρδιακή ανεπάρκεια
2 =Υψηλή αρτηριακή πίεση αίματος ή Υπέρταση
3 =Υψηλά επίπεδα χοληστερόλης αίματος
4 =Εγκεφαλικό επεισόδιο ή άλλη νόσος των αγγείων του εγκεφάλου
5 =Θυρεοειδή
6 =Σακχαρώδης διαβήτης
7 =Χρόνια πνευμονική νόσος, χρόνια βρογχίτιδα, ή εμφύσημα

8 =Άσθμα
9 =Αρθρίτιδα (συμπεριλαμβανομένης της οστεοαρθρίτιδας)ή 'ρευματικά'
10 =Οστεοπόρωση
11 =Καρκίνος ή νεόπλασμα, συμπεριλαμβανομένης της λευχαιμίας και του λεμφώματος - ΑΛΛΑ εξαιρώντας μικρά νεοπλάσματα δέρματος
12 =Έλκος στομάχου ή δωδεκαδακτύλου ή πεπτικό έλκος
13 =Νόσος του Πάρκινσον
14 =Καταρράκτης
15 =Κάταγμα ισχίου ή μηρού
96 = Καμία
97 =άλλη ή άλλες ασθένειες που δεν αναφέρθηκαν

28. Ποιες άλλες παθήσεις έχετε; .....

Η επόμενη ερώτηση είναι σχετική με τα φάρμακα που λαμβάνετε.

29. Αυτή την περίοδο παίρνετε **φάρμακα;**
1 =ΝΑΙ
2 =ΟΧΙ

Κοιτάξτε αυτή την κάρτα 5 με τα φάρμακα.

29Α. Ποια παίρνετε εσείς;
1. Αντιπηκτικά
2. Ασπιρίνη
3. Φάρμακα για υψηλή χοληστερόλη αίματος
4. Φάρμακα για αρτηριακή υπέρταση
5. Φάρμακα για στεφανιαία νόσο ή νόσο των αγγείων του εγκεφάλου
6. Φάρμακα για άλλη καρδιοπάθεια
7. Φάρμακα για άσθμα
8. Φάρμακα για σακχαρώδη διαβήτη
9. Θυρεοειδή
10. Φάρμακα για (παυσίπονα) για πόνο στις αρθρώσεις ή αρθρίτιδα
11. Φάρμακα παυσίπονα για άλλο πόνο (π.χ. πονοκέφαλο, πόνο στη μέση, κλπ.)
12. Φάρμακα για πρόβλημα ύπνου
13. Φάρμακα για άγχος και κατάθλιψη
14. Φάρμακα για οστεοπόρωση
15. Άλλα μη ορμονικά φάρμακα για οστεοπόρωση
16. Φάρμακα για έλκος στομάχου ή δωδεκαδακτύλου
17. Φάρμακα για χρόνια βρογχίτιδα

96. Κανένα
97. Άλλα φάρμακα που δεν αναφέρθηκαν εδώ

29Β. Ποια άλλα φάρμακα;……

29C. Πόσων ειδών φάρμακα παίρνετε την εβδομάδα **.....**
Κανένα
1-2
3-5
Περισσότερα από 5

30. Νοσηλεία σε νοσοκομεία
Κατά τη διάρκεια των 12 τελευταίων μηνών χρειάστηκε να νοσηλευτείτε σε νοσοκομείο;1=ΝΑΙ 2= ΟΧΙ ΕΑΝ ΝΑΙ ΓΙΑ ΠΟΣΕΣ ΜΕΡΕΣ ΚΑΙ ΓΙΑ ΠΟΙΟ ΛΟΓΟ;
30Α. Ημέρες…….
30Β. Λόγος……..

31. Τώρα θα σας ρωτήσω σχετικά με τη **στοματική σας υγεία**. Έχετε φυσικά δόντια;
1=ΝΑΙ 2=ΟΧΙ

31 Α. Χρησιμοποιείτε οδοντοστοιχίες; 1=ΝΑΙ 2=ΟΧΙ

31 Β. Πώς θα χαρακτηρίζατε την κατάσταση στο στόμα σας ως προς τα δόντια;

1 =Δεν έχω φυσικά δόντια. Φορώ οδοντοστοιχίες
2 =Έχω και φυσικά δόντια και οδοντοστοιχίες
3 =Έχω δικά μου μόνο δόντια
4 =Δεν έχω ούτε δόντια δικά μου ούτε φορώ οδοντοστοιχίες

32 Α.	**32 Β.**
Έχετε δικά σας δόντια ΝΑΙ ΟΧΙ	*Έχετε δικά σας δόντια ΝΑΙ ΟΧΙ*
Νωδός στην άνω γνάθο	*Νωδός στην κάτω γνάθο*
1=ΝΑΙ	1=ΝΑΙ
2=ΟΧΙ	2=ΟΧΙ

33. Πόσο συχνά καθαρίζετε τα δόντια ή τις οδοντοστοιχίες σας;
1= Ποτέ
2=Λιγώτερο από μια φορά την ημέρα
3= Μια φορά την ημέρα
4=Δύο φορές την ημέρα
5=Περισσότερο από δυο φορές την ημέρα
6= Άλλο

34. Πόσος καιρός πέρασε από την τελευταία επίσκεψη στον οδοντίατρο;
1=Λιγώτερο από 12 μήνες
2=1-2 χρόνια

3=3–5 χρόνια
4=Περισσότερα από 5 χρόνια
5=ποτέ/ Δεν έχω πάει ποτέ σε οδοντίατρο

35. Συνήθεις λόγοι για τους οποίους επισκέπτεσθε οδοντίατρο είναι
1=Τακτικό έλεγχο ρουτίνας
2=Περιστασιακά
3= Μόνο όταν πονάω ή έχω κάποιο πρόβλημα

36. Οδοντοστοιχίες/ Κατά τη διάρκεια των τελευταίων 12 μηνών, είχατε κάποιο πρόβλημα με τα δόντια ή την/ τις οδοντοστοιχίες σας;
1 =ΝΑΙ 2 =ΟΧΙ

37. Οδοντοστοματολογική υγεία γενικά. Ούλα, δόντια και όλο το στόμα.
Θα λέγατε ότι η υγεία του στόματος σας είναι

5 =Άριστη
4 =Πολύ καλή
3 =Καλή
2 =Μέτρια
1 =Κακή

38 OIDP
Ποιότητα ζωής ως πρός την στοματική υγεία- Συχνότητα και βαρύτητα επίδρασης που επηρεάζει την καθημερινή ζωή (Ρωτήστε για τους τελευταίους 6 μήνες).

Δραστη-ριότητα	Πρόβλημα / δυσκολία με τη δραστη-ριότητα **1=ΝΑΙ 2=ΟΧΙ**	Πρόβλημα / δυσκολία με τη δραστη-ριότητα Σε κανονική συνεχή βάση	Πρόβλημα / δυσκολία με τη δραστη-ριότητα Μόνο για λίγο χρονικό διάστημα	C Σε κανο-νική / συνεχή βάση Πόσο συχνά?	D Μόνο για λίγο χρονικό διά-στημα	E Επίδραση αυτής της δυσκολίας στην καθημε-ρινή ζωή
Να τρώω	1 2	1→C	2→D			
Να μιλώ	1 2	1→C	2→D			
Να καθαρίζω τα δόντια	1 2	1→C	2→D			
Να κάνω καθημε-	1 2	1→C	2→D			

ρινές δραστη-ριότητες						
Να βγαίνω έξω	1 2	1→C	2→D			
Να χαλαρώνω	1 2	1→C	2→D			
Να κοιμάμαι	1 2	1→C	2→D			
Να χαμογελώ	1 2	1→C	2→D			
Να είναι σε συναισθη-ματική ισορροπία	1 2	1→C	2→D			
Να έχω κοινωνικές επαφές	1 2	1→C	2→D			

Εάν απαντήσει ΝΑΙ, θα πρέπει να γίνουν οι ερωτήσεις από το ερωτηματολόγιο OIDP ξεχωριστά και αναλυτικά.

Πέστε μου εάν γυμνάζεσθε. Για παράδειγμα, περπατάτε, κάνετε ποδήλατο; Πάτε για ψώνια; Στο ΚΑΠΗ έρχεστε πεζός/ πεζή;

39. Δηλαδή Περπατάτε για 20 λεπτά και πόσο συχνά?

1=Καθημερινά
2=Περισσότερο από 1 φορά τη βδομάδα
3=Μια φορά τη βδομάδα
4=1-3 φορές το μήνα
5=Σχεδόν ποτέ ή ποτέ
6=Άλλο.....

Θα σας ρωτήσω τώρα σχετικά με τη **διατροφή** σας

40 Μπορείτε να μου πείτε εάν **φάγατε χτες από τις τροφές** που θα σας διαβάσω σε λίγο και σε σχέση με τη δοσολογία που αναφέρω.
Διαβάστε τον κατάλογο όλο και μετά να απαντήσει. Χρησιμοποιείστε το ΜΗΔΕΝ για να δείξετε ότι δεν έφαγε το συγκεκριμένο φαγητό. Βάλτε σε κύκλο τον αριθμό αριστερά για να δείξετε ότι έφαγε το συγκεκριμένο φαγητό χτες και γράψτε με αριθμό στα αριστερά για ποσότητα εάν έφαγε περισσότερο από μια μερίδα.

1. Σαλάτα (μέτριο μπολ).
2. Εκτός από πατάτες, πόσες κουταλιές μεγάλες φάγατε χτες από σαλατικά και ωμά λαχανικά. Πχ, φασόλια, χόρτα, μαρούλι, καρότο (είτε ωμά, είτε ψημένα είτε σε κονσέρβα)
3. Πόσες κουταλιές από μαγειρεμένα όσπρια (φασόλια, φακές, αμπελοφάσουλα)

4. Πόσες κουταλιές από άλλα φαγητά με χόρτα πχ χορτόσουπα, λαζάνια με χόρτα, ψαρόσουπα ή κοτόσουπα με χορταρικά κλπ.

41 Μπορείτε να μου πείτε για χτες, εάν φάγατε και εάν ναι πόσες μερίδες από τις τροφές που θα σας διαβάσω σε λίγο και σε σχέση με τη δοσολογία που αναφέρω.

10. Μιά χούφτα πολύ μικρά φρούτα, πχ σταφύλι, φράουλες, κεράσια.....
11. Μικρά φρούτα πχ μανταρίνια, βερύκοκα.....
12. Μεσαίου μεγέθους φρούτα μήλο, μπανάνα, πορτοκάλι.....
13. ½ από μεγάλο φρούτο πχ γκέι φρουτ.....
14. Μέτριο κομμάτι από πολύ μεγάλο φρούτο πχ καρπούζι.....
15. Πόσες κουταλιές από κονσέρβα φρούτου ή κατεψυγμένου φρούτου.....
16. Πόσες κουταλιές αποξηραμένα φρούτα πχ σταφίδες, βερίκοκα.....
17. Πόσες κουταλιές από άλλα εδέσματα που γίνονται με φρούτα πχ φρουτοσαλάτα ή τάρτα φρούτου.....
18. Μικρό ποτήρι από χυμό φρούτου.....

Θα σας κάνω μερικές ερωτήσεις για τη ξηροστομία

42 XEROSTOMIA-Q1

Αισθάνεσθε καθόλου ξηρότητα στο στόμα σας κατά τους τελευταίους 6 μήνες;

1 =ΝΑΙ → ΕΑΝ ΝΑΙ: **42A**
2 =ΟΧΙ → ΕΑΝ ΟΧΙ: **43**

42 XEROSTOMIA-Q2 *ΑΙΣΘΑΝΟΜΑΙ ΞΗΡΌΤΗΤΑ*

1 = Ναι ξηρότητα στο στόμα μερικές φορές όταν τρώω φαγητό
2 = Ναι κατά τη διάρκεια της νύχτας
3 = Ναι όταν ξυπνώ το πρωί
4 = Ναι σε άλλες περιπτώσεις κατά τη διάρκεια της ημέρας
9 = δεν μπορώ να πω/ δεν ξέρω

42 B XEROSTOMIA-Q3

ΝΑΙ Η ξηρότητα στο στόμα σας προκαλεί κάποια δυσκολία

1 =Τη μάσηση της τροφής
2 =Την κατάποση
3 =Στη λήψη φαρμάκων

4 = Καμία δυσκολία
5 = Κατά την ομιλία
9 = Δεν μπορώ να πω/ δεν ξέρω

42 C XEROSTOMIA-Q4 Για να ανακουφιστείτε από την ξηροστομία έχετε ποτέ κάνει κάτι από αυτά;

1 =Μάσηση τσίχλας
2 =Μάσηση καραμέλας, μέντας
3 =Κατάποση μικρής γουλιάς υγρού, νερού κλπ. για να καταπίνετε
4 =Λαμβάνετε κάποιο σκεύασμα ή φάρμακο για τη ξηροστομία

Τώρα θα ήθελα να κάνω μερικές ερωτήσεις για την οικογένεια και τους φίλους σας

43. Έχετε σύζυγο ή σύντροφο που μένετε μαζί;

1 =ΝΑΙ ΕΑΝ ΝΑΙ προχώρησε στην **44**
2 =ΟΧΙ ΕΑΝ ΟΧΙ προχώρησε στην **45**

44. Πόσο στενή είναι η σχέση σας με τον/την σύντροφό σας

1 =Πολύ στενή
2 =Σχετικά στενή
3 =Όχι πολύ στενή
4 =Καθόλου στενή

ΕΛΕΓΞΕ από την 1η σελίδα εάν έχει ζώντα παιδιά και ΕΑΝ ΝΑΙ προχώρησε στην 45.

45. Πόσο συχνά βλέπετε/ συναντάται τα παιδιά σας ή μιλάτε στο τηλέφωνο με τα παιδιά τους συγγενείς και τους φίλους σας;

Παιδιά

45.1-1 Βλέπω ή συναντώ		45.1-2 Μιλώ στο τηλέφωνο	
Τρείς ή περισσότερες φορές/ βδομάδα	1	Τρείς ή περισσότερες φορές/ βδομάδα	1
Μία ή δύο φορές/ βδομάδα	2	Μία ή δύο φορές/ βδομάδα	2
Μία ή δύο φορές το μήνα	3	Μία ή δύο φορές το μήνα	3
Κάθε μερικούς μήνες	4	Κάθε μερικούς μήνες	4
Μία ή δύο φορές το χρόνο	5	Μία ή δύο φορές το χρόνο	5
Λιγότερο από μία φορά το χρόνο	6	Λιγότερο από μία φορά το χρόνο	6

Συγγενείς (εκτός από παιδιά)

45.2-1Βλέπω ή συναντώ		45.2-2 Μιλώ στο τηλέφωνο	
Τρείς ή περισσότερες φορές/ βδομάδα	1	Τρείς ή περισσότερες φορές/ βδομάδα	1
Μία ή δύο φορές/ βδομάδα	2	Μία ή δύο φορές/ βδομάδα	2
Μία ή δύο φορές το μήνα	3	Μία ή δύο φορές το μήνα	3
Κάθε μερικούς μήνες	4	Κάθε μερικούς μήνες	4
Μία ή δύο φορές το χρόνο	5	Μία ή δύο φορές το χρόνο	5
Λιγότερο από μία φορά το χρόνο	6	Λιγότερο από μία φορά το χρόνο	6

Φίλοι

45.3-1 Βλέπω ή συναντώ		45.3-2 Μιλώ στο τηλέφωνο	
Τρείς ή περισσότερες φορές/ βδομάδα	1	Τρείς ή περισσότερες φορές/ βδομάδα	1
Μία ή δύο φορές/ βδομάδα	2	Μία ή δύο φορές/ βδομάδα	2
Μία ή δύο φορές το μήνα	3	Μία ή δύο φορές το μήνα	3
Κάθε μερικούς μήνες	4	Κάθε μερικούς μήνες	4
Μία ή δύο φορές το χρόνο	5	Μία ή δύο φορές το χρόνο	5
Λιγότερο από μία φορά το χρόνο	6	Λιγότερο από μία φορά το χρόνο	6

46. Με πόσα από τα παιδιά σας θα λέγατε ότι έχετε **στενή σχέση**;.....
Κανένα
1-3
3-5
5-7
7-10
Πλέον των 10
Άλλο……

47. Με πόσους από τους φίλους σας θα λέγατε ότι έχετε **στενή σχέση**;.....
Κανένα
1-3
3-5
5-7
7-10
Περισσόρεροι από 10
Άλλο……

48. Με πόσους από τους συγγενείς σας θα λέγατε ότι έχετε **στενή σχέση**;.....
Κανένα
1-3
3-5

5-7
7-10
Περισσόρεροι από 10
Άλλο……

49. Πόσο συχνά κάνετε κάποια από αυτές τις δραστηριότητες;

Πηγαίνω σινεμά/ θέατρο	1 2 3 4 5 6 7 8 9
Τρώω έξω από το σπίτι με φίλους / οικογένεια σε ταβέρνα	1 2 3 4 5 6 7 8 9
Τρώω έξω από το σπίτι σαν καλεσμένος σε άλλο σπίτι	1 2 3 4 5 6 7 8 9
Πηγαίνω σε καφέ ή ουζερί	1 2 3 4 5 6 7 8 9
Πηγαίνω σε γείτονες ή φίλους για καφέ	1 2 3 4 5 6 7 8 9
Προσκαλώ φίλους για καφέ στο σπίτι	1 2 3 4 5 6 7 8 9
Πηγαίνω σε ΚΑΠΗ	1 2 3 4 5 6 7 8 9

ΕΠΕΞΗΓΗΣΗ ΣΥΧΝΟΤΗΤΑΣ ΒΑΛΤΕ ΣΕ ΚΥΚΛΟ ΤΟΝ ΑΡΙΘΜΟ

1 =Καθημερινά
2 =2-3 φορές την εβδομάδα
3 =Μία φορά την εβδομάδα
4 =Δύο φορές την εβδομάδα
5 =Περίπου μια φορά την εβδομάδα
6 =Μια- δυο φορές το μήνα
7 =Μία ή δύο φορές το χρόνο
8 =Λιγότερο από μία φορά το χρόνο

50. Πηγαίνετε στην εκκλησία;

1=ΝΑΙ Εάν ΝΑΙ προχώρησε στην ερώτηση **50Α**
2=ΟΧΙ Εάν ΟΧΙ προχώρησε στην ερώτηση **51**

50Α. Πόσο συχνά πηγαίνετε στην εκκλησία;

1= Μία φορά την εβδομάδα
2= Δυο φορές το μήνα
3= Περίπου μια φορά το μήνα
4= Μία φορά κάθε 2-3 μήνες
5= Μία ή δύο φορές το χρόνο
6= Λιγότερο από μία φορά το χρόνο
7= Ποτέ
8= Άλλο…….

51. Πόσο συχνά θα λέγατε ότι νοιώθετε (Ερωτηματολόγια για Μοναξιά)

	Σχεδόν ποτέ / Ποτέ =1	Μερικές φορές =2	Συχνά=3
Q1 έλλειψη συντροφιάς			
Q2 αποκλεισμένος/ αποκομμένος, απομονωμένος			
Q3 δεν ταιριάζετε με τους γύρω σας			
Q4 μοναξιά			

52. *Θα σας διαβάσω μερικές φράσεις και σας παρακαλώ να μου πείτε εάν συμφωνείτε και πόσο πολύ ή πόσο λίγο συμφωνείτε* Ικανοποίηση από τη ζωή (SWL)

Q1: Κατά το πλείστων η ζωή μου είναι σχεδόν ιδανική	
Q2: Οι συνθήκες ζωής μου είναι πολύ καλές	
Q3:Είμαι ικανοποιημένος/ η από τη ζωή μου	
Q4:Έως τώρα έχω όλα τα σημαντικά για τη ζωή μου	
Q5:Εάν μπορούσα να ξαναζήσω τη ζωή μου δεν θα άλλαζα σχεδόν τίποτα	

Συμφωνώ απόλυτα=7
Συμφωνώ=6
Συμφωνώ λίγο=5
Ούτε συμφωνώ ούτε διαφωνώ=4
Διαφωνώ λίγο=3
Διαφωνώ=2
Διαφωνώ απόλυτα=1

53: *Τώρα θα ήθελα να σκεφθείτε και να μου πείτε ΟΧΙ πόσων ετών είστε αλλά* Πόσων ετών αισθάνεσθε; .....(δώστε αριθμό)

Φτάσαμε στην τελευταία ερώτηση και θέλω να σας ευχαριστήσω για τη συμμετοχή σας στην έρευνα.

Τώρα, θα σας δείξω ένα σχήμα .....

54. Θα σας δείξω ένα σχήμα με μια σκάλα. Ας πούμε ότι είναι η σκάλα της κοινωνίας μας. Σκεφτείτε ότι στην κορυφή και στα πάνω σκαλοπάτια είναι αυτοί που είναι καλύτερα κοινωνικά και οικονομικά. Έχουν περισσότερη μόρφωση και χρήματα, καθώς και καλύτερη δουλειά. Μετά σκεφθείτε ότι στα κάτω σκαλοπάτια είναι αυτοί

που έχουν λιγότερη μόρφωση και χρήματα καθώς και όχι τόσο καλές δουλειές ή μπορεί να είναι άνεργοι.

Δηλαδή, όσο πιο πάνω στα σκαλοπάτια, τόσο πιο κοντά σε αυτούς που είναι στην κορυφή. Όσο πιο κάτω στα σκαλοπάτια τόσο πιο κοντά σε αυτούς που βρίσκονται στα χαμηλά σκαλοπάτια.

Σκεφθείτε και βάλτε ένα μεγάλο χ στο σκαλοπάτι που νομίζετε ότι βρίσκεστε εσείς σήμερα.

Αυτή είναι η τελευταία ερώτηση και σας ευχαριστώ πολύ για τη συμμετοχή σας στην έρευνα

Ερευνήτρια: Πόπη Δαμασκηνού
Καθηγήτρια: Χ. Κωλέτση-Κουνάρη
Εργαστήριο Προληπτικής και Κοινωνικής Οδοντιατρικής, Οδοντιατρική Σχολή, Πανεπιστήμιο Αθηνών.

Dental examination coding

Dental Status

Numbering of teeth was 1, 2, 3, 4, 5, 6, 7, and 8, starting from the media line for each quartile; each quartile will have a numbers 1, 2, 3, and 4 and this is 1 for upper right, 2 for upper left, 3 for lower left, and 4 for lower right quartile. Thus, the numbering of teeth will be recorded as seen in the mouth and according to FDI.

Upper right 18 17 16 15 14 13 12 11 21 22 23 24 25 26 27 28 *Upper left*

Lower right 48 47 46 45 44 43 42 41 31 32 33 34 35 36 37 38 *Lower left*

The codes used are according to the Oral Health Surveys Basic Method of WHO (1997) as presented on Table APP.4-1 below, with some modifications suitable for the present study.

Table APP.4-1: Codes Used for Recording Dental Status

Crown	Root	Condition Status
0	0	Sound
1	1	Decayed
2	2	Filled, with decay
3	3	Filled, no decay
4	-	Missing for any reason
5	-	Remnant roots
6	-	Fissure sealants
7	7	Bridge abutment, special crown or veneer/ implant
8	8	Unerupted tooth crown/ root
88	88	Trauma/ fracture
9	9	Not recorded

For recording each tooth (crown and root), always start from the right side of the patient area tooth 18, when at midline, *say midline,* so the person who is recording may check his/her records. Then continue to the next area, which is tooth 21 and move towards tooth 28. Next,

move to area tooth 38 calling to the clerk that you have moved to the lower jaw. Continue to 31, and *say midline,* so that the clerk can follow you. Continue to 41 and then until the last tooth, 48. Right (Upper right →Upper left → Lower left→ Lower right).

Sound Crown (0)

A crown is recorded as 'sound' when there is no evidence of treated or untreated clinical caries. A crown that has one of the following defects should be coded as sound if no other conditions indicating caries are present: white or chalky spots, discolored or rough spots that are not soft to touch with metal CPI probe, stained pits or fissures in the enamel that do not have visual signs of undermined enamel or softening of the floor or walls detectable with a PCI probe, dark, shiny, hard, pitted areas of enamel in a tooth showing signs of moderate to severe fluorosis, lesions that, on the basis of their distribution, history, visual, or tactual examination, appear to be due to abrasion. The code for the sound crown in permanent teeth is 0.

Sound Root (0)

A root is recorded as sound when it is exposed and shows no evidence of treated or untreated clinical caries. The code for a sound root is 0 (but the unexposed roots are coded 8).

Decayed Crown (1)

Caries are recorded as present when a lesion in a pit or fissure, or on a smooth tooth surface, has an obvious cavity, impaired enamel, or a detectably softened floor or wall. A tooth with a temporary filling, or one which is sealed, code 6, (F) when also decayed should be recorded as decayed crown. In cases where the crown has been ruined by caries and only the root is present then the caries is judged to have generated on the crown. In this case, the score is as crown caries only. The use of the CPI probe may be necessary to prove the existence of the caries on the occlusal, buccal, and lingual surfaces. Where any doubt exists, caries should not be recorded as present. When in doubt always score low.

Decayed Root (1)

Caries are recorded as present when a lesion feels soft or leathery to probing with the WHO CPI probe. If the root is separated from the crown, thus requiring a discrete treatment, then it should be recorded as root caries. When the lesion affects both crown and root, then an estimation of the origin of the carious lesion should be made, as only one record should be made. If it is difficult to identify the origin of the lesion leading to a dilemma then both the crown and the root should be recorded as decayed.

Filled Crown, With Decay (2)

The crown of the tooth is accounted as filled with caries when one or more restorations are there and one or more areas have a carious lesion regardless of the type of caries (primary and secondary caries). The carious lesion may be in physical relationship with the restoration(s).

Filled Root, With Decay (2)

The root is judged as filled, with decay, when there are co-existing restoration(s) and caries lesion(s). Again, no demarcation is made between the types of caries (primary or secondary).

When the fillings affect both the crown and the root, assessment of the site of origin is more difficult. For any restoration involving both the crown and the root with secondary decay, then evaluate the most likely site of the primary caries and then recorded it as filled, with caries.

Filled Crown, With no Decay (3)

A crown is recorded as filled, without decay, when there are one or more permanent restorations without any presence of caries. If the tooth has been crowned because of previous decay, then it is reported in this classification. In case the tooth was crowned not for caries but any other reason (i.e., bridge abutment) then is coded as 7.

Filled Root, With no Decay (3)

A root is recorded as filled, without decay, when one or more permanent restoration(s) are present and there is a lack of carious lesions. In cases that restoration involves both the crown and the root, the most possible position of the primary carious lesion is recorded as filled. If impossible to assess the place of origin, both the crown and the root should be reported as filled.

Missing Tooth for Any Reason (4)

This code is used to record any missing teeth due to caries lesions, trauma, orthodontics, periodontal disease, if it is congenitally absent, etc. Teeth that have been extracted for any reason are coded 4.

Remnant Roots (5)

If there are any remnants of roots after a tooth has been extracted for any reason, it is coded 5.

Fissure Sealant (6): The code 6 is used to indicate a fissure sealant placed on the occlusal surface. If there is a sealant and a carious lesion exists, then is coded as 1. Though this code is usually used for children's recordings nowadays, sealants are used for older adults too, for caries prevention.

Bridge Abutment, Special Crown or Veneer (7)

The use of this code indicates that a tooth consists a part of a fixed bridge (i.e., it is a bridge abutment). The same code is used to indicate crowns placed for other reasons than caries and for veneers or laminates replacing or covering the labial surface of a tooth with no evidence of decay or restoration. Note: Teeth that are replaced by bridge pontics are coded 4 under coronal status, while root status is scored 9.

Implants are indicated by the same code as for bridge abutment, special crown, or veneer using code 7.

Unerupted Crown (8)

This ranking is only for permanent teeth and for a space in the mouth with an unerupted permanent tooth but without a primary tooth. Those teeth that are scored as unerupted are excluded from all computations pertaining to dental caries. This class does not include congenitally missing teeth or teeth lost as a result of trauma, etc., as these are coded 5.

Soft Tissue Lesions

For recording soft tissue pathology, it is necessary to conduct a brief but careful examination of the lips and perioral tissues and then continue for the intra-oral examination. The examination must include the areas of floor mouth, the upper and lower lips including the mucosal surface of the lips, the buccal sulci while the mouth is half closed, the cheeks while gently retracted, and finally the soft palate, which is clearly seen directly.

Soft tissue lesions: angular cheilitis, denture stomatitis I, denture stomatitis II denture stomatitis III, denture hyperplasia, ulcer associated with denture trauma. More than one code can be recorded, as these diseases are not reciprocally restricted. The code to be used is 1 –Yes and 0 – No.

The different ranking of denture stomatitis is based on a WHO classification and was used by NDNS (1998):

I	Patsy or localized redness over denture bearing area
II	Redness over full denture bearing area
III	Multiple small nodular or granular lesions covering denture bearing area with associated inflammation

Angular Cheilitis: Check commeasures for inflammation with or without cracking. You must score as present for either localization.

Denture Hyperplasia: Check oral mucosa for denture hyperplasia. This is easily detected, as it is related to ill-fitting dentures and usually appears as firm enlargement.

Ulceration (Aphthous, herpetic, traumatic): Check oral mucosa and the tongue that clinically is like aphthous or herpetic or traumatic ulceration. You should score as present if any of this is present.

Acute Necrotizing Gingivitis: Acute necrotizing gingivitis is an easily diagnosed condition because of clinical icon appearance; gums are inflamed and there is a characteristic white trace around gums. If you see this contrition in the mouth, check for enlarged and tender lymph nodes in the neck.

Candidiasis: Candidiasis or Thrush; Check oral mucosa for any infection brought on because of fungal (moniliasis or thrush), and be sure to record this white lesion.

Osteitis/ Osteonecrosis: Record any lesion that is related to exposed bone. Non vital bone appearance is white or yellow in color.

Abscess: Record any abscess seen in the mouth and oral mucosa. Check for swollen areas either because of a decayed tooth/root canal treatment, gingival inflammation, or a post extraction abscess. If any of this is present score *1.*

Mobility: The examiner will detect any movement of the teeth. Even very small movements can be detected fairly easily. Increased mobility should be coded where there is unequivocally increased mobility. One mm mobility is quite a lot, and this will correspond to very mobile teeth.

The mobility of the teeth was recorded according to the modified Miller's index, as used in NDNS (1998). If in doubt, score low.

No increased mobility=0
Increased mobility but less than 1mm movement horizontally=1
Gross movement, > mm or vertical / rotational movement =2
Unscorable=9

To detect movement of the teeth, place your index finger at one side of the tooth while a rigid instrument (e.g., mirror handle) is applied to the other, then wiggle the tooth very gently.

Occlusal Contacts- Posterior Occlusal Contacts: Start from the midline and move backward to record the occlusal contacts. In case the individual to be examined has natural teeth in both arches, then an examination for recording pairs in contact will take place. The instructions to the person to be examined are to swallow and keep the teeth firmly closed.

While checking the contacts that have a natural stop with the opposite teeth and arch, the examiner should score them as present (1) or absent (0). Thus, the recorder should apply this on the chart. If in doubt, score low and in this case the low score means contact is present =1. When there are fixed bridges they are considered as steady and permanent occlusal units as a natural tooth. Natural posterior teeth that are in place but not functional as they lack contact and pairing are counted and recorded.

Denture Wearing: Check if the person has full dentures in the upper jaw, score 1 for Yes or 0 for No

Check if the person has full dentures in lower jaw, and score 1 for Yes or 0 for No

Denture Hygiene: Denture hygiene will be examined and scored, as this is important for people with no teeth and is also an indicator for oral behaviour. The scores are: good, moderate, and poor. Denture hygiene will be recorded by examining and recording each denture for its cleanliness. This examination should be made when the person removes the dentures for the oral lesions' examination. How to record denture hygiene: If the surface against the mucosa is clean or mostly clean, score as good=1.If dental plaque, calculus, or food remnants cover more than one third of the surface, score as moderate=2. If dental plaque, calculus, or food remnants cover more than two third of the surface, score as poor=3.

Plaque Index

Criteria for Plaque Index System (Silness and Loe, 1964)

Criteria for Plaque Index System	
0	No plaque in gingival area
1	Film or plaque attached to the free gingival margin and the
2	Modest gathering of soft deposits within the gingival pocket, or the tooth and gingival margin which is exposed and visible
3	Plentifulness of soft matter within the gingival pocket and/or on the tooth and gingival margin

OHI-S

The average individual debris and calculus scores are combined to obtain simplified Oral Hygiene Index

Criteria for classifying calculus (CI)

Scores	Criteria
0	No calculus present
1	Supragingival calculus covering not more than third of the exposed tooth surface.
2	Supragingival calculus covering more than one third but not more than two thirds of the exposed tooth surface or the presence of individual flecks of subgingival calculus around the cervical portion of the tooth or both.
3	Supragingival calculus covering more than two third of the exposed tooth surface or a continuous heavy band of subgingival calculus around the cervical portion of the tooth or both.

Criteria for classifying debris (DI)

Scores	Criteria
0	No debris or stain present
1	Soft debris covering not more than one third of the tooth surface, or presence of extrinsic stains without other debris regardless of surface area covered
2	Soft debris covering more than one third, but not more than two thirds, of the exposed tooth surface.
3	Soft debris covering more than two thirds of the exposed tooth

Municipality..... KAPI..... Postcode.....

Year Month	Day	Identification number	Examiner	Original/duplicate

GENERAL INFORMATION

DAY CENTER .....

Date of birth (Year Month)

Age in years

Sex (M = 1, F = 2)

OTHER DATA

.....

.....

CONTRAINDICATION TO EXAMINATION

Reason.....

.....

0 = No
1 = Yes

CLINICAL ASSESSMENT

EXTRA-ORAL EXAMINATION

0 = Normal extra-oral appearance
1 = Ulceration, sores, erosions, fissures (head, neck, limbs)
2 = Ulceration, sores, erosions, fissures (nose, cheeks, chin)
3 = Ulceration, sores, erosions, fissures (commissures)
4 = Ulceration, sores, erosions, fissures (vermilion border)
5 = Cancrum oris
6 = Abnormalities of upper and lower lips
7 = Enlarged lymph nodes (head, neck)
8 = Other swellings of face and jaws
9 = Not recorded

TEMPOROMANDIBULAR JOINT ASSESSMENT

SYMPTOMS	SIGNS	
0 = No	0 = No	Clicking
1 = Yes	1 = Yes	Tenderness (on pulpation)
9 = Not recorded	9 = Not recorded	Reduced jaw mobility (< 30 mm opening)

ORAL MUCOSA

CONDITION
0 = No abnormal condition
1 = Malignant tumour (oral cancer)
2 = Leukoplakia
3 = Lichen planus
4 = Ulceration (aphthous, herpetic, traumatic)
5 = Acute necrotizing gingivitis
6 = Candidiasis
7 = Abscess
8 = Other condition (specify if possible).....
9 = Not recorded

LOCATION
0 = Vermilion border
1 = Commissures
2 = Lips
3 =Sulci
4 = Buccal mucosa
5 = Floor of mouth
6 = Tongue
7 = Hard and/or palate
8 = Alveolar ridges/gingiva
9 = Not recorded

OTHER SOFT TISSUE LESIONS

Angular Chelitis
Denture Stomatitis I
Denture Stomatitis II
Denture Stomatitis III
Denture Hyperplasia

0 = Absent
1 = Present
9 = Not recorded

DENTITION STATUS

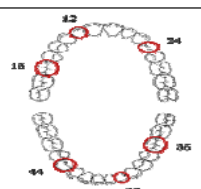
	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
Crown																
Root																
Treatment																

	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Crown																
Root																
Treatment																

Crown	Root	STATUS
0	0	Sound
1	1	Decayed
2	2	Filled, with decay
3	3	Filled, no decay
4	__	Missing, for any reason
5	__	Remnant roots
6	__	Fissure sealant
7	7	Bridge abutment, special crown or veneer/implant
8	8	Unerupted tooth, (crown)/unexposed root
88	88	Trauma (fracture)
9	9	Not recorded

PLAQUE INDEX

TEETH	16	12	24	36	32	44
Buccal						
Lingual						
Distal						
Mesial						



Index
0 = No plaque in gingival area
1 = Film or plaque attached to the free gingival margin
2 = Modest gathering of soft deposits within the gingival pocket
3 = Plentifulness of soft matter within the gingival pocket and/or on the tooth and gingival margin

TOOTH MOBILITY

18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38

MOBILITY: 0=none, 1= <1mm , 2=>1mm , 9=not recorded

8d	8m	7d	7m	6d	6m	5	4	3	2	1	1	2	3	4	5	6m	6d	7m	7d	8m	8d

Pairs in contact: 0 = No contact
1= Both opposing teeth are natural
(Bridges are considered as natural in this measurement)

PROSTHETIC STATUS

Upper Lower

0 = No prosthesis
1 = Bridge
2 = More than one bridge
3 = Partial denture
4 = Both bridge(s) and partial denture(s)
5 = Full removable denture
9 = Not recorded

COMPLETE DENTURES

Matching pair ☐ 1 = Yes 2 = No

Complete denture in upper jaw ☐
Complete denture in lower jaw ☐

0 = Absent
1 = Present
9 = Not recorded

DENTURE STATUS

	ADAPTATION	RETENSION	EXTENSION
Upper Denture	☐	☐	☐
Lower Denture	☐	☐	☐
	1 = Adequate 2 = Inadequate 3 = Unrecordable	1 = Adequate 2 = Inadequate 3 = Unrecordable	1 = Adequate or underextended 2 = Overextended 3 = Unrecordable

PARTIAL DENTURES

Partial denture in upper jaw ☐
Partial denture in lower jaw ☐

0 = Absent
1 = Present
9 = Not recorded

PARTIAL DENTURE REPLACE ALL MISSING TEETH

Partial denture in upper jaw ☐
Partial denture in lower jaw ☐

1 = Yes
2 = No

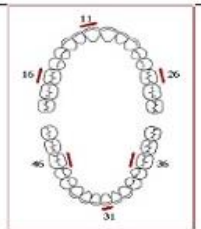
DENTURE HYGIENE

Complete denture in upper jaw ☐
Complete denture in lower jaw ☐
Partial denture in upper jaw ☐
Partial denture in lower jaw ☐

1 = Good
2 = Moderate
9 = Not recorded

CALCULUS INDEX

TEETH	16	11	26	36	31	46
Buccal						
Lingual						
Labial						
Labial						



SIMPLIFIED ORAL HYGIENE INDEX (OHI-S)

Index
0 = No calculus present
1 = Supragingival calculus < 1/3 of the exposed tooth surface
2 = Supragingival calculus >1/3 and < 2/3 of the exposed tooth surface
3 = Supragingival calculus >2/3 of the exposed tooth surface, or a continuous, heavy band of subgingival calculus around the cervical portion of the tooth, or both.

DEBRIS INDEX

TEETH	16	11	26	36	31	46
Buccal						
Lingual						
Labial						
Labial						

Index
0 = No debris or stain present
1 = Soft debris covering < 1/3 of the exposed tooth surface
2 = Ssoft debris covering >1/3 and < 2/3 of the exposed tooth surface
3 = Soft debris covering >2/3 of the exposed tooth surface

COMMUNITY PERIODONTAL INDEX (CPI)

0 = Healthy
1 = Bleeding
2 = Calculus
3 = Pocket 4-5 mm (black band on probe partially visible)
4 = Pocket 6 mm or more (black band on probe not visible)
X = Excluded sextand
9 = Not recorded

17/16 11 26/27
47/46 31 36/37

LOSS OF ATTACHMENT

0 = 0-3 mm
1 = 4-5 mm (cementoenamel junction (CEJ) within black band)
2 = 6-8 mm (CEJ between upper limit of black band and 8.5 mm ring)
3 = 9-11 mm (CEJ between 8.5 mm and 11.5 mm rings)
4 = 12 mm or more (CEJ beyond 11.5 mm ring)
X = Excluded sextand
9 = Not recorded

17/16 11 26/27
47/46 31 36/37

NEED FOR IMMEDIATE CARE AND REFERRAL

Life-threatening condition ☐
Pain or infection ☐
Other condition (specify)..... ☐

0 = Absent
1 = Present
9 = Not recorded

Referral ☐
0 = No
1 = Yes
9 = Not recorded

NOTES

Abstract in Greek

Περίληψη

Exploring the impact of complex socioeconomic, psychometric and behavioural factors and the social gradient concerning clinical and subjective measures of oral health, in Greek older adults.

«Διερεύνηση σύνθετων κοινωνικοοικονομικών, ψυχομετρικών και συμπεριφορικών παραγόντων και διαβαθμισμένων ανισοτήτων σε κλινικούς και υποκειμενικούς δείκτες στοματικής υγείας ατόμων τρίτης ηλικίας, στην Ελλάδα»

Οι κοινωνικοοικονομικές ανισότητες βρίσκονται στο επίκεντρο των επιστημονικών ερευνών διότι έχει παρατηρηθεί και τεκμηριωθεί η διασύνδεση αυτών των ανισοτήτων με τις διαβαθμισμένες ανισότητες ως προς την υγεία , την ευημερία αλλά και ως προς το προσδόκιμο ζωής σε σχέση με τη θέση που κατέχει το άτομο στο κοινωνικό σύνολο. Όσο πιο ψηλά βρίσκεται κάποιος ως προς την κοινωνική και οικονομική θέση, τόσο περισσότερες πιθανότητες έχει για μεγαλύτερο προσδόκιμο ζωής και ευημερίας, σε αντίθεση με αυτούς που βρίσκονται σε κατώτερες θέσεις της κοινωνικής και οικονομικής κατάταξης. Αυτές οι διαφορές και καταγραφόμενες διαβαθμισμένες ανισότητες αφορούν όλο το φάσμα και σε όλα τα επίπεδα κοινωνικοοικονομικής θέσης και εξαρτώνται από το στάδιο ανάπτυξης του ατόμου, το γένος, τη χώρα, τους δείκτες υγείας, αλλά και τους δείκτες και τον βαθμό των ανισοτήτων.

Τα χρόνια νοσήματα και ο γηράσκων πληθυσμός είναι προβλήματα που απασχολούν τις αναπτυγμένες χώρες. Οι κοινωνικοοικονομικές διαβαθμισμένες ανισότητες που επηρεάζουν την υγεία, αφορούν σχεδόν όλα τα χρόνια νοσήματα στις αναπτυγμένες χώρες και αφορούν και τη στοματική υγεία. Στην Ελλάδα, ο πληθυσμός 65 ετών και άνω είναι σε συνεχή αύξηση και προβλέπεται να αυξηθεί από 18.5% (2007) σε 32% για το έτος 2050. Αυτή η δημογραφική αλλαγή οφείλεται σε συνδυασμό παραγόντων όπως είναι η μείωση των γεννήσεων, η

αύξηση του χρόνου επιβίωσης, η μετανάστευση και αλλαγές στον τρόπο ζωής.

Σκοπός της παρούσας διατριβής είναι η διερεύνηση σύνθετων κοινωνικοοικονομικών, ψυχομετρικών και συμπεριφορικών παραγόντων και διερεύνηση διαβαθμισμένων ανισοτήτων σε κλινικούς και υποκειμενικούς δείκτες στοματικής υγείας ατόμων τρίτης ηλικίας, στην Ελλάδα. Στην έρευνα χρησιμοποιήθηκαν τρείς αντικειμενικοί δείκτες (εισόδημα, εκπαίδευση και επάγγελμα) αλλά και ένας υποκειμενικός δείκτης υγείας, για τη μελέτη των κοινωνικών ανισοτήτων στην υγεία. Η επιδημιολογική έρευνα έγινε σύμφωνα με τους κανόνες Ηθικής και Δεοντολογίας για την Ιατρική έρευνα και σύμφωνα με τη Διακήρυξη του Ελσίνκι για τις αρχές που διέπουν την Ιατρική έρευνα, αλλά και τους κανονισμούς και οδηγίες της Ευρωπαϊκής Ένωσης καθώς και του κώδικα Ηθικής και Δεοντολογίας για την ιατρική και οδοντιατρική άσκηση στην Ελλάδα.

Η παρούσα διατριβή, ερευνά και καταγράφει τη στοματική υγεία ατόμων που επισκέπτονται τις Λέσχες Φιλίας του Δήμου Αθηναίων, και τα Κέντρα Αγάπης και Αλληλεγγύης του Δήμου Πειραιά και ερευνά διαβαθμισμένες κοινωνικοοικονομικές ανισότητες. Η εξέταση και η καταγραφή έγινε σύμφωνα με τις οδηγίες του Παγκόσμιου Οργανισμού Υγείας για οδοντοστοματολογική έρευνα. Όλοι οι συμμετέχοντες εθελοντές, άντρες και γυναίκες, ήσαν 65 ετών και άνω, και εγγεγραμμένοι στις Λέσχες Φιλίας ή στα Κέντρα Αγάπης και Αλληλεγγύης. Για την έρευνα εργάσθηκαν ένας τυποποιημένος (calibrated) εξεταστής και τρεις εκπαιδευμένοι συνεντεύκτες. Κλινικοί δείκτες αλλά και υποκειμενικοί δείκτες υγείας και πώς οι ίδιοι οι συμμετέχοντες αξιολογούν την υγεία τους και την ποιότητα ζωής της οδοντοστοματολογικής τους υγείας καταγράφηκαν και εξετάσθηκαν σε σχέση με τις κοινωνικοοικονομικές συνθήκες και ψυχομετρικές παραμέτρους, όπως είναι η ικανοποίηση από τη ζωή, η γνωστική ικανότητα, η μοναξιά, και τα κοινωνικά δίκτυα. Επίσης, καταγράφηκαν και αναλύθηκαν συμπεριφορικοί παράγοντες για τη στοματική υγεία, συνήθειες διατροφής, η κοινωνική συμμετοχή, προβλήματα γενικής υγείας, φαρμακευτική αγωγή, επίδραση της στοματικής υγείας στην ποιότητα ζωής και χρόνια προβλήματα υγείας που επηρεάζουν την κινητικότητα και την καθημερινή δραστηριότητα. Για τη διερεύνηση

των ανισοτήτων χρησιμοποιήθηκαν τρεις αντικειμενικοί δείκτες (εκπαίδευση, εισόδημα, και τελευταίο κύριο επάγγελμα) καθώς και ένας υποκειμενικός κοινωνικοοικονομικός δείκτης (social ladder), δηλαδή η υποκειμενική αξιολόγηση της κοινωνικής και οικονομικής κατάστασης και θέσης του ατόμου.

Για τη στατιστική ανάλυση χρησιμοποιήθηκαν περιγραφική ανάλυση, δοκιμασίες t-test, χ2, Kolmogorov-Smirnov, συντελεστές συσχέτισης Spearman και Pearson, Γενικευμένα Γραμμικά Μοντέλα (GLM), αλλά και πολυπαραγοντική ανάλυση (πολλαπλή λογιστική παλινδρόμηση και λογιστική παλινδρόμηση). Χρησιμοποιήθηκε το στατιστικό πρόγραμμα SPSS v.24. και το επίπεδο σημαντικότητας ορίσθηκε στο $p<0.05$.

Τα αποτελέσματα έδειξαν ότι οι κοινωνικο-οικονομικές συνθήκες είναι παράγοντες που επηρεάζουν τη στοματική υγεία, τόσο στους κλινικούς όσο και στους υποκειμενικούς δείκτες υγείας. Τα αποτελέσματα επιβεβαίωσαν την ύπαρξη κοινωνικοοικονομικών διαβαθμισμένων ανισοτήτων στους κλινικούς δείκτες (ελλείποντα δόντια, τερηδόνες και DMFT, OHI-S) και στην υποκειμενική εκτίμηση της οδοντοστοματικής υγείας και της γενικής υγείας. Διαβαθμισμένες ανισότητες στην υγεία καταγράφηκαν σε όλο το φάσμα της κοινωνικοοικονομικής θέσης σε επίπεδο εισοδήματος, εκπαίδευσης και επαγγέλματος. Η εκπαίδευση, η οικονομική δυνατότητα (ατομικό εισόδημα ή οικογενειακό εισόδημα), επάγγελμα αλλά και η υποκειμενική κατάταξη στην κοινωνική κλίμακα, εξηγούν τις ανισότητες. Αυτά τα αποτελέσματα είναι σε συμφωνία με τα αποτελέσματα άλλων ερευνών. Τα αποτελέσματα έδειξαν ότι η απώλεια δοντιών σχετίζεται στατιστικά σημαντικά με το οικογενειακό εισόδημα, το φύλο, την οικογενειακή κατάσταση, τα χρόνια που βρίσκονται στη σύνταξη, την υποκειμενική αξιολόγηση για την ποιότητα οδοντοστοματικής υγείας OHRQL, και τη νοητική ικανότητα των συμμετεχόντων. Η εκπαίδευση, το επάγγελμα και η υποκειμενική αντίληψη της κοινωνικής θέσης είναι επίσης προγνωστικοί παράγοντες για τον αριθμό των απολεσθέντων δοντιών. Αυτοί οι οποίοι ανέφεραν ότι εργάσθηκαν ως χειρώνακτες εργάτες, είχαν χαμηλότερη μόρφωση, χαηλότερο εισόδημα και υποκειμενική αντίληψη της κοινωνικής θέσης σε χαμηλή θέση, είναι πιθανότερο να έχουν χάσει περισσότερα δόντια.

Οι ίδιες κοινωνικοοικονομικές διαβαθμισμένες ανισότητες βρέθηκαν και για τους δείκτες DMFT και OHI-S. Στη στατιστική ανάλυση σε όλα τα μοντέλα, χρησιμοποιήθηκαν οι μεταβλητές (σταθμισμένη ανάλυση): ηλικία, φύλο, ο δήμος κατοικίας και το εάν ζουν μόνοι τους. Η υποκειμενική εκτίμηση της στοματικής και της γενικής υγείας επίσης παρουσιάζουν στατιστικά σημαντικές διαφορές και διαβαθμισμένες ανισότητες ανάλογα με το εισόδημα, την εκπαίδευση, το επάγγελμα και την υποκειμενική κοινωνική θέση.

Το επίπεδο στοματικής υγιεινής (OHI-S) σχετίζεται στατιστικά σημαντικά με το εισόδημα, το επίπεδο εκπαίδευσης, το επάγγελμα και την υποκειμενική εκτίμηση της κοινωνικοοικονομικής θέσης. Λιγότερο εισόδημα, χαμηλότερο επίπεδο εκπαίδευσης, εργασία σε χειρωνακτική απασχόληση και χαμηλότερη υποκειμενική κοινωνικοοικονομική θέση σχετίζεται με φτωχή (κακή) στοματική υγιεινή. Η επίδραση της γνωστικής ικανότητας στις ανισότητες για τον δείκτη στοματικής υγιεινής είναι ισχυρή και εξουδετερώνει την επίδραση των κοινωνικοοικονομικών δεικτών.

Η υποκειμενική εκτίμηση της υγείας και η υποκειμενική εκτίμηση της στοματικής υγείας σχετίζονται στατιστικά σημαντικά με το οικογενειακό εισόδημα, το επίπεδο εκπαίδευσης, το επάγγελμα και την υποκειμενική εκτίμηση της κοινωνικοοικονομικής θέσης. Η υποκειμενική εκτίμηση της κοινωνικοοικονομικής θέσης είναι ο ισχυρότερος προγνωστικός παράγοντας για την υποκειμενική υγεία και την υποκειμενική στοματική υγεία. Ο τόπος διαμονής (Αθήνα ή Πειραιάς), δεν βρέθηκε να είναι στατιστικά σημαντικός για την υποκειμενική εκτίμηση της στοματικής και της γενικής υγείας.

Η ικανοποίηση από τη ζωή σχετίζεται στατιστικά σημαντικά με την ύπαρξη χρόνιου νοσήματος που επιδρά στην καθημερινότητα με μείωση της καθημερινής δραστηριότητας, τον αριθμό των εναπομεινάντων δοντιών, και το λόγο για επίσκεψη στον οδοντίατρο. Υπάρχουν κοινωνικοοικονομικές διαβαθμισμένες ανισότητες ως προς την υποκειμενική στοματική υγεία και παραμένουν στατιστικά σημαντικές όταν η ικανοποίηση από τη ζωή προστέθηκε στο στατιστικό μοντέλο, το εισόδημα παραμένει στατιστικά σημαντικό.

Ο λόγος επίσκεψης στον οδοντίατρο, ο χρόνος από την τελευταία επίσκεψη στον οδοντίατρο, η συχνότητα βουρτσίσματος δοντιών ή οδοντοστοιχιών παρουσιάζουν κοινωνικοοικονομικές διαβαθμισμένες ανισότητες. Η συχνότητα βουρτσίσματος των δοντιών ή οδοντοστοιχιών, λιγότερο από μια φορά την ημέρα, έχει στατιστικά σημαντικές διαφορές σε σχέση με όσους βουρτσίζουν δύο φορές την ημέρα, ανά επαγγελματική κατηγορία, εισόδημα και επίπεδο εκπαίδευσης και υπάρχουν διαβαμισμένες ανισότητες. Επίσης, η υποκειμενική εκτίμηση της κοινωνικοοικονομικής θέσης είναι στατιστικά σημαντική και σχετίζεται με το βούρτσισμα των δοντιών. Χαμηλότερη υποκειμενική κοινωνικοοικονομική θέση σχετίζεται στατιστικά σημαντικά με λιγότερο συχνό βούρτσισμα και υπάρχουν διαβαθμισμένες ανισότητες.

Στην παρούσα έρευνα, οι ψυχομετρικοί παράγοντες που εξετάσθηκαν, εν μέρει εξηγούν τις κοινωνικοκοικονομικές διαβαθμισμένες ανισότητες στην υγεία. Η γνωστική ικανότητα, τα κοινωνικά δίκτυα, η ικανοποίηση από τη ζωή και η μοναξιά επιδρούν στην υγεία και τη στοματική υγεία. Η γνωστική ικανότητα εν μέρει ερμηνεύει τις οικονομικές και κοινωνικές ανισότητες σε κλινικούς δείκτες π.χ. αριθμό των ελλειπόντων οδόντων, DMFT, OHI-S) και στους υποκειμενικούς δείκτες που εξετάσθηκαν (p<0.05). Για την υποκειμενική εκτίμηση της στοματικής υγείας και τις κοινωνικοοικονομικές ανισότητες, στο τελικό μοντέλο ανάλυσης, υπάρχει ισχυρή συσχέτιση της ικανοποίησης από τη ζωή και του αισθήματος μοναξιάς, τόσο ισχυρή ώστε εξουδετερώνει την επίδραση του οικογενειακού εισοδήματος. Για την υποκειμενική (γενική) υγεία, ως προς τις ανισότητες και τα κοινωνικά δίκτυα, στο τελικό μοντέλο το εισόδημα και τα κοινωνικά δίκτυα παραμένουν στατιστικά σημαντικά. Όσοι έχουν χαμηλότερο εισόδημα και λιγότερες κοινωνικές επαφές (κοινωνικά δίκτυα), είναι πιθανότερο να εκτιμήσουν την υποκειμενική τους υγεία ως φτωχή (κακή).

Το επίπεδο εκπαίδευσης σχετίζεται στατιστικά σημαντικά με την υποκειμενική υγεία, και οι συσχετίσεις αυτές παραμένουν στατιστικά σημαντικές στο τελικό μοντέλο ανάλυσης όπως στατιστικά σημαντικά είναι και η ικανοποίηση από τη ζωή, η μοναξιά και τα κοινωνικά δίκτυα. Αυτό αποδεικνύει και επιβεβαιώνει ότι το επίπεδο εκπαίδευσης είναι ισχυρός προγνωστικός παράγοντας για την

υποκειμενική υγεία και η ικανοποίηση από τη ζωή, η μοναξιά και οι κοινωνικές επαφές εν μέρει εξηγούν αυτές τις διαβαθμισμένες ανισότητες.

Η υποκειμενική στοματική υγεία παρουσιάζει στατιστικά σημαντικές διαφορές ως προς το επίπεδο εκπαίδευσης, το εισόδημα και το επάγγελμα. Λιγότερο εισόδημα, χαμηλότερο επίπεδο εκπαίδευσης και όσοι αναφέρουν ότι εργάσθηκαν ως χειρώνακτες εργάτες είναι πιθανότερο να εκτιμήσουν και να χαρακτηρίσουν την υποκειμενική στοματική τους υγεία ως φτωχή. Επίσης, ο μικρότερος βαθμός ικανοποίησης από τη ζωή, σχετίζεται στατιστικά σημαντικά με την πιθανότητα να χαρακτηρίσουν την υποκειμενική τους υγεία ως φτωχή και εν μέρει εξηγεί τις ανισότητες στην υγεία. Η υποκειμενική στοματική υγεία σχετίζεται στατιστικά σημαντικά με το επάγγελμα, αλλά αυτό ισχύει μόνο για τις δύο πρώτες κατηγορίες επαγγελμάτων. Όσοι εργάσθηκαν σε καλύτερα επαγγέλματα (επαγγελματίες, μάνατζερς/ και μη επαγγελματίες/μάνατζερς και μη χειρώνακτες εργάτες), εκτιμούν την υποκειμενική στοματική τους υγεία καλή, σε σχέση με όσους εργάσθηκαν σε χειρωνακτικές εργασίες και οι οποίοι εκτιμούν την υποκειμενική στοματική τους υγεία ως φτωχή.

Η ικανοποίηση από τη ζωή και η μοναξιά έχει επίσης στατιστικά σημαντική συσχέτιση με την υποκειμενική στοματική υγεία. Η νοητική ικανότητα σχετίζεται στατιστικά σημαντικά με τον αριθμό των απολεσθέντων οδόντων, όπως και η ηλικία, το εισόδημα και η εκπαίδευση και εν μέρει διασαφηνίζει τις παρατηρούμενες διαβαθμισμένες ανισότητες. Επίσης, τα αποτελέσματα δείχνουν ότι τα άτομα χωρίς φυσικά δόντια, είναι πιθανότερο να χαρακτηρίζουν ως φτωχή (κακή) την υποκειμενική στοματική και γενική τους υγεία και να αισθάνονται λιγότερο ικανοποιημένοι από τη ζωή. Οι κλινικοί και υποκειμενικοί δείκτες οι οποίοι εξετάσθηκαν και οι διαβαθμισμένες ανισότητες στην υγεία που παρατηρήθηκαν συσχετίζονται στατιστικά σημαντικά με την γνωστική ικανότητα, η επίδραση της οποίας συμβάλλει στην μείωση της επίδρασης των κοινωνικοοικονομικών δεικτών.

Οι ανισότητες και οι διαβαθμισμένες ανισότητες επιμένουν στα ηλικιωμένα άτομα και δεν έδειξαν να μειώνονται στις μεγαλύτερες

ηλικίες. Οι πολιτικές υγείας και τα μέτρα ενίσχυσης των ηλικιωμένων είναι απαραίτητα όπως και τα προγράμματα πρόληψης τα οποία θα πρέπει να εφαρμόζονται σε νεαρή ηλικία ώστε όταν το άτομο φτάσει σε μεγαλύτερη ηλικία να έχει διατηρήσει περισσότερα δόντια. Τα αποτελέσματα της έρευνας είναι σημαντικά και χρήσιμα στον σχεδιασμό, την υιοθέτηση μέτρων αλλά και την εφαρμογή εθνικών προγραμμάτων για την προαγωγή της στοματικής υγείας ενηλίκων και ατόμων 65 ετών και άνω. Θα συμβάλουν στην κατανόηση των παραγόντων κινδύνου για τη θεραπεία και την πρόληψη οδοντοστοματολογικών νοσημάτων και απώλειας δοντιών, αλλά και για τη γενική υγεία, με στόχο τη βελτίωση της ποιότητας ζωής των ατόμων 65 ετών και άνω και επιπλέον θα συμβάλουν στη μείωση των ανισοτήτων στην υγεία.