MSc IN HEALTHCARE MANAGEMENT

University of Macedonia

THESIS

AN EMPIRICAL INVESTIGATION OF ORAL HEALTH LITERACY AND ITS

RELATIONSHIP WITH DENTAL ANXIETY AMONG UNIVERSITY STUDENTS.

By

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Solemn Declaration
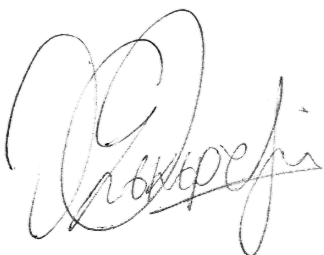
I hereby declare that I am the writer of this thesis and that all the aid I have received is fully recognised and indicated in the study. I have referenced all sources from which I employed data, ideas or phrases, whether verbatim or paraphrased. Furthermore, I declare that the present thesis is, in its entirety, my own and autonomous work, specifically prepared as part of the requirements for the MSc Programme in Healthcare Management of the Department of Business Administration, University of Macedonia.

Christina G. Sekertzi

To my family,
for their endless love and support.

Acknowledgements

Abstract

Background: Oral health literacy (OHL) refers to an individual's capacity to obtain, process and understand basic health information and services needed to make appropriate oral health decisions. It is a multi-dimensional construct that has steadily gained prominence in dental research as a factor possibly associated with oral health behaviours, oral health outcomes and dental care access. Dental anxiety (DA) is a widespread issue in everyday dental practice; it poses a challenge for patients and dentists alike and is considered a major driving force behind poor dental attendance. Oral health literacy and dental anxiety both affect the patient-dentist relationship and are associated with a social gradient that may exacerbate oral health disparities. Only a few studies have explored the relationship between these two constructs in any population.

Purpose: The purpose of this cross-sectional study was a) to assess the oral health literacy of University of Macedonia students through a newly translated and validated oral health literacy instrument, b) to provide insights on the relationship between oral health literacy and dental anxiety and c) to explore the associations between these two constructs and several sociodemographic and oral health-related factors.

Materials and Methods: Data were collected from 278 University of Macedonia students via a questionnaire survey. Oral health literacy was measured with the OHL–AQ tool, which was translated into Greek following a forward-backward translation process. Dental anxiety was measured with the Modified Dental Anxiety Scale (MDAS). Sociodemographic characteristics and data pertaining to dental anamnesis and oral health-related behaviours were also recorded. OHL–AQ's internal consistency was assessed with Cronbach's alpha coefficient. Bivariate analyses were employed to explore the associations between the two constructs (OHL and DA) and the sociodemographic and oral health-related variables. The association between oral health literacy and dental anxiety was evaluated with Spearman's correlation coefficient. A multiple linear regression model with dental anxiety (MDAS score) as the dependent variable was developed to investigate further the relationship between oral health literacy and dental anxiety on a multivariable level.

Results: The Greek version of OHL–AQ had a Cronbach's alpha value of 0.721, indicating adequate internal consistency. The face, content and construct validity of the instrument were

also favourable. The average age of the participants was 20.7 (*SD* = 3.9) and 52.9% were female (*n* = 147). A departure from normality was observed for the OHL-AQ (*p* <0.001, *mean (SD)* = 10.9 (3.2), *Md* = 11, *IQR* = 4, range = 1–17) and MDAS (*p* <0.001, *mean (SD)* = 11.4 (4.6), *Md* = 10, *IQR* = 6, range = 5–25) sum scores. Overall, 28.8% of the participating students had inadequate, 22.7% had marginal, and 48.5% had adequate oral health literacy. The OHL–AQ scores were significantly associated on a bivariate level with sex, mother's education, the financial situation of the household, self-perceived oral health status, tooth brushing frequency and frequency of dental visits. The estimated proportion of participants with extreme dental anxiety was 8.6%. OHL–AQ and MDAS scores had a negative but weak correlation (ρ = -0.295, *p* < 0.001). According to the multiple linear regression model, the MDAS score had a significant multivariate association with OHL–AQ score (β = -0.42, *p* < 0.001), after adjusting for sex, mother's education level, previous traumatic dental experience, tooth brushing frequency and frequency of dental visits.

Conclusions: The Greek version of OHL–AQ seems to be a reliable and valid instrument for the assessment of oral health literacy. The prevalence of inadequate oral health literacy is significant (28.8%), even among highly educated young adults. Potentially dental phobic individuals comprised 8.6% of the sample. Oral health literacy and dental anxiety are negatively correlated and their association remains significant even after adjusting for other variables. Both constructs are associated with sociodemographic determinants and oral health-related factors. Further research should elucidate the specific pathways of this complex relationship and explore the potential use of oral health literacy interventions for the management of dental anxiety.

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Abbreviations

ADA	American Dental Association
DA	Dental Anxiety
EU	European Union
HLS-EU	European Health Literacy Survey
IOM	Institute of Medicine
IQR	Interquartile Range
IRR	Incidence rate ratio
Md	Median
MDAS	Modified Dental Anxiety Scale
OECD	Organisation for Economic Co–operation and Development
OHL	Oral Health Literacy
OHL–AQ	Oral Health Literacy – Adults Questionnaire
REALD-30	Rapid Estimate of Adult Literacy in Dentistry-30
REALM	Rapid Estimate of Adult Literacy in Medicine
SD	Standard Deviation
UoM	University of Macedonia
US	United States of America
WHO	World Health Organization

1. Introduction

An ongoing shift can be observed in health care, from the paternalistic, physician-led archetype towards an increasingly patient-centred and individualised model; patients are becoming active stakeholders rather than mere objects of care (European Commission, 2007) and new health care management approaches emphasise the achievement of high value for patients as the principal goal of health care delivery (Porter, 2010). The World Health Organization (WHO) has advocated for a further move towards integrated, people-centred health care systems that focus on individuals, families and communities, rather than diseases and provide a continuum of accessible services (World Health Organization, 2020). The health care provider-patient relationship is changing; people seek to participate in their own health care decisions and pursue health-related information from a variety of –not always reputable– sources, rather than rely solely on those provided by their physicians (Tan and Goonawardene, 2017). People's health beliefs and behaviours can be shaped by the information they consume and the sources they trust and may lead to decisions that have a significant public health impact (e.g. vaccine hesitancy, adherence to COVID-19 precautionary measures)(Charron, Gautier and Jestin, 2020; Swire-Thompson and Lazer, 2020; Tong *et al.*, 2020).

Now more than ever, individuals' willingness and ability to acquire, understand, critically appraise and use health information to make educated decisions are of crucial importance. This constellation of knowledge, skills and competencies is incorporated in the concept of health literacy (Sørensen *et al.*, 2012). Limited health literacy is considered an important health policy issue, affecting a large number of people and resulting in limited use of health services, poorer health outcomes, and health inequalities (Berkman *et al.*, 2011; Office of Disease Prevention and Health Promotion, 2015a).

Oral health literacy frames literacy concerns in the specific context of oral health; it refers to the degree an individual has the capacity to obtain, process and understand basic health information and services needed to make appropriate oral health decisions (American Dental Association, 2009). Oral health literacy is a multi-dimensional construct that has steadily gained prominence in dental research as a factor related to oral health outcomes and health

disparities (Horowitz and Kleinman, 2012). While limited oral health literacy has been linked to lower socioeconomic status and poor educational attainment (VanWormer, Tambe and Acharya, 2019), it can be prevalent even among highly educated individuals (Mathew and Kabir, 2021). According to evidence, low oral health literacy may hamper effective dentist-patient communication and thus pose a significant barrier to patient-centred care (Schiavo, 2011; Fico and Lagoe, 2018).

Dental anxiety is a widespread phenomenon that remains a chief barrier to dental care, regardless of the notable advancements in dentistry in the fields of pain control and patient management (Appukuttan *et al.*, 2012; Hill *et al.*, 2013). It is a frequently encountered issue in clinical practice and represents a challenge for both patients and dentists (Bernson *et al.*, 2011). Individuals who experience extreme dental anxiety are considered dental phobics and may engage in avoidance behaviours (Berggren and Meynert, 1984). Dental anxiety has been associated with a lower socioeconomic status, unfavourable oral health outcomes and a negative effect on patients' oral health-related quality of life (McGrath and Bedi, 2004; Armfield, Spencer and Stewart, 2006; Heidari, Banerjee and Newton, 2015). Effective communication and a supporting, trusting dentist-patient relationship are essential towards the successful treatment plan completion and general management of the dentally anxious patient (Bernson *et al.*, 2011; Appukuttan, 2016).

A relationship between oral health literacy and dental anxiety has been hypothesised due to their shared social gradient and their connection with patient-dentist communication (Shin, Braun and Inglehart, 2014). While a few studies have suggested the presence of a negative correlation between the two issues (Shin, Braun and Inglehart, 2014; Barasuol *et al.*, 2017; Kadambari and Leelavathi, 2019), the research on this specific subject remains rather limited. Further exploration of this association would advance our understanding of these issues and their interplay and offer insights into how they affect oral health outcomes and behaviours.

The present thesis intended to amend the limited research on oral health literacy in Greece, as well as the overall scarcity of studies investigating the link between oral health literacy and dental anxiety. The aim was to assess the oral health literacy of the UoM student population, provide insights on its relationship with dental anxiety and explore the associations between

these two constructs and several sociodemographic and oral health-related variables. For that purpose, a cross-sectional study design was adopted, utilising validated measuring instruments in the form of structured questionnaires. The second chapter comprises a literature review regarding oral health literacy and dental anxiety and provides the theoretical framework of the thesis. Subsequently, the detailed aims, objectives and hypotheses (Chapter 3), as well as the methodology (Chapter 4) of the exploratory study are presented. Chapter 5 includes the presentation of the results and Chapter 6 the discussion of the findings in relation to the previously existing evidence and knowledge. Ultimately, the conclusions of the thesis are summarised in Chapter 8.

2. Literature review

2.1 Health literacy

2.1.1 Background and conceptualisation

The term health literacy was first introduced in 1974 in a paper that highlighted health education as a social policy issue relating to the health system, the educational system and mass communications (Simonds, 1974). Nonetheless, it remained a relatively obscure field of research until the early 90's. In 1992, Williams et al. (1995) conducted what is now considered the seminal work in the field. This landmark 2-year study focused on developing a standardised instrument and using it to assess participant's functional health literacy; i.e., their ability to perform the basic reading and numeracy tasks needed to function effectively in the health care environment. The researchers concluded that inadequate health literacy affects a significant number of patients, and it may hinder doctor-patient communication and high-quality health care (Williams *et al.*, 1995).

Since then, various definitions of health literacy have been proposed, most of which emphasise the complexity and multidimensionality of the concept. The WHO health promotion glossary states that:

> *"Health literacy represents the cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand and use information in ways which promote and maintain good health. By improving people's access to health information, and their capacity to use it effectively, health literacy is critical to empowerment (Nutbeam, 1998)."*

Nutbeam (2000) proposed a model that comprises three discrete levels:

- Functional health literacy (1st Level): refers to the basic skills in reading and writing required to function effectively in everyday situations. It can be improved by communicating information.

- Interactive health literacy (2nd Level): includes cognitive, literacy and social skills needed to participate actively in everyday situations, to extract information and derive meaning from different forms of communication and apply new information to changing circumstances. It can be improved through the development of personal skills.
- Critical health literacy (3rd Level): includes more advanced cognitive and social skills needed to critically analyse information and apply it to exert greater control over situations. It can be improved through empowerment on a personal and community level, via policy implementation and organisational change.

According to one of the most widely cited definitions, health literacy refers to "the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions" (Institute of Medicine (US) Committee on Health Literacy, 2004). This is the definition that was adopted by Healthy People 2020, a US program that sets 10-year goals and strategies regarding health promotion and prevention (Office of Disease Prevention and Health Promotion, 2015a).

In its latest iteration (Healthy people 2030), that definition was updated in order to encompass, apart from the personal, an organisational dimension of health literacy; personal health literacy refers to the "degree to which individuals have the ability to find, understand, and use information and services to inform health-related decisions and actions for themselves and others", while organisational health literacy is "the degree to which organizations equitably enable individuals to find, understand, and use information and services to inform health-related decisions and actions for themselves and others" (Office of Disease Prevention and Health Promotion, 2020).

In Europe, health literacy has been recognised as a priority health policy issue. It was explicitly mentioned as a key component of the core value of citizen empowerment in the European Commission's Health Strategy 2008-2013 (European Commission, 2007). In 2009, a consortium constituted by Maastricht University as lead partner and eight other organisations from EU member states (including Greece) developed the European Health Literacy Project, aiming to establish and further develop the issue of health literacy in Europe. As the major outcome of

the project, the European Health Literacy Survey (HLS–EU) generated first-time data on health literacy in the participating countries, adopting a comprehensive definition of the term:

> *"Health literacy is linked to literacy and entails people's knowledge, motivation and competences to access, understand, appraise, and apply health information in order to make judgments and take decisions in everyday life concerning healthcare, disease prevention and health promotion to maintain or improve quality of life during the life course (Sørensen et al., 2012)."*

The HLS–EU working group, through a thorough systematic review of peer-reviewed literature, proposed a conceptual matrix for health literacy that incorporates four dimensions of health literacy (access/comprehension/appraisal/use of information relevant to health) and three health domains (health care, disease prevention, disease promotion) (Sørensen et al., 2012). Their efforts culminated in a health literacy model (*Figure 1*) that incorporates the conceptual matrix, proximal and distal factors of importance and the pathways between health literacy and health outcomes (Sørensen *et al.*, 2012).
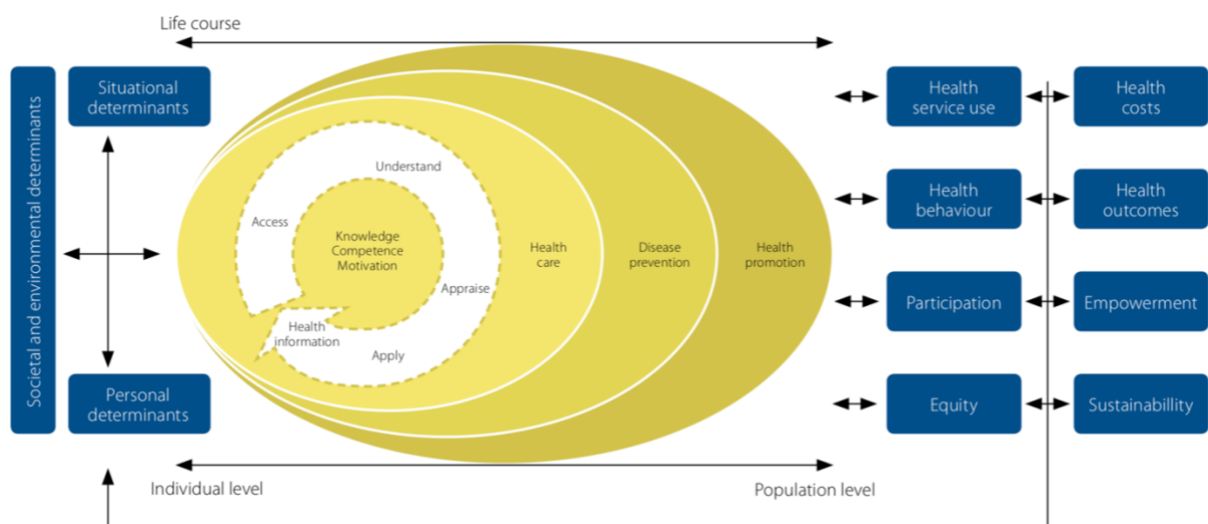
Figure 1. *Conceptual model of health literacy*
(Sørensen et al., 2012, adapted in World Health Organization, 2013).

The Commission's eHealth Action Plan 2012-2020 furthered the agenda of health literacy promotion, recognising limited digital health literacy (i.e., the ability to seek, find, understand and appraise health information from electronic sources and apply the knowledge gained to

addressing or solving a health problem) as an important barrier to the successful deployment of telemedicine initiatives (European Commission, 2015).

It becomes evident that there is no unanimously accepted definition of health literacy. This lack of consistency results in significant discrepancies in the ways the issue is perceived, measured and addressed through policy and targeted interventions, thus hindering the researchers from drawing valid and high-quality evidence-based conclusions (Pleasant, 2014). However, there is a notable shift away from the notion that health literacy is the mere application of literacy skills in a health context and towards an autonomous integrated concept that incorporates a public health perspective, acknowledges the responsibility of organisations, and emphasises people's ability to use health information to make educated decisions, rather than simply understand it (Pleasant, 2014; Office of Disease Prevention and Health Promotion, 2020).

2.1.2 Measuring health literacy

In health literacy research, the most widely used assessment instruments include the Rapid Estimate of Adult Literacy in Medicine (REALM) (Davis et al., 1993) and the Test of Functional Health Literacy in Adults (TOFHLA) (Parker et al., 1995), along with their shortened or adapted forms. REALM focuses on word recognition and pronunciation, while TOFHLA evaluates reading comprehension and numeracy skills. Due to their inherent inability to effectively assess important dimensions of the concept, they have been criticised for being non-comprehensive, and studies aiming to amend these perceived inadequacies have led to the development of numerous alternative instruments (Altin *et al.*, 2014; Haun *et al.*, 2014). Health literacy testing may be conducted via objective, subjective (including self-reports) or mixed measurement tools (Haun *et al.*, 2014). Health literacy can be viewed from a "clinical risk" or a "personal asset" perspective (Nutbeam, 2008) and this is reflected in the differentiation between instruments developed mainly for clinical screening/detecting individuals with limited health literacy (e.g. REALM) and instruments designed to procure general population data in a public health context (e.g. the instrument used HLS-EU). Instruments like the Newest Vital Sign, which assess the comprehension of a nutrition label in 3 minutes, are shorter and may be more appropriate for use in health care settings (Weiss *et al.*, 2005). Patients seem amenable to health literacy screening and don't experience discomfort or dissatisfaction when it is

performed in a respectful way as part of their routine history and physical examination (Ryan *et al.*, 2008; Komenaka *et al.*, 2014). However, the integration of analogous practices in daily clinical practice has been questioned as possibly stigmatising or deflecting from the need to adopt universal precautions (Paasche-Orlow and Wolf, 2008; Hadden and Kripalani, 2019).

2.1.2 Prevalence of health literacy

The prevalence of limited health literacy is considerable. According to a systematic review evaluating the related health care costs, it ranges from 34 to 59% across different populations (Eichler, Wieser and Brügger, 2009). In 2018, the OECD Health Working Paper "Health Literacy for People-centred Care" estimated that low health literacy may affect at least a third of the OECD population, as inferred from accumulated data on 18 countries, including Greece (Moreira, 2018). *Figure 2* displays the proportion of individuals with low health literacy levels in selected OECD countries.
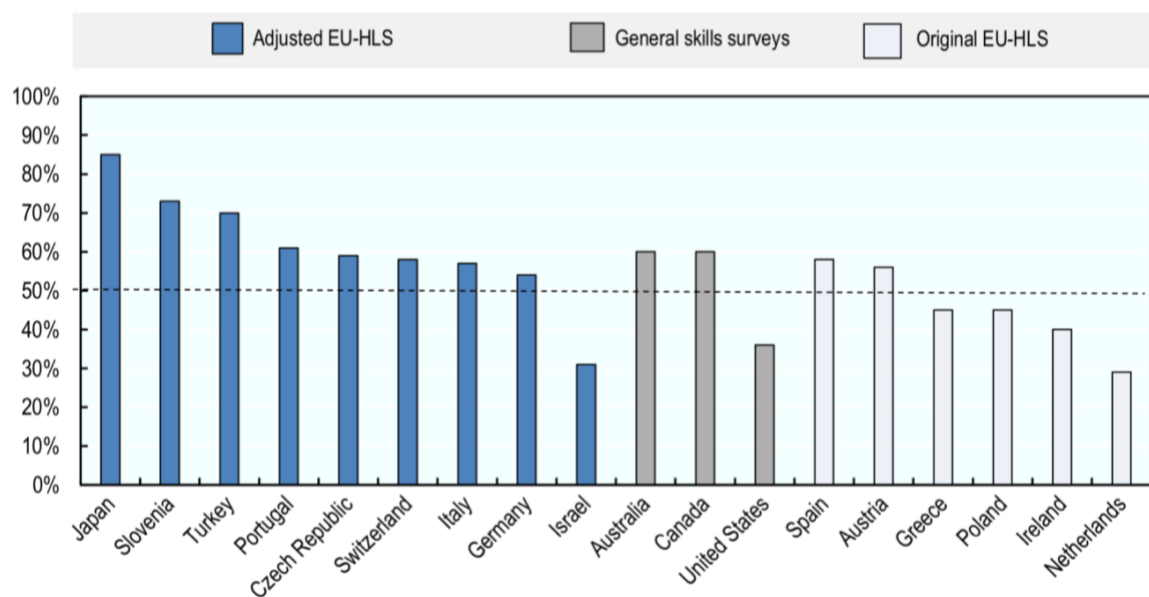
Figure 2. Proportion of individuals with low health literacy levels – selected OECD countries (Moreira, 2018).

As displayed in the above figure, the information regarding health literacy in European countries has been extracted from the results of the original European Health Literacy Survey (EU-HLS). EU-HLS used a 47-item evidence-based questionnaire, specially designed for the purpose of comprehensively estimating the health literacy levels of the general population in eight EU member states, with Greece among them (The HLS-EU Consortium, 2012). The

findings revealed that, on average, 47% of the population had limited literacy, with substantial differentiation observed across the participating countries (29-62%). Certain vulnerable population subgroups, such as people with low education, low social status, the financially deprived and the elderly, were associated with higher proportions of limited health literacy, thus suggesting the presence of a social gradient (Sørensen et al., 2015).

Regarding Greece specifically, the HLS-EU results indicated that 45% of the population has limited health literacy, a proportion close to the European average (Kondilis et al., 2012). In their report, the Greek HLS-EU working group highlighted the disparities observed in vulnerable subgroups, similar to the rest of the participating countries. However, they also noted the relative subjectivity of the results, prompted by the self-efficacy component of the instrument and the tendency of the Greek population to overestimate their abilities (Kondilis et al., 2012).

2.1.3 Antecedents of health literacy

In a systematic review conducted within the scope of the HLS–EU, Sørensen et al. (2012) provide a summary of the main antecedents of health literacy. These include:

- Personal determinants like age, gender, race, physical abilities, social and meta-cognitive skills.
- Notable demographic and social factors such as socioeconomic status, occupation and employment status, income, social support, language, media use, and environmental/political forces.
- Health promotion actions like education, social mobilisation and advocacy.

2.1.4 Associations of health literacy with health outcomes and behaviours – health system and social implications

Limited health literacy has been associated with a vast array of unfavourable health outcomes. The causal pathways of this relationship have been conceptualised as health literacy interfering with three main factors: (1) access and utilisation of healthcare, (2) patient/provider interaction, and (3) self-care (Paasche-Orlow and Wolf, 2007). Patients with limited health literacy tend to demonstrate poorer adherence to medication and disease preventive

behaviours, less successful self-management of chronic diseases, lower health-related knowledge and comprehension, and –when elderly– poorer overall health status and higher mortality rates (Berkman *et al.*, 2011; Hersh, Salzman and Snyderman, 2015). In the context of health care, limited health literacy negatively impacts doctor-patient communication, hinders disease prevention and screening, impedes patients' active participation in treatment decisions, and leads to differential use of health services, including increased use of emergency care, higher hospitalisation, and decreased immunisation rates (Davis *et al.*, 2002; Berkman *et al.*, 2011).

On a health system level, it has been estimated that the burden of limited health literacy accounts for 3 to 5% of the total health care cost per year (Eichler, Wieser and Brügger, 2009). High health literacy is impactful on both individual and community levels. It is associated with increased health knowledge, better navigation of health services, more successful adherence to recommendations, higher self-confidence, enhanced resilience to socioeconomic adversities, as well as improved community empowerment and increased participation to population health initiatives, among others (Sørensen *et al.*, 2012).

2.1.5 Interventions for the promotion of health literacy

Strategic reforms and targeted interventions have been proposed for the goal of promoting health literacy. WHO, in a Regional Office for Europe publication (2013), acknowledges health literacy as a "whole-of-society issue" involving multiple stakeholders, highlights the need to mitigate the negative effects of limited health literacy and proposes actions towards the creation and strengthening of health literacy-friendly settings across education, community, workplace, health care and media.

According to OECD (Moreira, 2018), in order to address health literacy barriers in patient-centred care, countries are encouraged to strengthen multi-stakeholder approaches (*Figure 3*), invest in health literacy research (e.g. studies on policy cost-effectiveness), improve the infrastructure of health literacy data and engage in international collaboration to share good practices and innovations. The multi-stakeholder approach recognises that health literacy barriers should also be addressed by means other than just the education of individuals; e.g. by training professionals to adapt towards the patients' needs, promoting plain language

initiatives and supporting the creation of health literate organisations that recognise the challenges limited health literacy presents and take steps to improve the accessibility of health information and services (World Health Organization, 2013; Moreira, 2018). Plain language is considered an essential facilitator of effective communication and entails imperatives like: (1) emphasise key information by providing it first, (2) break down complex information, (3) use language familiar to the audience, (4) avoid specialised terms, or if not possible, provide clear definitions (Office of Disease Prevention and Health Promotion, 2015).
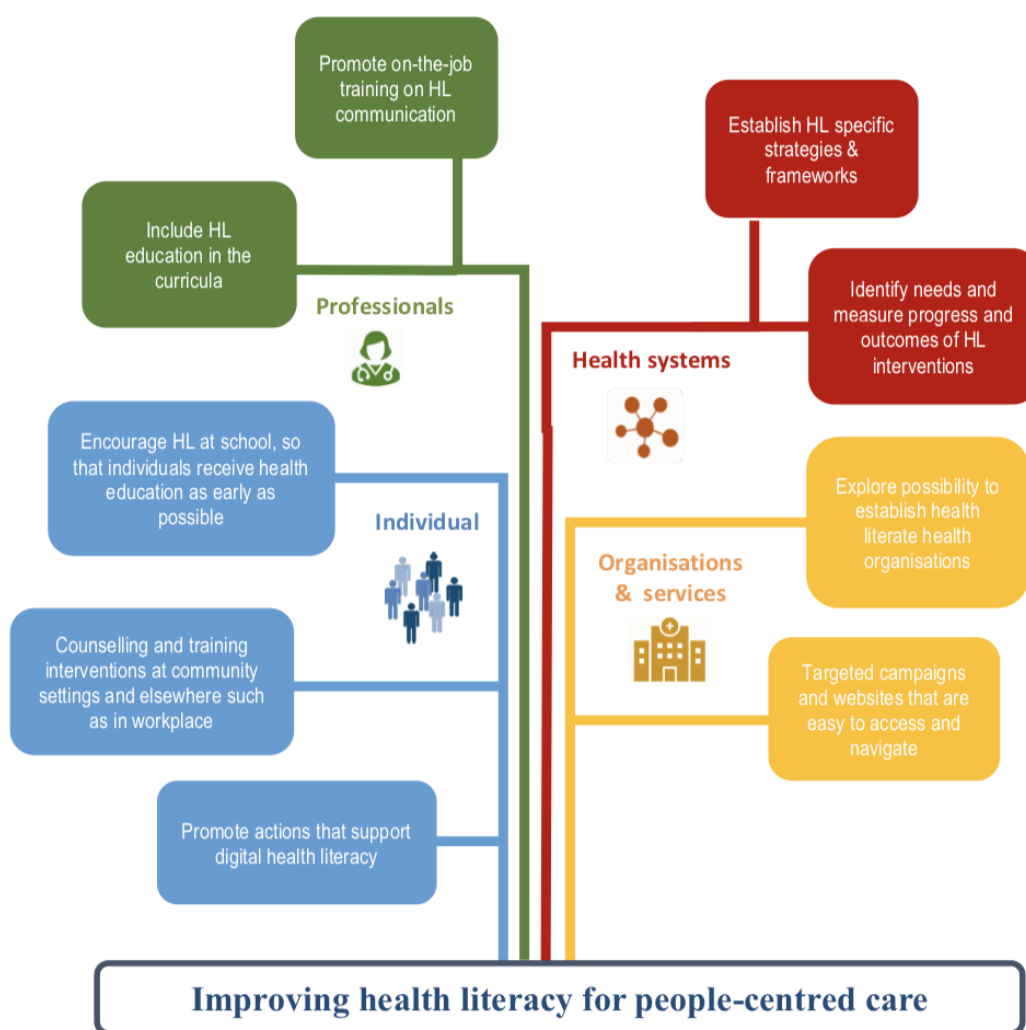
Figure 3. *Multi-stakeholder health literacy approach – targeted interventions (adapted from Moreira, 2018).*

2.2 Oral health literacy

2.2.1 Background and definition

The rising prominence of health literacy as a determinant of health with significant individual and societal implications instigated further research on high-impact field-specific concepts, like diabetes health literacy (Lee *et al.*, 2018), cancer health literacy (Dumenci *et al.*, 2014), HIV health literacy (Wawrzyniak *et al.*, 2013) and more recently COVID-19 health literacy (Okan et al., 2020).

In dentistry, oral health literacy (OHL) has attracted the interest of researchers for a little over a decade. The American Dental Association (2009) defines oral health literacy as "the degree to which individuals have the capacity to obtain, process and understand basic health information and services needed to make appropriate oral health decisions". This widely accepted definition, first professed in Healthy People 2010 (Office of Disease Prevention and Health Promotion, 2000), aligns with the concept of functional health literacy and encompasses the spectrum of skills needed to acquire essential knowledge and act accordingly, in order to ensure one's oral health; however, this definition omits to highlight the systemic aspects of the issue (National Institute of Dental and Craniofacial Research, 2005).

Oral health and general health are inextricably linked; a number of systemic diseases present oral manifestations and oral diseases may impact chronic systemic conditions via inflammatory or nutritional paths (Sabbah, Folayan and El Tantawi, 2019). According to a WHO bulletin, oral diseases represent the most common chronic diseases and their importance as a major public health problem stems from their prevalence, their impact on an individual and societal level as well as the considerable treatment-associated expenses (Sheiham, 2005). Oral health is riddled with profound disparities; the burden of the associated diseases is disproportionately carried by vulnerable and disenfranchised groups, identified by low socioeconomic status, limited education, old age and minority characteristics (Lee and Divaris, 2014). In many countries, including Greece, the coverage of dental procedures by public health systems is severely limited, with the majority of dental care being an out-of-pocket expense (Economou *et al.*, 2017; Allin *et al.*, 2020), thus further exacerbating the existing social gradient in oral health. Since most oral diseases are largely preventable (FDI World Dental Federation, 2016) and

health behaviours are influenced by health literacy, oral health literacy is considered a necessity for oral health promotion and disease prevention, as expressly stated in Healthy People 2010 (Office of Disease Prevention and Health Promotion, 2000).

2.2.2 Oral health literacy framework

A framework for oral health literacy was proposed by a workgroup sponsored by the US National Institute of Dental and Craniofacial Research (2005). The model is an adaptation of a previously established framework for health literacy (Institute of Medicine (US) Committee on Health Literacy, 2004), and aims to emphasise the multi-dimensionality of the issue and suggest points of intervention. As observed in *Figure 4*, the sociocultural background, together with the education and health systems, serve as the contextual environment within which oral health literacy exists. Crucially, the interplay between the health system and oral health literacy is emphasised. A patient's oral health literacy can be influenced and modified by the health system; at the same time, oral health literacy informs the way in which the patient interacts with the health system and utilises its services. Ultimately, oral health literacy, along with the contextual determinants, influence oral health outcomes and costs. (National Institute of Dental and Craniofacial Research, 2005).
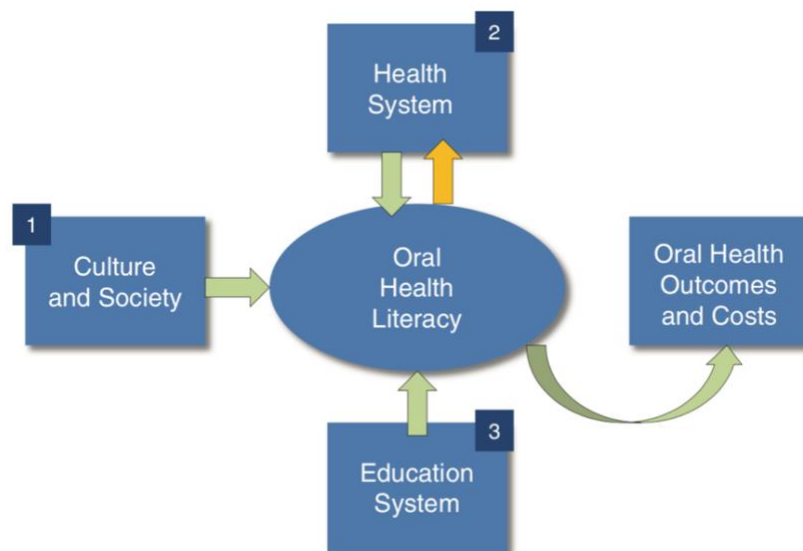
Figure 4. Oral health literacy framework

(Roundtable on Health Literacy; Institute of Medicine, 2013 adapted from Institute of Medicine (US), 2004).

2.2.3 Measuring oral health literacy

The first oral health literacy instruments were adapted versions of previously existing health literacy instruments; in particular, the Estimate of Adult Literacy in Medicine (REALM) (Davis et al., 1993) and the Test of Functional Health Literacy in Adults (TOFHLA) (Parker et al., 1995) were used as a foundation by researches developing oral health literacy tools. Hence, the resulting instruments propagated the same limitations and have been similarly criticised for not providing a comprehensive assessment of oral health literacy by being disproportionally focused on evaluating the skill set of the individual rather than examining how and whether they actually apply it in their health behaviours and utilisation of health services. (Dickson-Swift et al., 2014)

The most popular oral health literacy instruments are those based on the REALM format designed by Davis et al. (1993) (Dickson-Swift et al., 2014). The Rapid Estimate of Adult Literacy in Dentistry (REALD-30) is a REALM adaptation that relies on word recognition, requiring the participants to correctly pronounce thirty dental terms of escalating difficulty and grade their performance on a scale of 0 to 30 (Lee et al., 2007). A range of similarly developed instruments followed, including REALD-99 (Richman et al., 2007), REALM-D (Atchison et al., 2010) and REALMD-20 (Gironda et al., 2013). These word recognition instruments have validated psychometric properties and, while they offer a limited view of oral health literacy, can function as useful screening tools in clinical settings (Dickson-Swift et al., 2014). The first oral health instrument available in Greek (GROHL) was developed by Taoufik et al.; it is also based on the REALD format (2020). GROHL assesses word pronunciation and recognition through the addition of a word comprehension component (Taoufik et al., 2020).

The Test of Functional Health Literacy in Dentistry (ToFHLiD) is an adaptation of the ToFHLA format (Parker et al., 1995) and provides an assessment of oral health literacy through the evaluation of reading comprehension and numeracy skills (Gong et al., 2007). During the initial validation, ToFHLiD demonstrated low internal consistency and a moderate discriminatory ability between health literacy and oral health literacy. However, it showed a strong convergent validity with REALD-99 scores and has been frequently used together with other oral health literacy instruments (Dickson-Swift et al., 2014).

The Oral Health Literacy Instrument (OHLI) is another tool modelled on the ToFHLA format, developed by Sabbahi et al. (2009) to assess functional oral health literacy for adults. OHLI comprises a reading comprehension and a numeracy component. The reading comprehension section consists of two passages on dental caries and periodontal disease with missing words, and the numeracy section tests the ability to comprehend dental prescription directions, post-extraction instructions and clinical appointments. During validation, it exhibited high internal consistency and significant correlation with a concurrently administered oral health knowledge test (Sabbahi et al., 2009).

More recently designed instruments adopted a comprehensive view of oral health literacy and aimed to ameliorate the former shortcomings. The Health Literacy in Dentistry scale (HeLD) was adapted from the Health Literacy Measurement Scale (HeLMS), aiming to quantify oral health literacy as "an individual's ability to seek, understand and utilise oral health information to make appropriate oral health-related decisions" (Jones, 2013). HeLD employs 29 items scored on a Likert-scale in order to reflect the "difficulty experienced" across the seven domains that compose the oral health literacy construct: receptivity, understanding, support, economic barriers, access, communication and utilisation (Jones, 2013). HeLD is a validated, culture-sensitive instrument, appropriate for use in vulnerable or mainstream populations (Dickson-Swift et al., 2014).

The Oral Health Literacy Adults Questionnaire (OHL-AQ) was developed as a generic oral health literacy instrument for adult participants (Naghibi Sistani et al., 2014). The researchers intended to ameliorate what they perceived as limitations of oral health literacy testing; the existing instruments were lengthy, not necessarily relevant across different societies and primarily focused on the assessment of reading comprehension and numeracy skills. The OHL-AQ comprises 17 items, divided into four sections: reading comprehension, listening, numeracy and decision-making. According to the authors, the OHL-AQ is a valid and reliable oral health literacy instrument, suitable for public health purposes, such as community or population-based studies. Its short format and easy administration render it useful in clinical or research settings for the enhancement of oral health-related literacy skills and dentist–patient communication (Dickson-Swift et al., 2014).

The English-language oral health literacy instruments have been linguistically and culturally adapted for use in diverse populations (Cartes-Velásquez and Luengo Machuca, 2017; Peker et al., 2017; Ho et al., 2020). A chronological summary of the main published and validated oral health literacy instruments, based on two systematic reviews, is presented in Table 1 (Dickson-Swift et al., 2014; Ghaffari et al., 2020).

Table 1. Validated oral health instruments (adapted from Dickson-Swift et al., 2014; Ghaffari et al., 2020).

Abbreviation	Instrument name	Authors	Year	Language of validated version	Domains assesed
REALD-99	Rapid Estimate of Adult Literacy in Dentistry	Richman et al.	2007	English	Pronunciation
ToFHLiD	Test of Functional Health Literacy in Dentistry	Gong et al.	2007	English	Comprehension, numeracy
REALD-30	Rapid Estimate of Adult Literacy in Dentistry -30	Lee et al.	2007	English	Pronunciation
OHLI	Oral Health Literacy Instrument	Sabbahi et al.	2009	English	Comprehension, numeracy
CMOHK	Comprehensive Measure of Oral Health Knowledge	Macek et al.	2010	English	Conceptual knowledge
REALM-D	Rapid Estimate of Adult Literacy in Medicine and Dentistry	Atchison et al.	2010	English	Comprehension, pronunciation
TS-REALD	Two-stage Rapid Estimate of Adult Literacy in Dentistry	Stucky et al.	2011	English	Pronunciation
HKREALD-30	Hong Kong Rapid Estimate of Adult Literacy in Dentistry	Wong et al.	2012	Cantonese	Comprehension
OHLA-S	Oral Health Literacy Assessment-Spanish	Lee et al.	2012	Spanish & English	Word recognition, comprehension, service utilisation
REALMD-20	Rapid Estimate of Adult Literacy in Dentistry-20	Gironda et al.	2013	English	Pronunciation
HKOHLAT-P	Hong Kong Oral Health Literacy Assessment Task for Paediatric Dentistry	Wong et al.	2013	Cantonese	Pronunciation
HeLD	Health Literacy in Dentistry	Jones et al.	2013	English	Comprehension, numeracy,
OHL-AQ	Oral Health Literacy Adults Questionnaire	Naghibi Sistani et al.	2013	Persian	Reading/oral comprehension, numeracy, literacy, decision making
AREALD-30	Arabic Rapid Estimate of Adult Literacy in Dentistry	Tadakamadla et al.	2014	Arabic	Pronunciation
IREALD-99	Persian Rapid Estimate of Adult Literacy in Dentistry	Pakpour et al.	2014	Persian	Pronunciation
BREALD-30	Brazilian Rapid Estimate of Adult Literacy in Dentistry	Junkes et al.	2015	Portuguese	Pronunciation
TREALD-30	Turkish Rapid Estimate of Adult Literacy in Dentistry	Peker et al.	2017	Turkish	Pronunciation
REALMD-20	Brazilian Rapid Estimate of Adult Literacy in Medicine and Dentistry	Cruvinel et al.	2017	Portuguese	Pronunciation
OHLA-B	Oral health literacy assessment–Brazilian Portuguese	Bado et al.	2017	Portuguese	Pronunciation, comprehension
OHLI-cl	Chilean Oral Health Literacy Instrument	Cartes-Velásquez and Luengo Machuca	2017	Spanish	Comprehension, numeracy, general
Span-REALD-30	Chilean Rapid Estimate of Adult Literacy in Dentistry	Cartes-Velásquez and Luengo Machuca	2018	Spanish	Comprehension, numeracy, general, comprehension
GRHOL	Greek Oral Health Literacy instrumennt	Taoufik et al.	2020	Greek	Pronunciation, word recognition

2.2.4 Prevalence of limited oral health literacy

The prevalence of limited oral health literacy is considerable, even though it varies significantly between studies. In the Carolina Oral Health Literacy study, a large study with a multi-racial sample of 1,405 low-income female caregivers, 25% of the participants presented low oral health literacy according to their REALD-30 scores (Divaris *et al.*, 2011). In another US study with a high education level sample, low oral health literacy affected a third of the participants. In a Brazilian study with a probability sample of 248 adults, 71.5% had low oral health literacy (Batista, Lawrence and Sousa, 2017). A large epidemiological study in Iran (n = 1,031) showed that 34.8% of the sample had inadequate, and 24.7% had marginal oral health literacy (Flynn, John and Naghibi Sistani, 2018). Mathew and Kabir (2021) reported an alarmingly high prevalence of inadequate and moderate oral health literacy (77.9%) among university students in Ireland. According to an Iranian study, moderate oral health literacy is prevalent even among senior health sciences university students (Yazdani, Mohebbi and Chehree, 2017). The researchers who validated GROHL in a sample of 282 adult patients in Athens, Greece, reported that the participants had a mean score of 12/20; although they refrained from expressly categorising the scores, they stated that they fall within the low-end of the theorised range for similar instruments in the REALD format (Taoufik *et al.*, 2020). These findings, while indicative of limited oral health literacy being a widespread and relatively common issue, should be considered with caution when drawing conclusions or making comparisons; the studies refer to substantially dissimilar population groups and use a vast array of different measuring instruments with largely arbitrary cut-off points for limited oral health literacy.

2.2.5 Determinants of oral health literacy

According to published research, the determinants of oral health literacy include a variety of personal and sociodemographic characteristics. As evident from its definition, oral health literacy is dependent upon personal capacities like cognition, basic literacy and social skills. Older age, limited dental knowledge, lower socioeconomic status, unemployment and lower level of personal or parental education have all been reported in individual studies as risk factors for lower oral health literacy (Jones, Lee and Rozier, 2007; Lee *et al.*, 2011; Horowitz and Kleinman, 2012; Atchison, Macek and Markovic, 2017; Yazdani, Mohebbi and Chehree, 2017; Henderson *et al.*, 2018) Cultural background, race and language barriers may also be

contributing elements to an individual's oral health literacy level (Lee *et al.*, 2011; Atchison, Macek and Markovic, 2017).

2.2.6 Associations of oral health literacy with oral health outcomes and oral health-related behaviours

Several studies have suggested a relationship between oral health literacy and oral health-related behaviours. People with lower oral health literacy exhibit non-adherence to dental appointments, lower usage of routine dental care services and higher usage of emergency ones, lower engagement in preventive behaviours like consistent tooth brushing, and higher incidence of harmful habits such as frequent consumption of carbohydrate drinks and snacks (Sabbahi *et al.*, 2009; Ueno *et al.*, 2013; Baskaradoss, 2016; Batista, Lawrence and Sousa, 2017; Naghibi Sistani *et al.*, 2017). A higher level of oral health literacy was associated with better self-assessed oral health status (Naghibi Sistani *et al.*, 2013), higher performance in indices measuring oral health-related quality of life (Divaris *et al.*, 2011) and improved patient-dentist communication (Guo *et al.*, 2014). In a randomised controlled trial with pregnant women, lower health literacy had a negative effect on retention of oral health information (Vilella *et al.*, 2017). Oral health literacy was negatively associated with dental anxiety, even after adjustment for other factors (Shin, Braun and Inglehart, 2014).

Research findings have also indicated an association between oral health and oral health outcomes. A higher prevalence of oral health conditions, such as dental caries, severe periodontal disease and missing teeth, has been reported among patients with lower oral health literacy (Wehmeyer *et al.*, 2014; Blizniuk *et al.*, 2015; Baskaradoss, 2018). Lower levels of caregivers' oral health literacy have been associated with adverse oral health outcomes in children, such as increased caries incidence and history of endodontic therapy (Miller *et al.*, 2010; Shin, Braun and Inglehart, 2014) and elevated associated expenditures (Vann *et al.*, 2013).

However, the above-mentioned associations should be considered with caution, as individual studies have reported conflicting results. A systematic review of 10 epidemiological studies by Firmino *et al.* (2017) examined the evidence on oral health literacy and associated oral conditions and found a weak association between oral health literacy and dental caries in the

primary dentition. In adult participants, lower oral health literacy was associated with increased loss of clinical attachment and more missing teeth. The other associations could not be corroborated at a higher level due to the limited number of studies reporting on the same outcomes and the substantial clinical and statistical heterogeneity. The researchers further commented on the methodological quality of the individual studies, mentioning non-representative/non-probabilistic sampling (concerning more than two-thirds of the studies) and absence of sample size calculation as the two most commonly observed drawbacks.

In a subsequent systematic review regarding oral health literacy and oral health-related behaviours, the association between oral health literacy and frequency of dental visits could not be verified in the meta-analysis (Firmino *et al.*, 2018). The other associations could not be statistically synthesised due to high heterogeneity or the absence of multiple studies. An association between oral health literacy and dental anxiety was found, but the researchers cautioned against extrapolation since the two studies that reported these results both relied on a care-seeking sample. The evidence on the associations between (1) high oral health literacy and greater oral health knowledge and (2) low health literacy and night bottle-feeding (a detrimental behaviour) were also limited due to methodological shortcomings. Findings regarding other oral health-related behaviours and oral health literacy remained inconclusive. The researchers emphasised the need for more high-quality studies with robust methodologies and comprehensive oral health literacy instruments (Firmino *et al.*, 2018).

2.2.7 Oral health literacy challenges

As with health literacy, the issue of oral health literacy should be regarded comprehensively, taking into consideration the individual's skills or abilities, as well as the demands and complexities of the system they are asked to interact with. Often, oral health information entails unfamiliar terminology and patient-education materials, whether sourced from the dental office or online, may be written in a scientific style riddled with dental jargon, thus rendering it difficult for the average patient to comprehend self-care recommendations fully, treatment options or post-operative instructions (Alexander, 2000; Woodmansey, 2010). Additional challenges, specific to the dental practice settings, such as the high prevalence of dental anxiety (White, Giblin and Boyd, 2017), may further impede effective communication. Post-consultation, dentists and patients differ in their perceptions regarding advice and

agreed-upon future actions, with patients recalling significantly less than what the dental care professionals believed they had communicated (Misra *et al.*, 2013).

2.2.8 Addressing oral health literacy in the clinical setting

It is important for the dental practitioner to be vigilant regarding patients' oral health literacy and verify that effective communication has been achieved. According to research, it is possible for people with health literacy limitations to not perceive them as such or, even if they do, to avoid drawing attention to them and ask for assistance out of discomfort and shame (Parikh et al., 1996; National Institute of Dental and Craniofacial Research, 2005). Patients without apparent communication problems may still face difficulties with written materials that are likely to go unnoticed by health professionals (Easton, Entwistle and Williams, 2010). The stigma associated with literacy difficulties, in combination with the relative commonness of limited health literacy and the challenges in effective screening, has led researchers to advocate for ubiquitous measures and literacy-sensitive support in the clinical setting rather than more targeted approaches (Killian and Coletti, 2017). ADA highlights the importance of increasing the dental team's awareness and knowledge about oral health literacy and urges practitioners to manage its implications with initiatives such as the use of plain language, teach-back techniques –i.e. asking the patients to repeat the information they received– and adoption of universal oral health literacy precautions (American Dental Association, 2020). The latter assume that all patients may face health literacy-related challenges and aim to create an easy-to-navigate environment with professionals that communicate simply, confirm comprehension and support patients' efforts towards health improvement (Agency for Healthcare Research and Quality, 2020). The universal precautions could be applied across the spectrum of a health care system, in public care settings and private practices alike and require from the health practitioners, among others, to communicate clearly, use the teach-back method, follow up with the patients, be culturally sensitive, use assisting materials effectively (such as visual and decision aids) and encourage questions (Agency for Healthcare Research and Quality, 2020).

2.2.9 Interventions for the promotion of oral health literacy

Policy interventions are essential in effectively promoting oral health literacy on an individual, community and health care level. The integration of oral health literacy, along with effective communication skills-building, in dental school curricula has been recommended in order to ensure oral health literacy awareness among dental professionals. Educational community programs regarding oral health literacy have been proposed as an effective strategy that should be culturally-sensitive and primarily focused on vulnerable populations, like children, minorities and low-income groups (Roundtable on Health Literacy; Board on Population Health and Public Health Practice; Institute of Medicine, 2013). The cooperation of different stakeholders, such as dental associations, dental schools, local health organisations and volunteer dental professionals, in collaborative programs for the promotion of oral health in children has demonstrably led to improved outcomes regarding oral health knowledge, frequency of visits to the dentist and brushing habits (Roundtable on Health Literacy; Board on Population Health and Public Health Practice; Institute of Medicine, 2013).

Regarding public health policy in Greece, oral health literacy has not been addressed as a specified issue. However, the National Committee on Oral Health on its National Action Plan for Oral Health 2008-2012, while not expressly acknowledging oral health literacy, recognised limited oral health information and knowledge as a significant issue and included in the list of proposed actions an awareness-raising national campaign (Ypoyrgeio Ygeias kai Koinonikis Allileggyis, 2008). Nevertheless, the majority of oral health-promoting incentives are undertaken by professional associations. In collaboration with volunteer dentists, local authorities, social stakeholders and private sponsors, the Greek Dental Association runs the Program for Promotion and Recording of the Greek Population's Oral health since 2001. In this context, volunteer dentists visit kindergartens, schools and other social institutions, providing essential oral health information in an accessible manner and assessing oral health needs. In addition, the volunteer dentists, in collaboration with primary and secondary education teachers, implement a comprehensive program of experiential learning that incorporates brainstorming, discussion and creative projects on several oral health subjects and has been shown to improve children's oral health outcomes and dental knowledge (Aggelopoulou, Kavvadia and Oulis, 2016).

2.3. Dental Anxiety

2.3.1 Background and definition

Dental fear and anxiety is an exceedingly common phenomenon, which in its severe form constitutes a significant barrier to oral health care attendance, dental treatment, and eventually oral health (Milgrom *et al.*, 2010).

The terms dental fear, dental anxiety and dental phobia, while frequently used interchangeably in the dental literature, denote different concepts. Dental fear is a normal emotional reaction to one or more specific stimuli in the dental environment that are threatening or perceived as such. Dental anxiety represents a state of apprehension that something dreadful is imminent in relation to dental treatment, and it is characterised by a sense of loss of control. In contrast, dental phobia is a clinical diagnosis from a trained professional that refers to a particularly severe type of dental anxiety. It denotes a marked and persistent anxiety, associated either with specific objects/situations, such as dental anaesthesia or drilling, or with the context of dental care in general. Dental phobia is overwhelming, involuntary and leads to the individual avoiding the associated stimuli altogether or enduring them with intense distress; it interferes with the person's social functioning and acts as a significant barrier to dental attendance. Due to the existing ambiguity the umbrella term dental fear and anxiety (DFA) is often used (Klingberg and Broberg, 2007). In the Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM-5), fear of dental treatment is categorised under specific phobias (American Psychiatric Association, 2013). According to Freeman (1999), the diagnosis of dental phobia should have as a prerequisite a history of dental avoidance on the patient's part, rather than be exclusively based on the presence of dental anxiety. Nevertheless, dental anxiety and dental phobia can be viewed as existing in a continuum, with dental phobia occupying the extreme end of the dental anxiety spectrum (Hill *et al.*, 2013; Beaton, Freeman and Humphris, 2014).

2.3.2 Aetiology and pathways of dental anxiety

Dental anxiety has a complex multifactorial aetiology (Beaton, Freeman and Humphris, 2014). Weiner and Sheehan (1990) proposed that dental anxiety sources can be categorised as endogenous and exogenous. The former components comprise internal factors and personal characteristics that render an individual susceptible to anxiety disorders, while the latter refer

to dental anxiety as a consequence of a conditioning process by external factors, i.e. direct or vicarious traumatic dental experiences (Locker *et al.*, 1999). The age of onset of dental anxiety may play a role in its source, with child-onset more likely to be associated with exogenous factors, while adult-onset more prone to having endogenous aetiology (Locker *et al.*, 1999).

The exogenous components comprise negative dental experiences, direct or indirect, that may lead to the development of dental anxiety. Patients with current or former dental anxiety are more likely to report having painful dental treatment in their history when compared with patients who never had dental anxiety (Davey, 1989; De Jongh *et al.*, 1995). Past feelings of extreme helplessness and embarrassment during dental treatment, as well as lack of understanding on the dentist's part, have been associated with a significant prevalence of dental anxiety (Humphris and King, 2011). Researchers have proposed that the phenomenon may follow a classical (pavlovian) conditioning process, whereby a neutral stimulus, when paired with another unconditioned stimulus, becomes able to directly elicit the same response as the latter (Carter *et al.*, 2014). A patient may acquire a conditioned association between dental context stimuli (conditioned stimulus) and the fear or anxiety elicited (conditioned response) due to a traumatic dental experience (unconditioned stimulus). From then on, any further exposure to the conditioned stimulus will be able to elicit dental anxiety (Carter *et al.*, 2014). Common anxiety-inducing factors include, among others, the vulnerable position of laying back on the inclined dental chair and sensory stimuli of the dental environment, such as the sighting of needles or air-turbine drills, the smell of eugenol or cut dentine, high-frequency vibrations, and sounds of drilling or screams (Appukuttan, 2016). The conditioning pathway appears to be the most common in patients with dental anxiety (Carter *et al.*, 2014). However, not all negative dental experiences lead to the development of dental anxiety; the number of non-anxious patients with a history of similar traumatic experiences is considerable, with 60-80% of them reporting at least one painful dental treatment (Davey, 1989; De Jongh *et al.*, 1995). Researchers propose that latent inhibition is the mechanism behind the differentiated outcomes (Davey, 1989; De Jongh *et al.*, 1995; Seligman *et al.*, 2017). A history of relatively painless non-traumatic dental treatments previous to the conditioning event acts as a mitigating factor against future development dental anxiety (De Jongh *et al.*, 1995). Nevertheless, latent inhibition processes may be attenuated if the negative event is significantly painful (Davey, 1989). From this perspective, early dental experiences are

particularly important, and regular positive exposure to the dental care context during childhood or adolescence may act protectively against future development of dental anxiety (Seligman *et al.,* 2017).

Indirect negative experiences may also play a significant role in the development of dental anxiety through a variety of potentially synergistic pathways (Carter *et al.*, 2014). These include:

- The vicarious pathway: refers to a person acquiring dental anxiety via directly observing the fearful dental experience of other individuals (e.g. observing another patient's fear responses during a dental visit).
- The parental pathway: refers to children developing dental anxiety through experiencing parental and especially maternal fearful behaviour. It is related to the vicarious pathway, but in this instance the parental expression of dental fear is the sole influencing factor.
- The informative pathway: involves acquiring a bias for dental anxiety through receiving information about negative dental experiences from other individuals or the media.
- The verbal threat pathway: refers to the fearful emotional response elicited when the dental stimuli are presented in a threatening/dangerous context, i.e. when a visit to the dentist is employed as a form of punishment for undesirable behaviours.

An important indicator of the endogenous origins of dental anxiety is that its presence has been associated with comorbid phobias, such as agoraphobia, social phobia and other simple phobias like phobia of flying, heights, enclosed spaces or blood (Roy-Byrne *et al.*, 1994; Locker, Shapiro and Liddell, 1997; Locker, Poulton and Thomson, 2001; Tellez *et al.*, 2015). Furthermore, the incidence of depression and mood disorders is increased among individuals with high dental anxiety (Halonen *et al.*, 2018). Individual perceptions of uncontrollability, unpredictability, dangerousness and disgustingness have been reported as more accurate predictors of dental anxiety than negative dental experiences (Armfield, 2010). Cognitive ability may also play a role in dental anxiety; children who score higher on verbal intelligence quotient (IQ) had a lower level of dental anxiety (Blomqvist *et al.*, 2013). In a large longitudinal study of over 2000 twins, an element of hereditary genetic predisposition towards dental anxiety has been suggested, with the heritability of the associated traits being higher for girls

than boys (Ray *et al.,* 2010). However, while genetics may influence an individual's vulnerability to dental anxiety, they are considered a distal factor in the development of actual phobic symptoms (Carter *et al.,* 2014).

2.3.3 Dental anxiety and dental attendance: the vicious cycle model

Armfield *et al.* (2007) supported the model of the vicious cycle of dental fear (*Figure 5*), as an illustration of the pathway that links dental fear and anxiety with treatment avoidance and dental problems (*Figure 5*). According to this hypothesis, people who suffer from high dental fear are prone to delaying dental treatment. As a consequence, their dental problems become more extensive and severe, making it more likely that subsequent dental visits will occur in order to address acute symptoms. These visitation patterns are performed under duress and do not serve as an opportunity to reframe the dental care context since emergency dental treatment is often invasive and even painful until the cause can be properly addressed. Thus, any positive outcome from the exposure to the dental setting is likely mitigated by the potentially aversive treatment experience. This situation creates a feedback loop that further reinforces or exacerbates the existing dental anxiety, leading to the continuation of the vicious cycle. The same study reported that 29.2% of the people who had high dental fear had a history of dental avoidance, symptom-driven treatment and poor oral health, as opposed to 11.6% of the people who were not afraid (Armfield, Stewart and Spencer, 2007).
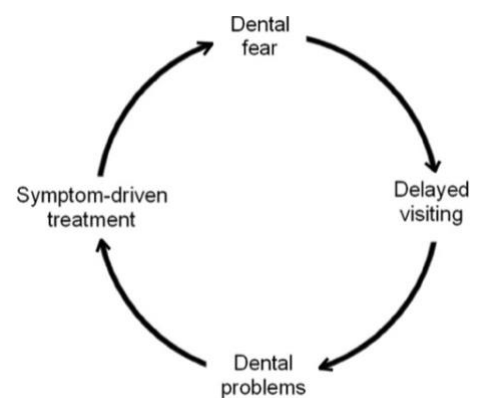
Figure 5. *Model of the vicious cycle of dental fear (Armfield, Stewart and Spencer, 2007)*

This model is a slightly altered version of the vicious cycle of dental anxiety that was proposed by Berggren (Berggren and Meynert, 1984), who first described the feedback loop between

dental anxiety/fear, dental avoidance, progressively deteriorating oral health status and the subsequent feelings of guilt, shame and inferiority.

Figure 6. *The vicious circle of dental anxiety as described by Berggren (Moore, Brødsgaard and Rosenberg, 2004)*

Milgrom *et al.* (1995) proposed that dentally anxious patients can be sorted in four different categories, based on their dental care attendance patterns:

- Apprehensive patients: they experience a relatively moderate degree of dental anxiety that does not necessarily cause issues during dental treatment; they do not avoid dental care.
- "Goer but hater" patients: they experience a significantly more intense level of dental anxiety, but not at a rate that will impede regular dental attendance; great mental efforts on the patient's part may be required to tolerate the treatment (Bernson *et al.*, 2011).
- Partial avoiders: they experience high dental anxiety that may lead to significant delays in seeking dental care. These patients may postpone making dental appointments for significant periods of time, only attending a dentist in cases of dental emergency.
- Total avoiders: phobic patients who largely avoid dental care altogether.

However, patients with high levels of fear may still seek and complete dental treatment; these patients may have adequate coping mechanisms at their disposal or their tendency to abide by social norms is more impactful than their tendency to avoid dental treatment (Vassend, 1993).

2.3.4 Identifying and measuring dental anxiety

Dental anxiety can be identified and measured through a variety of means, including semi-structured interviews, anxiety questionnaires and objective measurements.

The semi-structured interviews are ideal for the clinical setting and could be part of the initial patient–dentist interaction. The dentist can use a few open-ended questions, aiming to identify the main reason for the visit, previous dental experiences and the fears, worries, and expectations of the patient regarding dental treatment. This method does not provide an exact quantification, but rather aids the clinician in detecting an underlying dental anxiety and adjusting accordingly in terms of behaviour towards the patient and treatment planning. In the case that suspicion of a wider psychological disorder arises, a multi-disciplinary approach should be followed by providing a referral to the appropriate professionals. (Appukuttan, 2016)

The objective measures refer to the assessment of physical reactions known to be associated with elevated levels of anxiety, such as the patient's blood pressure, pulse rate, oxygen levels, finger temperature and galvanic skin response (Appukuttan, 2016). While methods based on physiological stress markers are considered accurate –e.g. the galvanic skin response, which provides an evaluation of sweating in response to anxiety (Caprara *et al.*, 2003)–, they are mostly used in research settings due to the special equipment required, that may also appear threatening (Folayan, Idehen and Ojo, 2004).

The dental anxiety questionnaires are single or multi-item self-reporting instruments aiming to assess dental anxiety in patients, and can be used in both clinical and research settings. Single-item questionnaires include instruments like the Dental Anxiety Question ("Are you afraid of going to the dentist?") (Neverlien, 1990) and the visual analogue scale (Luyk, Beck and Weaver, 1988). They are brief and straightforward but do not provide further context on the specific source of the anxiety or fear. While no instrument is considered a gold standard, the multi-item questionnaires Corah's Dental Anxiety Scale (CDAS) (Corah, 1969), Modified Dental Anxiety Scale (MDAS) (Humphris, Morrison and Lindsay, 1995) and Dental Fear Survey (DFS) (Kleinknecht, Klepac and Alexander, 1973) are the most commonly used in published research (Appukuttan, 2016).

Corah's Dental Anxiety Scale (CDAS) is a brief dental anxiety instrument that comprises four questions regarding dental anxiety in different dental situations (the day before a dental appointment, waiting in the dental office, tooth drilling, teeth cleaning). There are five response options for every question, each of them corresponding to a different level of dental anxiety. The questions are scored from 1 ("not anxious") to 5 ("extremely anxious"), thus leading to a range of 4 to 20, with 15 as the cut-off score for potentially phobic patients (Corah, 1969). The psychometric properties of CDAS have been validated in multiple languages (Appukuttan, 2016).

The Modified Dental Anxiety Scale (MDAS) is a more recent modification of the CDAS with uniform responses in a five-point Likert scale ranging from "Not anxious" to "Extremely anxious". A fifth question was added to the 4 questions of CDAS, inquiring specifically about anxiety related to dental anaesthesia. These changes were made in order to improve comparability between responses and provide a more comprehensive assessment of dental anxiety since the fear of injection is thought to be almost as common as the fear of tooth drilling. MDAS scores range from 5 to 25, with higher scores denoting higher dental anxiety and a cut-off value of 19 for potentially phobic patients (Humphris, Morrison and Lindsay, 1995). MDAS is widely used and has been extensively validated in an array of languages, including Greek (Humphris, Morrison and Lindsay, 1995; Coolidge, Arapostathis, *et al.*, 2008; Chapman *et al.*, 2010; Appukuttan *et al.*, 2012; Giri *et al.*, 2017).

The Dental Fear Survey (DFS) is a reliable and valid instrument that comprises 20 items, each having five possible responses. DFS covers dental treatment avoidance, physical reactions to anxiety and reactions to different stimuli in the dental care context. The resulting scores range from 20 to 100, with 60 as an empirical cut-off score for potentially phobic patients (Kleinknecht *et al.*, 1984).

2.3.5 Prevalence of dental anxiety

While it is generally acknowledged that dental anxiety is relatively common, its prevalence varies between studies, depending on ethnological and cultural factors, as well as the characteristics of the measuring instrument employed (Schwarz and Birn, 1995; Folayan, Idehen and Ojo, 2004). The prevalence of high dental anxiety has been reported to be as low

as 5.4% for an urban Swedish population (Hakeberg, Berggren and Carlsson, 1992), while in a Japanese study of 3041 adolescents and adults, 42.1% had high dental fear (Weinstein *et al.*, 1992). Researchers in a telephone survey in Australia (Armfield, Spencer and Stewart, 2006) reported that 16.1% of the 7312 participants had high dental fear. In a Dutch survey of 1,959 adults, the prevalence of dental anxiety was 24.3%, and dental phobia was the most common among the phobias inspected, having a prevalence of 3.7% (Oosterink, de Jongh and Hoogstraten, 2009). In Greece, a study of 270 dental patients with the MDAS instrument reported a 7% prevalence of dental phobia (Makri, Alexias and Togas, 2020). In a second study of 164 adults, dental phobic and highly dentally anxious patients comprised 7.9% and 14,6% of the sample respectively (Tsimpiris, Triadafyllidou and Anagnostopoulos, 2020).

2.3.6 Determinants of dental anxiety

Dental fear and anxiety are presumed to have a social gradient, with higher levels being associated with worse socioeconomic status and a lower level of educational attainment (Moore *et al.*, 1993; Armfield, Spencer and Stewart, 2006; Pohjola *et al.*, 2007; Milgrom *et al.*, 2010; Heidari, Banerjee and Newton, 2015). Women consistently appear to be more susceptible to high dental anxiety than men (Moore *et al.*, 1993; Armfield, Spencer and Stewart, 2006; Milgrom *et al.*, 2010; White, Giblin and Boyd, 2017), a finding that coincides with the higher percentages of anxiety observed in women (Feingold, 1994). As a possible explanation of the phenomenon, researchers have suggested that women may be more forthcoming than men in expressing and admitting their fears (Pierce and Kirkpatrick, 1992). Dental anxiety has been negatively associated with age, being more prominent in younger versus older groups, in studies of both children and adults (Klingberg and Broberg, 2007; Humphris, Dyer and Robinson, 2009). However, these findings are not universally consistent, with studies reporting dental anxiety oscillating between lower and higher levels for progressively older age groups (Locker, Shapiro and Liddell, 1996).

2.3.7 Implications of high dental anxiety

High dental anxiety has been associated with adverse oral health outcomes. People with high dental anxiety reportedly have less restored dentitions, higher incidence of dental caries and a more frequent presence of other adverse oral conditions like puss, ulceration, fistulae or

abscesses (Heidari, Banerjee and Newton, 2015). More missing teeth (Locker and Liddell, 1992) and worse periodontal status (Ng and Leung, 2008) have also been connected to higher levels of dental anxiety. People who engage in deleterious behaviours, such as regular smoking, and do not adhere to preventive behaviours (i.e. frequent tooth brushing) are more likely to be very afraid of visiting the dentist (Pohjola *et al.*, 2008).

The link between dental anxiety and dental avoidance is well-documented (Berggren, 1993; Moore *et al.*, 1993; Armfield, Stewart and Spencer, 2007). A large nationwide study in Finland (n = 8028) revealed that in 41% of the cases who did not visit a dentist consistently, irregular dental attendance could be attributed to high dental fear, thus suggesting that if the latter was eliminated, ceteris paribus, the individuals would become regular attendees (Pohjola *et al.*, 2007). Dental phobic patients who are long-term avoiders may suffer consequences in terms of their social life, and experience feelings of loneliness and isolation (Berggren, 1993). High dental anxiety has been reported to double an individual's risk of belonging to the tier with the poorest oral health-related quality of life (McGrath and Bedi, 2004).

2.3.8 Management of patients with dental anxiety

Dental anxiety can be managed through a variety of psychotherapeutic methods: from relatively simple ones, such as communication building, positive reinforcement, active distraction and relaxation techniques, to more specialised ones like cognitive behavioural therapy and hypnotherapy. Pharmacological interventions like sedation or general anaesthesia may be required if the psychotherapeutic approach is not suitable or fails to produce satisfactory results. In the clinical setting, interventions that render the dental environment more friendly and relaxing –such as muting potentially anxiety-inducing noises from the operation room, reducing waiting times and playing soft music– can play an important role in mitigating the initiation of dental anxiety. (Appukuttan, 2016)

Highly anxious patients are hypervigilant, have a heightened perception of pain during treatment, and are less cooperative with dental professionals; their successful treatment is a challenging task that requires more time and resources and may result in a stressful experience for both dentist and patient (Moore and Brødsgaard, 2001; Appukuttan, 2016; Lin, Wu and Yi, 2017). Anxiety has been associated with inattentiveness, poor memory and confusion, which

may further impede dentist-patient communication (Appukuttan, 2016). It is essential for all dental practitioners to be mindful of dental anxiety, understand its aetiology and mechanisms and adopt appropriate alleviating behaviours, that include but are not limited to: being friendly, composed, non-judgmental and empathetic to the patient, appearing competent and respectful, encouraging questions and two-way communication, listening actively to the patient's fear and concerns, providing information and moral support and being honest without giving false reassurances (Corah, 1988; Bernson *et al.*, 2011; Appukuttan, 2016). Lack of understanding or impoliteness on the dental practitioner's part has been reported as a past negative exposure associated with an increased risk of high dental anxiety (Oosterink, de Jongh and Aartman, 2009). Hence, a positive dental experience with a supportive dentist and enhanced dentist-patient communication is not only crucial for the effective management of a dentally anxious patient, but may also play a mitigating role against the future development of high dental anxiety in non-anxious patients.

2.3 Oral health literacy and dental anxiety

Oral health literacy is an emerging concept with potentially significant oral health effects. Both limited oral health literacy and dental anxiety are important barriers to comprehensive patient-centred dental care and, in extension, oral health in general. The two issues are related to the utilisation of oral health care services and dentist-patient communication; in addition, they appear to have a significant social gradient that could further intensify existent health disparities.

However, to the author's knowledge, only three published studies have attempted to explore the relationship between oral health literacy and dental anxiety (Shin, Braun and Inglehart, 2014; Barasuol *et al.*, 2017; Kadambari and Leelavathi, 2019). The first research team conducted a study of 187 parents/guardians and children in the US and, considering a lack of understanding as a possible exacerbator of dental anxiety, they hypothesised that patients with lower oral health literacy would have higher dental anxiety. They developed multiple linear regression models for both dental anxiety and oral health literacy, rotating the positions of the two variables between dependent and independent (Shin, Braun and Inglehart, 2014). A significant association was found in all instances, suggesting the presence of a relationship between oral health literacy and dental anxiety, the specific pathways of which remain unclear. Barasuol et al. (2017), in their study of 168 caregivers and children in Brazil, having developed a Poisson regression model with dental anxiety as the dependent variable, also reported a significant bivariate and multivariable association between the two constructs and highlighted the cross-cultural strength of said association. Both research teams emphasised the need for further research in community-based settings since certain parameters –like dental anxiety– may differ significantly in an actively dental care-seeking population. Kadambari and Leelavathi (2019) reported a significant negative correlation between dental anxiety and oral health literacy ($r = -0.388$, $p < 0.001$); however, the main focus of the paper was the individual effects of parents' dental anxiety and oral health literacy on children's oral health.

3. Aims, objectives and research hypotheses

Aims:

I. To detect and quantify the oral health literacy of University of Macedonia (UoM) students through a newly translated and validated oral health literacy instrument.

II. To assess the prevalence of dental anxiety in University of Macedonia (UoM) students and investigate the relationship between oral health literacy and dental anxiety in the same population.

III. To explore the associations between these two constructs and several sociodemographic factors and oral health-related variables.

Objectives:

- To collect, via specialised instruments (questionnaires), data pertaining to:
  › oral health literacy among UoM students and
  › the dental anxiety of UoM students.
- To gather additional data regarding population parameters of importance.
- To perform statistical analysis of data from both sets of specialised questionnaires in order to measure the levels of oral health literacy and dental anxiety and further explore them against the associated population parameters.
- To suitably synthesise the data from both sets in a regression model, control for important confounding variables and investigate whether a correlation between oral health literacy and dental anxiety can be inferred.

Research hypotheses:

1ˢᵗ Hypothesis: The prevalence of limited oral health literacy is considerable, even among a highly educated population.

2ⁿᵈ Hypothesis: Oral health literacy is associated with sociodemographic factors and oral health-related characteristics.

3ʳᵈ Hypothesis: Dental anxiety is associated with sociodemographic factors and oral health-related characteristics.

4ᵗʰ Hypothesis: Oral health literacy and dental anxiety are negatively associated on a multivariable level. An increase in oral health literacy scores would bring about a statistically significant reduction in dental anxiety scores.

4. Materials and Methods

4.1 Study design

This exploratory observational study followed a cross-sectional design, in the form of a questionnaire survey.

4.2 Ethical considerations

The research protocol was approved by the Ethics Committee of the University of Macedonia (Appendix 1) and was conducted in accordance with the declaration of Helsinki (World Medical Association, 2013). All data were collected anonymously. Participation in the study was voluntary, and all individuals reserved the right to withdraw their informed consent at any point.

4.3 Setting and participants

The on-site research was conducted on the University of Macedonia premises in November, 2019. The researcher adopted a convenience sampling process by contacting the professors who held courses in the Department of Business Administration at the time and asking for permission to perform the survey at the beginning of the respective lectures. All students who (1) were able to read and fill the survey form independently and (2) gave oral consent, were considered eligible for participation.

4.4 Sample size calculation

A sample size estimate was calculated through power analysis performed with the G*Power program for Mac OS, version 3.1.9.4 (Faul et al., 2007). According to findings from previously published research (Sistani et al., 2013; Shin, Braun and Inglehart, 2014; VanWormer, Tambe and Acharya, 2019), the sample size was calculated to detect a medium effect size (d = 0.45, corresponding approximately to a 1-point difference in the OHL-AQ score between two groups). Assuming α = 0.05 and β = 0.05, the analysis yielded a required sample size of 260

participants when testing for significant mean differences with a 2-tailed t-test for independent samples. Due to the in-person nature of the survey, the response rate was expected to be relatively high; nevertheless, around 10% of the required sample was added to account for unreturned questionairres.

4.5 Measurement instruments

Questionnaires in general, provide a succinct, standardised and cost-effective way of gathering research data that precludes researcher/interviewer bias via its uniformity. The whole process can be effectively anonymised, for confidentiality purposes. While there are certain disadvantages, such as low response rates, reduced quality and depth of information and potential for misunderstandings, these can be mostly mitigated by applying a robust research strategy. (Gillham, 2007)

Structured questionnaires are the most common means used in the published literature to measure oral health literacy and dental anxiety. Taking into consideration the availability of reliable quantifying tools for the above-mentioned fields and the general advantages offered by this process, the questionnaire survey was chosen as the design best suited to the aims of the present study.

4.5.1 Questionnaire development

The questionnaire of the study comprises three main sections: an instrument measuring oral health literacy (GR-OHL-AQ), a tool measuring dental anxiety (MDAS), and a third part pertaining to sociodemographic factors and variables associated with oral health and oral health-related behaviours and experiences. There are 29 items overall, and the completion time was estimated at approximately 15 minutes. All variables and their coding can be seen in *Table 2, Table 3* and *Table 4.*

Part 1: Oral health literacy – Adults questionnaire (OHL-AQ)

Instrument selection — development

The oral health literacy instruments most frequently used in published research are based on the REALM format (e.g., REALD-30, REALM-D and their adaptations) (Dickson-Swift et al.,

2014). Their design employs word recognition to provide a reliable approximation of the skills and abilities associated with OHL. However, it has been argued that these tools may not be very efficient in distinguishing whether a patient has a real understanding of each term or merely the ability to pronounce the words with no deeper grasp of their meaning (Richman et al., 2007).

While pronunciation instruments are considered valuable predictors of comprehension in English (Davis et al., 1998), the phonetic structure of the Greek language hinders their application and suitability for Greek-speaking populations. Greek is characterised by a consistent grapheme-to-phoneme correspondence, i.e., one letter usually represents a singular sound (Protopapas and Vlahou, 2009). The high feedforward consistency of the Greek language (95.1% consistent in the reading direction) renders it quite transparent, especially in comparison to a relatively feedforward-opaque language, such as English (Protopapas and Vlahou, 2009). The emerging concern is that a person can pronounce a word relatively easily if they are able to recognise the letters. Even patients with low oral health literacy could presumably achieve a high score in tests relying exclusively on word pronunciation, thus compromising the validity of the resulting estimations.

Apart from the aforementioned challenges regarding the REALM format, there is concern that other oral health literacy instruments could professedly offer a more accurate assessment of the patient's functional oral health literacy levels. These alternative formats rely on the evaluation of various cognitive abilities related to everyday oral health-related tasks and decisions, rather than approximating the OHL estimate via word pronunciation. Taking these factors into consideration, the *Oral Health Literacy – Adults Questionnaire (OHL-AQ)* was selected as the most appropriate instrument for the purposes of the present thesis.

The Oral Health Literacy – Adults Questionnaire OHL-AQ, as briefly discussed in the Literature review chapter, is an instrument directed at quantifying the oral health literacy level of adult patients. The OHL-AQ was initially developed for an Iranian-speaking population and was subsequently translated to English by the original authors (Naghibi Sistani et al., 2014). It is a valid and reliable instrument, suitable for use in clinical and community settings (Naghibi Sistani *et al.*, 2014; Flynn, John and Naghibi Sistani, 2018), and it has consistently demonstrated

good psychometric properties across its translation and validation in other languages, including Hindi and Mandarin (Vyas *et al.*, 2016; Ho *et al.*, 2020).

The OHL-AQ consists of 17 items, distributed in four distinct sections. Functional oral health literacy is estimated through evaluating the patient's skills in four conceptual dimensions, i.e., reading comprehension, numeracy, listening (communication skills), and decision-making. In the reading comprehension section (reading and knowledge skills) the participant is required to complete sentences with six missing words/phrases by selecting the correct response out of a list of five multiple choice options. The Numeracy section (reading, writing and calculation skills) consists of two common sample prescriptions, each one attached to two questions (one free-text and one multiple choice). In the Listening section (listening, reading, writing, calculation, and communication skills), the participants are asked to listen to the post-extraction instructions recited by the researcher and respond to two questions (one free-text and one multiple choice). The final section, Appropriate decision-making (reading, comprehension, and decision-making skills), comprises five questions in multiple-choice format. The participants' questionnaire forms are scored on a scale from 0 to 17, with each correct answer awarding 1 point. According to the developing authors, the resulting scores can be grouped into three categories for their interpretation:

  i.   inadequate OHL (0-9),
  ii.   marginal OHL (10-11), and
  iii. adequate OHL (12-17) (Naghibi Sistani *et al.*, 2014; Flynn *et al.*, 2016).

Translation

The instrument was translated in two stages. A native Greek speaker (C.S.), specialising in dental care and proficient in English, provided the Greek translation (T) of the English version of OHL-AQ (Naghibi Sistani *et al.*, 2014). A bilingual dental proffessional (M.C.), blinded to the original questionnaire, back-translated T to English (BT). The BT version was compared to the original English OHL-AQ, and a few refinements were made. The final version was evaluated by the dentist who provided the original translation, another dental professional (F.K.) and an academic expert in public health and questionnaire development (V.A.). Minor modifications regarding clarity and cohesiveness were made until a consensus on the accuracy and suitability

of the translated instrument was reached. The Greek translation of OHL-AQ is available in the Appendix 2.

Because of the proposed setting of the study, the layout of OHL-AQ was slightly altered by moving the Listening component (that requires the participation of the researcher) at the beginning of the instrument; thus, having listened to the instructions provided by the researcher and completed the first part, the participants would be free to proceed uninterrupted with the rest of the questionnaire which is in a self-administered format.

Pilot testing – Validity

In order to assess the face validity of the questionnaire in the target population (university students) and identify potential issues with the translated items, the Greek version of OHL-AQ was administered to ten volunteers (from the same population), during the pilot testing phase. The questionnaire was positively appraised by the participants and no issues regarding its content, clarity and comprehensibility were reported.

According to previous research, the content validity of the instrument was deemed satisfactory (Naghibi Sistani *et al.*, 2014; Ho *et al.*, 2020). In this study, it was evaluated and approved by all four professionals involved in the translation process, but no specific index was used.

Construct validity was determined via known-groups comparisons. The OHL-AQ scores were examined in relation to subgroups of several sociodemographic and oral health-related variables. In accordance with previously published OHL-AQ validation studies, students with poorer self-perceived oral health status and inadequate oral health behaviors (i.e., infrequent tooth brushing) were hypothesised to have lower oral health literacy (Naghibi Sistani *et al.*, 2014; Flynn *et al.*, 2016). Even though individuals with higher educational attainment have been shown to achieve higher oral health literacy scores (Naghibi Sistani *et al.*, 2014; Flynn *et al.*, 2016), the known-groups validity was not tested in terms of education level, due to the uniformity across the sample (university students)

The internal consistency of the translated OHL-AQ instrument was assessed via Cronbach's alpha. Values above 0.70 were considered indicative of acceptable internal consistency reliability (Nunnally, 1978).

Due to the designated approach of the questionnaire administration, it was not possible to assess the reliability of the translated OHL-AQ via the "test-retest" method.

Part 2: Modified Dental Anxiety Scale (MDAS)

The Modified Dental Anxiety Scale is an instrument designed to detect and quantify the dental anxiety of patients (Humphris, Morrison and Lindsay, 1995). It was developed based on Corah's Dental Anxiety Scale (Corah, 1969), with the aim of further calibrating the new scale towards situations that can possibly trigger dental anxiety and improving upon the psychometric properties of DAS. MDAS comprises five questions, each requiring of the patient to assess their level of dental anxiety in the context of common dental situations; i.e., having a dental appointment the next day, sitting in the waiting room of a dental office, having their teeth drilled, receiving a dental scaling and receiving dental anaesthesia. The responses are expressed on a five-point Likert scale, ranging from the level of the least dental anxiety ("not anxious") to the greatest ("extremely anxious"). A score from 1 to 5 is assigned to the respective responses, and the patient's dental anxiety level is represented by the sum of the individual scores, ranging from 5 to 25.

Dental anxiety, as a construct, exists in a continuum. However, for practical and statistical purposes, the patients can be empirically classified according to their total MDAS scores in five categories:

    i.   not anxious (0-5),
   ii.   low anxiety (6-10),
  iii.   moderate anxiety (11-14),
  iv.   high anxiety (15-18), and
   v.   extreme anxiety/phobic (19-25). (Giri *et al.*, 2017)

In terms of comparability between studies, it is important to establish that not all researchers use the above-mentioned categorisation. The cut-off value of 19 that denotes a patient with extreme anxiety is universally adopted and can be used as an indicator for a potentially phobic patient in need of particular management or assistance. While it has been well-established via research in both clinical and community settings, it remains a useful approximation rather than a hard criterion (Humphris, Morrison and Lindsay, 1995; Humphris and King, 2011). The

ultimate decision of whether the patient truly qualifies as phobic lies with the clinician/researcher and should be determined on an individual basis (Humphris, 2020).

MDAS is one of the most frequently used instruments in dental anxiety research (Giri *et al.*, 2017). The process has been demonstrated not to elevate the anxiety level of the participants (Humphris and Hull, 2007); hence, it can provide a robust estimation within clinical and community settings, without inducing further obstruction or bias through the exacerbation of the patients' mental/emotional state. The self-administered format is easy to complete, straightforward and time-efficient. MDAS has been translated and adapted into various languages, including Turkish, Greek, Spanish, Chinese, Tamil, Arabic, Italian, Malay, and Finnish (Humphris, Morrison and Lindsay, 1995; Ilgüy *et al.*, 2005; Yuan *et al.*, 2008; Coolidge, Arapostathis, *et al.*, 2008; Coolidge, Chambers, *et al.*, 2008; Appukuttan *et al.*, 2012; Bahammam and Hassan, 2014; Facco *et al.*, 2015; Sitheeque *et al.*, 2015; Giri *et al.*, 2017; Tolvanen *et al.*, 2017). Its psychometric properties have been evaluated in these diverse populations and settings, consistently demonstrating a good cross-cultural validity, reliability and internal consistency (Coolidge *et al.*, 2010; Giri *et al.*, 2017).

The translation and adaptation of MDAS in Greek (available in Appendix 2), authored by Coolidge et al. in 2008, corroborated its excellent internal consistency (Cronbach's alpha value of 0.90) and high test-retest reliability (0.94). The psychometric properties of the Greek version were deemed satisfactory overall and comparable to the findings of previously published studies. In addition, the cut-off value for extremely anxious patients (≥ 19) was confirmed via examining the correlation with the respective independent ratings of the treating/observing dentist (Coolidge, Arapostathis, *et al.*, 2008).

Part 3: Sociodemographic aspects and variables associated with oral health

The third part of the study questionnaire comprises 12 items and focuses on relevant sociodemographic factors of importance, as well as variables pertaining to dental anamnesis and oral health-related behaviours. The first 7 items are related to sociodemographic characteristics of the participant, such as age, sex, financial situation etc. Oral health literacy has been closely associated with individual educational attainment. Since in our population –a university student body– this variable is more or less uniform, data on the parental level of

education were collected. The rest of the items are oral health-related and include data on the history of traumatic dental experience, self-perceived oral health status, tooth brushing frequency, frequency of dental visits and age of first dental visit.

4.5.2 Pilot testing

The study questionnaire was pre-tested in its entirety so as to reveal any potential inadequacies. Ten UoM students participated in the pilot testing after receiving a brief introduction to the study concepts. No issues regarding readability and clarity were reported, while the participants assessed the items as comprehensible and relevant to the study theme; hence, no changes were made to the questionnaire. All data collected at this stage were excluded from the main study.

Table 2. Sociodemographic variables of the sample and their coding.

Sociodemographic variables	Type	Levels/Coding
Gender	Qualitative (nominal)	Male = 1 Female = 2
Age	Quantitative (continuous)	not applicable
Year of study	Qualitative (ordinal)	1st = 1 2nd = 2 3rd = 3 4th or greater = 4
Place of origin	Qualitative (nominal)	City/urban area = 1 Town/Village = 2
Father's education	Qualitative (ordinal)	Primary education = 1* Secondary education = 2* Tertiary education (undergraduate studies) = 3** Postgraduate education/Doctorate = 4**
Mother's education	Qualitative (ordinal)	Primary education = 1* Secondary education = 2* Tertiary education (undergraduate studies) = 3** Postgraduate education/Doctorate = 4**
Financial situation of the household	Qualitative (ordinal)	Facing insurmountable financial difficulties = 1* Facing great financial difficulties = 2* Able to cover expenses w/o substantial savings = 3 Financially comfortable = 4 Don't know/No opinion = Missing

* levels merged for analytical purposes

** levels merged for analytical purposes

Table 3. Oral health-related variables of the sample and their coding.

Oral health-related variables	Type	Levels/Coding
Previous traumatic dental experience	Qualitative (ordinal)	Yes = 1 No = 2
Self-perceived oral health status	Qualitative (ordinal)	Very good = 1* Good = 2* Moderate = 3** Fair = 4** Poor = 5** Don't know/No opinion = Missing
Tooth brushing frequency	Qualitative (ordinal)	Twice per day (at least)= 1` Once per day = 2* Less than once per day = 3* Never = 4*
Frequency of dental visits	Qualitative (ordinal)	Every six months = 1* Every year = 2* Only when facing a dental problem = 3** Even less frequently = 4**
Age of first dental visit	Qualitative (ordinal)	Up to 5 years old = 1* 6 − 12 years old = 2* 12 − 18 years old = 3** Over 18 years old = 4**

* levels merged for statistical purposes

** levels merged for statistical purposes

Table 4. Oral health literacy and dental anxiety instrument variables and their coding.

Measurement instruments variables	Type	Levels/Coding
OHL-AQ score	Quantitative (discrete)	0 − 17
Oral health literacy level (according to OHL-AQ score)	Qualitative (ordinal)	Inadequate (0 − 9) = 1 Marginal (10 − 11) = 2 Adequate (12 − 17) = 3
M-DAS score	Quantitative (discrete)	5-25
Dental anxiety level (according to M-DAS score)	Qualitative (ordinal)	No anxiety (5) = 1 Low anxiety (6 − 10) = 2 Moderate anxiety (11 − 14) = 3 High anxiety (15 − 18) = 4 Extreme anxiety/possibly phobic patient (19 − 25) = 5

4.6 Data collection

The researcher (C.S.), along with a trained assistant (F.K.) entered the lecture classrooms and auditoriums, after consultation with the teaching professors. After proper introductions, the researcher thoroughly explained the purpose of the study, as well as the questionnaire response format to the participants. The questionnaire was not framed as a test, but rather as a procedure that would generate valuable information in the public health field and assist a fellow student with her thesis. The necessity of individually obtained answers was emphasised to avoid cross-contamination and strengthen the validity of the results. The privacy and confidentiality of answers and the option of withdrawal at any time were pointed out in order to obtain informed consent before the beginning of the study.

Once the forms were distributed, the researcher addressed the participating students to confirm that they could all listen clearly to the listening part of the OHL-AQ questionnaire that would follow. The brief post-extraction instructions were recited twice, as per the questionnaire protocol. Before the repetition of the sentences, any participant facing problems with listening was invited to say so. No issues were recorded.

Following the listening component, all participants were instructed to continue with the self-administered part of the forms. The researcher and the assistant provided clarifications regarding the filling method and administration upon request, but no further assistance pertaining to the substantial components of the questionnaires was offered. The participants were discouraged from collaborating on the answers and no such occurrence was noted.

The questionnaires were collected upon completion. Out of the 285 forms distributed, 278 were returned, thus constituting a very high response rate of 98%.

4.7 Data analysis

Descriptive statistics were used to produce suitable summary measures for all documented variables. The data were checked for missing values and duplicates. Each of the quantitative variables was tested for normality (Shapiro-Wilk test and graphs), and the corresponding statistical summary was acquired (mean, standard deviation and 95% confidence intervals,

median, interquartile range etc., as appropriate). The qualitative variables were summarised by absolute and relative frequencies.

Cronbach's alpha coefficient was used in order to evaluate the internal consistency of the translated OHL-AQ instrument. Values greater than $\alpha = 0.7$ were considered indicative of acceptable internal consistency.

For the purposes of bivariate and multivariable analysis, subcategories of qualitative variables with few participants were merged, on the condition that the contextual frame could support such action. A few additional variable subcategories were merged for interpretation purposes.

Bivariate analysis was used to compare the levels of oral health literacy (OHL-AQ total scores) and dental anxiety (MDAS total scores) for the subcategories of the sociodemographic and oral health-related variables. The normality of the OHL-AQ and MDAS scores' distributions within the aforementioned subgroups was evaluated statistically (descriptives, Shapiro-Wilk test at a significance level of $\alpha = 0.05$) and graphically (boxplots). The null hypothesis (H_0) of normally distributed data was rejected in all instances. Due to the observed departure from normality, non-parametric tests were used.

The Mann-Whitney U test has a null hypothesis (H_0) of no difference between the mean ranks of the data in two groups. The rejection of H_0 suggests a statistically significant difference between the groups. It was used to compare:
> the OHL-AQ scores for the subcategories of dental anxiety scores.
> the OHL-AQ and MDAS scores for the subgroups divided by sex, place of origin, parental education level, previous traumatic dental experience, self-perceived oral health status, tooth brushing frequency, frequency of dental visits and age of first dental visit.

The Kruskal-Wallis H test has a null hypothesis (H_0) of no difference between the mean ranks of the data in several groups. The rejection of H_0 suggests a statistically significant difference between the groups. In the case that H_0 was rejected, post hoc tests (Dunn – Bonferroni) were performed in order to further investigate the differences between the individual groups. It was used to compare:

> the MDAS scores for the subcategories of oral health literacy.

> the OHL-AQ and MDAS scores for the subgroups divided by year of study and household financial situation.

For each test, the corresponding effect size was calculated via the eta-squared (for Mann-Whitney U tests) and epsilon-squared statistic (for Kruskal-Wallis H tests) (Tomczak and Tomczak, 2014).

Spearman's rank correlation coefficient was used to measure:
> the correlation between OHL-AQ/MDAS scores and age.

> the correlation between oral health literacy (represented by the total scores of OHL-AQ) and dental anxiety (represented by the total scores of MDAS).

To further investigate the relationship between oral health literacy (as measured by OHL-AQ) and dental anxiety (as measured by MDAS), multiple linear regression was used. According to the 4th hypothesis, the MDAS score served as the dependent variable, while the OHL-AQ score was the main independent variable. All other recorded variables with a p-value of less than 0.25 in the bivariate analyses with dental anxiety, were considered possible confounders/modifiers in the initial model (Chowdhury and Turin, 2020). The final multiple linear regression model was reached via backward elimination (backward stepwise regression), using the Akaike Information Criterion (AIC) for selection between models. AIC is a relative indicator of optimal fit, balancing the trade-off between model accuracy (goodness of fit) and model parsimony (number of parameters). In order to avoid spurious correlations or omittance of meaningful variables, the resulting models were further compared and contrasted on the basis of conceptual cohesiveness. Variance inflation factor (IVF) and tolerance were used to diagnose possible multicollinearity; IVF values greater than 5 and tolerance values less than 0.2 were considered indicative of multicollinearity. The residuals were graphically evaluated for normality and heteroskedasticity and possible outliers.

All data analyses were performed with the SPSS software for Mac OS (version 24, SPSS Inc., IBM). The level of significance was set at $\alpha = 0.05$ and all statistical tests were two-tailed.

5. Results

5.1 Sample characteristics

The study sample consisted of 278 participants studying at the University of Macedonia (UoM), corresponding to a response rate of 98%. The sample characteristics were summarised via suitable descriptive statistics (*Tables 5 – 7*). Two participants did not answer the last page of the questionnaire (oral health-related variables). It was inferred that they neglected to turn over to the last page; thus, the data were assumed to be missing completely at random. Missing data were handled with pairwise exclusion from the corresponding analyses.

5.1.1 Sociodemographic variables

The first subset of sample characteristics comprised seven general sociodemographic variables (*Table 5*).

Age

The mean age of the participants was 20.7 years, with a standard deviation of 3.9 years and ranging from 18 to 55 years. The median age was 20 years.

Sex

The majority of the sample was female (52.9%).
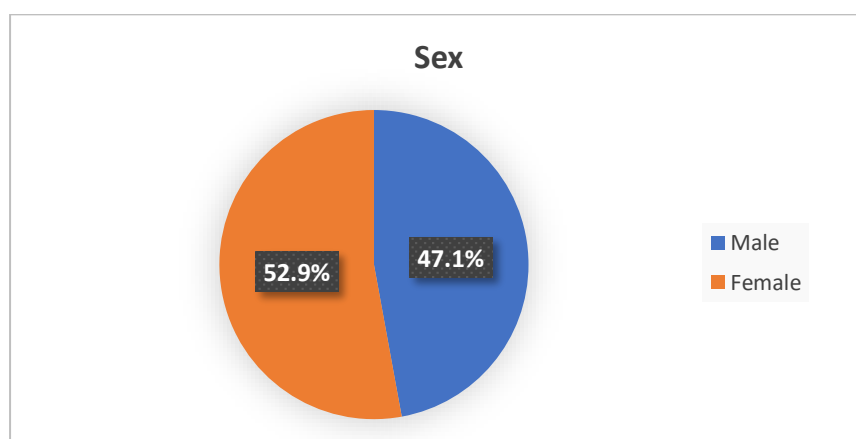
Figure 7. Sex — relative frequency distribution of the sample.

Year of study

Forty-one per cent of the participants were enrolled in the second year of university studies. The first and third years were each represented by approximately a quarter of the sample (24.5% and 23.7%, respectively). The rest of the participants (10.8%) were at least in their fourth year of studies.
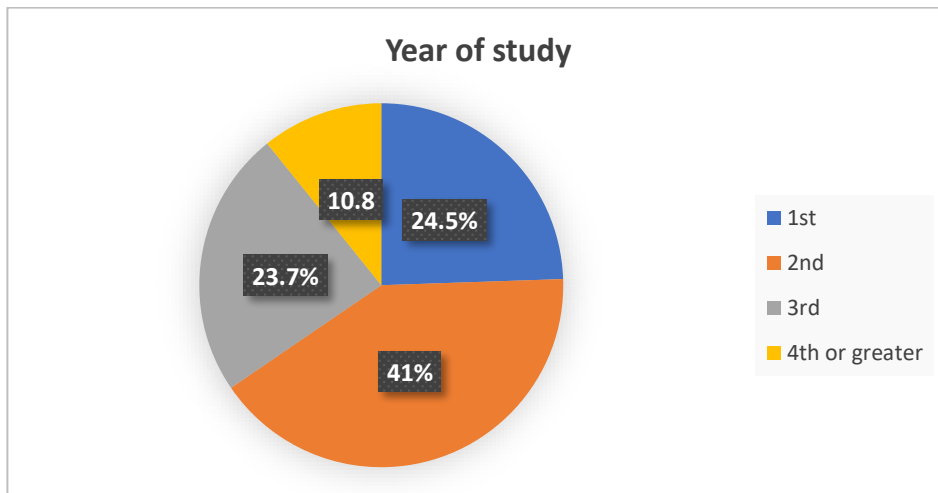
Figure 8. Year of study — relative frequency distribution of the sample.

Place of origin

The majority of the sample originated from a city/urban background (56.5%).
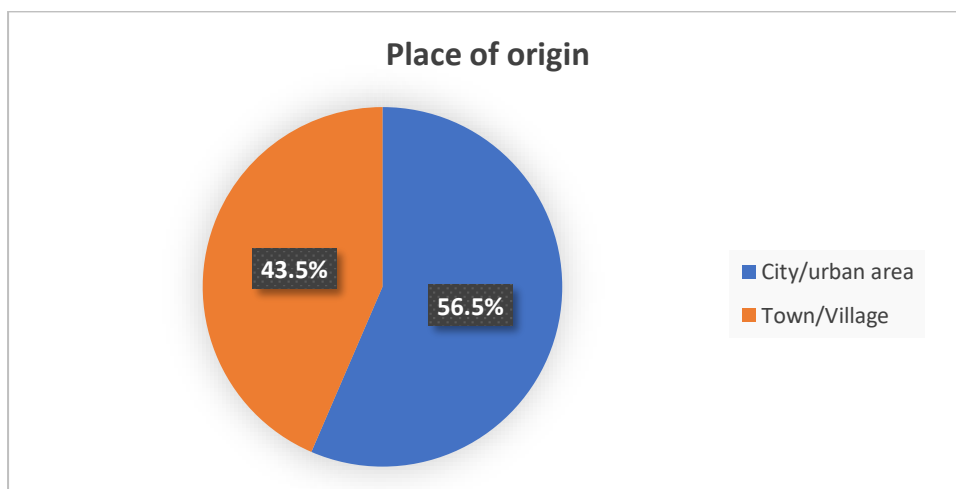
Figure 9. Place of origin — relative frequency distribution of the sample.

Parental education level

Most of the participants reported having at least one parent with a higher education (51% and 56.9% regarding fathers' and mothers' education, respectively). A small percentage had a parent that had attended only primary education (5.8% and 4.3% of the participants' fathers and mothers, respectively). The individual education levels most represented in the sample were secondary education for the fathers (43.2%) and tertiary education for the mothers (49.3%) of the participants.
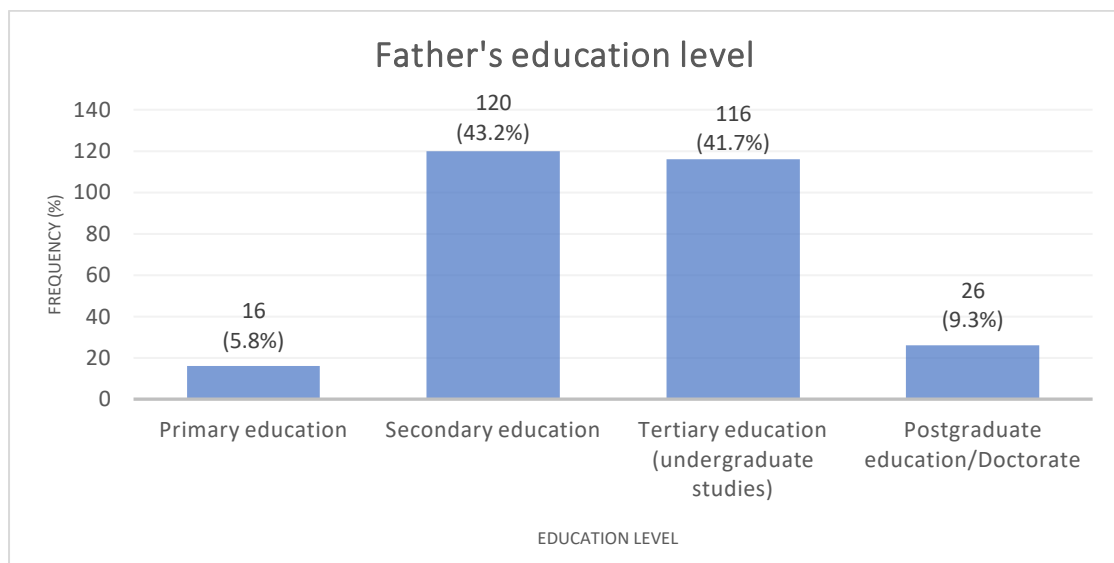
Figure 10. *Father's education level — absolute and relative frequency distribution of the sample.*
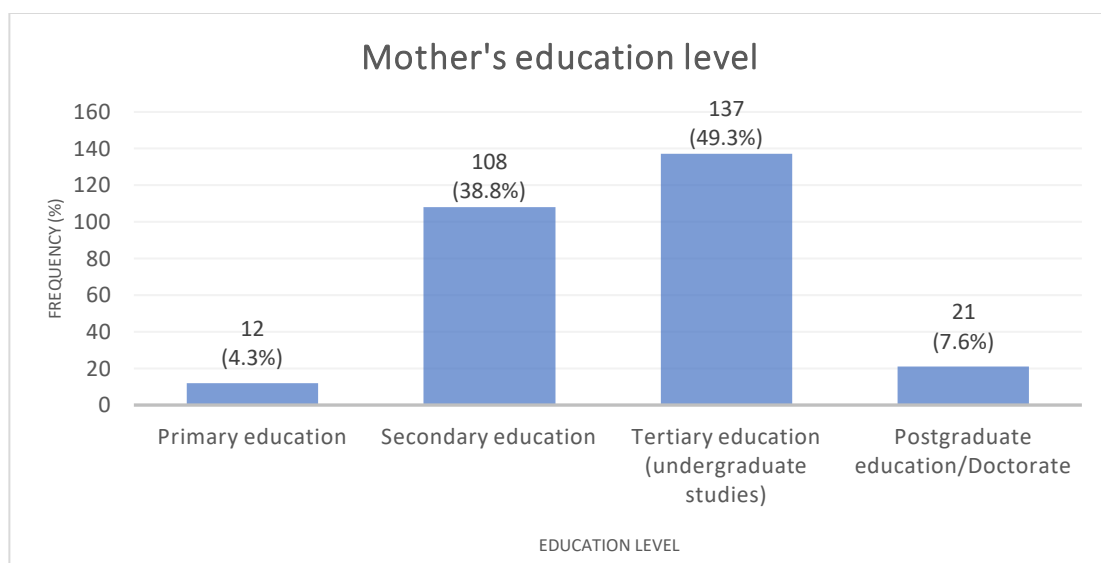
Figure 11. *Mother's education level — absolute and relative frequency distribution of the sample.*

Financial situation of the household

A majority of the participants were able to cover expenses yet not maintain substantial savings (50.7%), 31.3% were financially comfortable, while a significant percentage (18%) reported facing great or insurmountable financial difficulties.
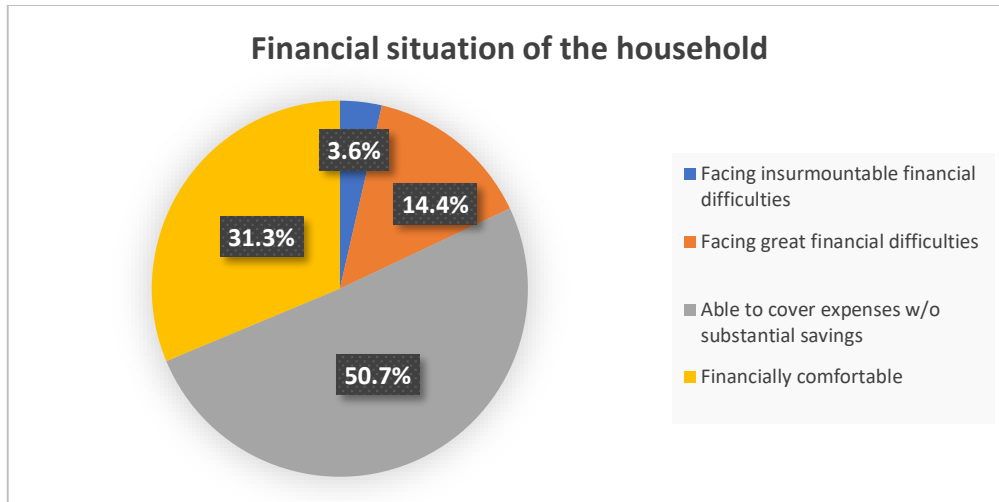
Figure 12. Financial situation of the household — relative frequency distribution of the sample.

5.1.2 Dental history and oral health-related variables

The second subset of sample characteristics was focused on variables relating to the dental history and the oral health of the participants.

Previous traumatic dental experience

Nearly half of the participants reported a previous traumatic dental experience (51.8%).
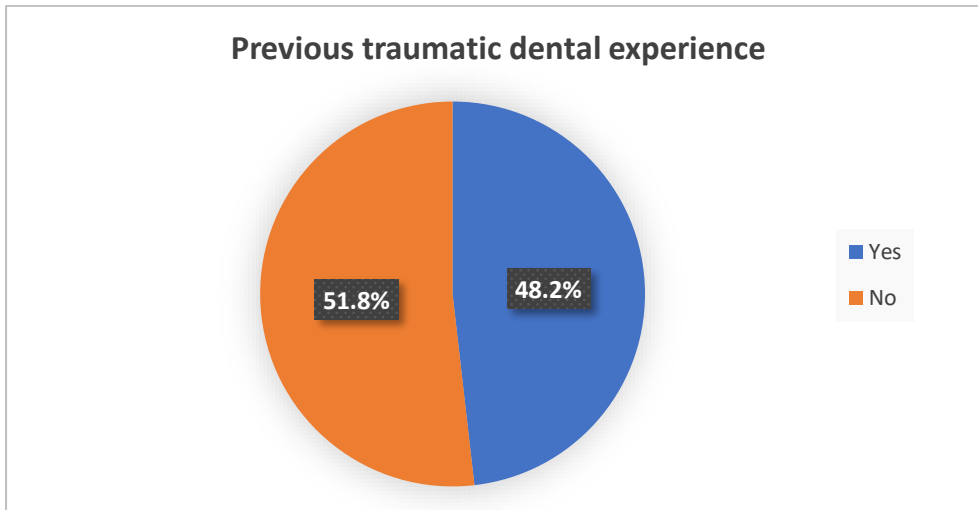
Figure 13. *Previous traumatic dental experience — relative frequency distribution of the sample.*

Self-perceived oral health status

Most of the participants assessed their oral health as good (56.4%), 20% evaluated it as moderate and only 4.3% reported having poor or very poor oral health.
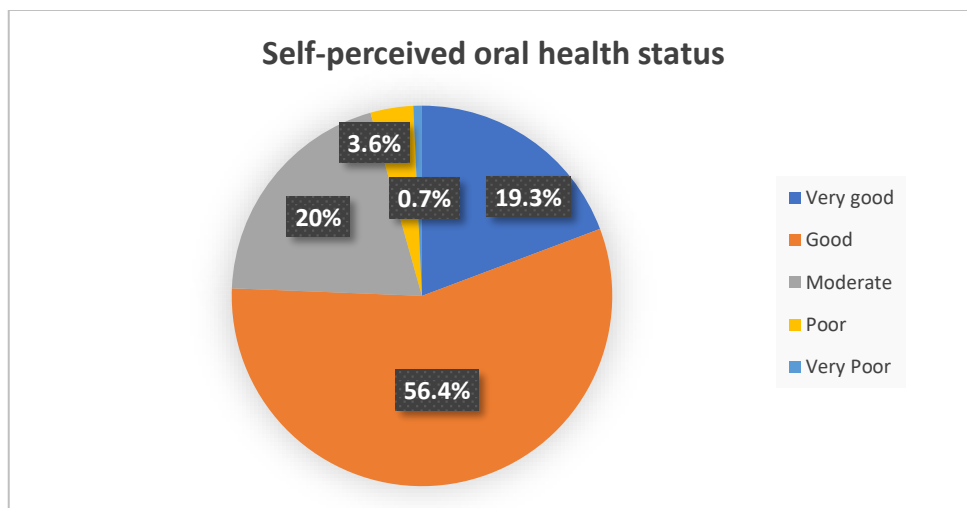
Figure 14. *Self-perceived oral health status — relative frequency distribution of the sample.*

Tooth brushing frequency

Nearly 2 out of 3 participants (62.7%) brushed their teeth at least twice per day, 31% brushed their teeth once per day, while 5% reported irregular tooth brushing and 0.7% never brushed their teeth.

Tooth brushing frequency

- Twice per day (at least) — 62.7%
- Once per day — 31.2%
- Less than once per day — 5.4%
- Never — 0.7%
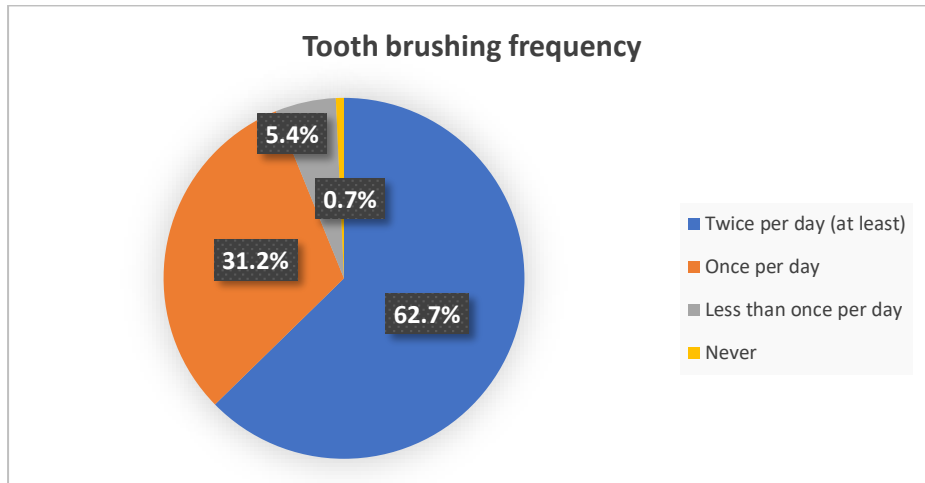
Figure 15. Tooth brushing frequency — relative frequency distribution of the sample.

Frequency of dental visits

Nearly 53% reported visiting their dentist regularly (at least once per year), while 45.7% reported visiting a dental health provider only when facing a dental problem. Conversely, 1.4% may not visit a dentist even when they are having dental problems.

Frequency of dental visits

- Every six months — 21%
- Every year — 31.9%
- Only when facing a dental problem — 45.7%
- Even less frequently — 1.4%
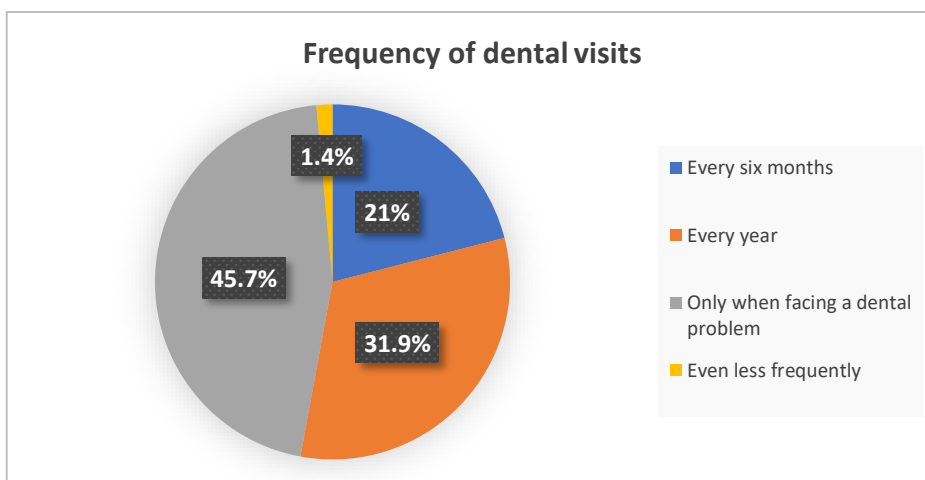
Figure 16. Frequency of dental visits — relative frequency distribution of the sample.

Age of first dental visit

A majority of the participating students (59.8%) had their first dental visit at an age between 5 and 12 years (mixed dentition stage) and 32.6% visited a dental practitioner for the first time at an age younger than 5 years (primary dentition stage), while only 1.4% did not visit the dentist before adulthood.
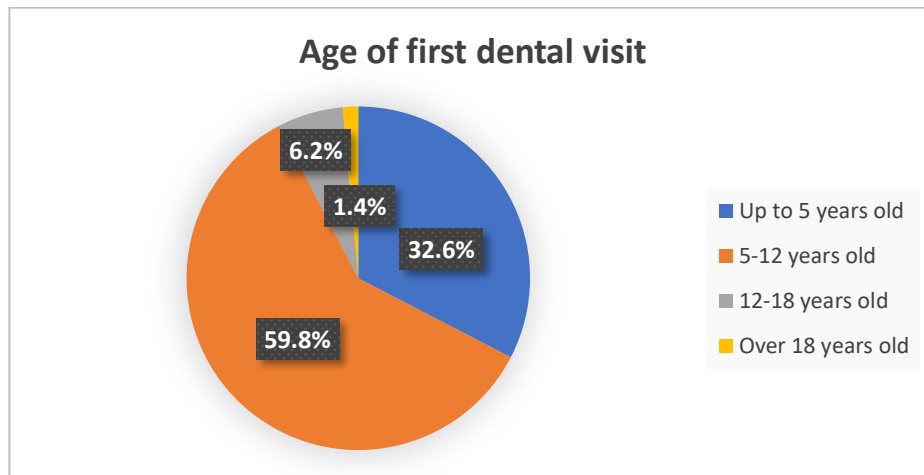
Figure 17. Age of first dental visit — relative frequency distribution of the sample.

Table 5. *Sample characteristics — Quantitative sociodemographic variables (n = 278)*

Sociodemographic variables		
Age		
Mean (SD)	20.7 (3.9)	
95% Confidence Interval	(20.2, 21.1)	
Median	20	
Mode	20	
Min	18	
Max	55	
Iterquartile range (IQR)	2	
Missing	–	
Shapiro-Wilk test p-value (a = 0.05)	<0.001	
Skewness	6.1	

Table 6. Sample characteristics — Categorical sociodemographic variables (n=278)

Sociodemographic variables				
	Frequencies			
	n	%	Valid %	Cumulative %
Sex				
Male	131	47.1	47.1	47.1
Female	147	52.9	52.9	100
Missing	–	–	–	–
Year of study				
1st	68	24.5	24.5	24.5
2nd	114	41	41	65.5
3rd	66	23.7	23.7	89.2
4th or greater	30	10.8	10.8	100
Missing	–	–	–	–
Place of origin				
City/urban area	157	56.5	56.5	56.5
Town/Village	121	43.5	43.5	100
Missing	–	–	–	–
Father's education				
Primary education	16	5.8	5.8	5.8
Secondary education	120	43.2	43.2	48.9
Tertiary education (undergraduate studies)	116	41.7	41.7	90.6
Postgraduate education/Doctorate	26	9.3	9.3	100
Missing	–	–	–	–
Mother's education				
Primary education	12	4.3	4.3	4.3
Secondary education	108	38.8	38.8	43.2
Tertiary education (undergraduate studies)	137	49.3	49.3	92.4
Postgraduate education/Doctorate	21	7.6	7.6	100
Missing	–	–	–	–
Financial situation of the household				
Facing insurmountable financial difficulties	10	3.6	3.6	3.7
Facing great financial difficulties	40	14.4	14.4	18
Able to cover expenses w/o substantial savings	141	50.7	50.7	68.7
Financially comfortable	87	31.3	31.3	100
Missing	–	–	–	–

Table 7. Sample characteristics — Dental history and oral health-related variables (n=278).

Dental history and oral health-related variables				
	Frequencies			
	n	**%**	**Valid %**	**Cumulative %**
Previous traumatic dental experience				
Yes	133	47.9	48.2	48.2
No	143	51.4	51.8	100
Missing	2	0.7	–	–
Self-perceived oral health status				
Very good	53	19.1	19.3	19.3
Good	155	55.7	56.4	75.6
Moderate	55	19.8	20	95.6
Poor	10	3.6	3.6	99.3
Very Poor	2	0.7	0.7	100
Missing	3	1.1	–	–
Tooth brushing frequency				
Twice per day (at least)	173	62.2	62.7	62.8
Once per day	86	40	31.2	93.8
Less than once per day	15	5.4	5.4	99.3
Never	2	0.7	0.7	100
Missing	2	0.7	–	–
Frequency of dental visits				
Every six months	58	20.9	21	21
Every year	88	31.7	31.9	52.9
Only when facing a dental problem	126	45.3	45.7	98.6
Even less frequently	4	1.4	1.4	100
Missing	2	0.7	–	–
Age of first dental visit				
Up to 5 years old	90	32.4	32.6	32.7
5-12 years old	165	59.4	59.8	92.4
13-18 years old	17	6.1	6.2	98.6
Over 18 years old	4	1.4	1.4	100
Missing	2	0.7	–	–

5.2 Oral health literacy

The oral health literacy (OHL) levels of the participants were assessed via the Greek version of the Oral Health Literacy – Adults Questionnaire (OHL-AQ).

5.2.1 Internal consistency of OHL-AQ (Greek version)

Prior to the data analysis of the OHL-AQ scores, we evaluated the internal consistency of the translated instrument by calculating Cronbach's alpha. The resulting value of the reliability coefficient ($\alpha = 0.72$) indicates an adequate internal consistency; thus, we can infer that the 17 items of the questionnaire measure the same latent variable, i.e., oral health literacy, to an adequate extent.

5.2.2 OHL-AQ scores

The answers to the 17 items were summed to calculate a total OHL-AQ score for each participant. Each correct response to one of the questionnaire items was awarded 1 point, for a highest possible score of 17.

OHL-AQ scores were recorded in both continuous and categorical form, according to the classification process suggested by the original authors. The resulting descriptive statistics are summarised in *Table 8.*

Table 8. *Sample characteristics — Oral health literacy (OHL-AQ) scores (n = 178).*

Oral health literacy results				
OHL-AQ score				
Mean (SD)	10.9 (3.2)			
95% Confidence Interval	(10.6, 11.3)			
Median	11			
Mode	13			
Min	1			
Max	17			
Iterquartile range (IQR)	4			
Skewness	-0.8			
Missing	–			
Shapiro-Wilk test p-value (a = 0.05)	<0.001			
Oral health literacy level	**Frequencies**			
(according to OHL-AQ score)	**n**	**%**	**Valid %**	**Cumulative %**
Inadequate (0-9)	80	28.8	28.8	28.8
Marginal (10-11)	63	22.7	22.7	51.4
Adequate (12-17)	135	48.5	48.5	100
Missing	–	–	–	–

The OHL-AQ scores diverged from the normal distribution (Shapiro-Wilk p-value <0.001) and ranged from the lowest to the highest possible score (1 to 17). The median score was 11 points, indicative of marginal oral health literacy, and the interquartile range was 4 points.

The majority of the participants (48.5%) had scores corresponding to an adequate level of oral health literacy, 22.7% to a marginal level, and a noteworthy 28.8% achieved scores that were classified as inadequate.
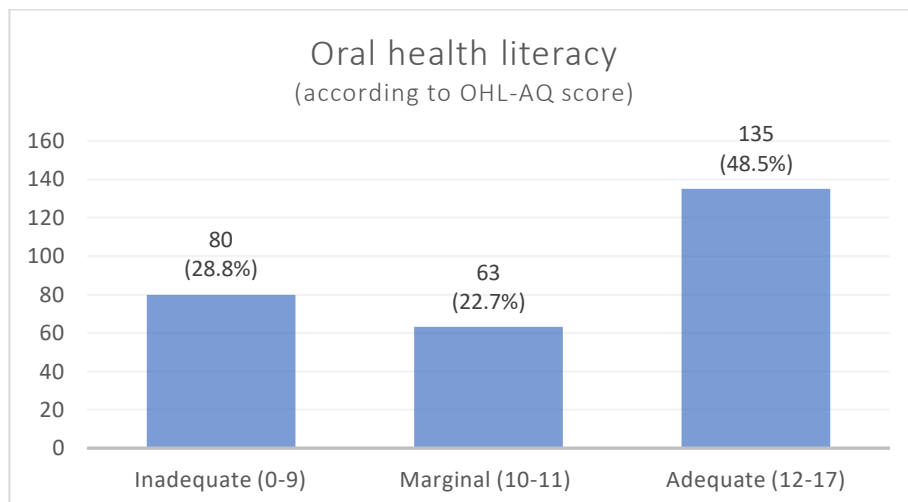
Figure 18. *Oral health literacy level — absolute and relative frequency distribution of the sample.*

5.3 Dental anxiety

The participants' dental anxiety was assessed with the Greek version Modified Dental Anxiety Scale (MDAS).

(MDAS) scores

The answers to the five MDAS items were scored on a Likert scale (1 to 5) and then summed, in order to calculate a total score representing the level of dental anxiety for each participant. The summated scores ranged from 5 (least anxious) to 25 (most anxious) and were recorded in both continuous and categorical forms, grouped according to the guidelines specified in *Materials and Methods.* A cut-off value of 19 was adopted to indicate a potentially phobic person that experiences severe dental anxiety. The descriptive statistics are summarised in *Table 9.*

Table 9. Sample characteristics — Dental anxiety (MDAS) scores (n = 178).

Dental anxiety results				
M-DAS score				
Mean (SD)	11.4 (4.6)			
95% Confidence Interval	(10.8, 11.9)			
Median	10			
Mode	9			
Min	5			
Max	25			
Iterquartile range (IQR)	6			
Skewness	0.9			
Missing	–			
Shapiro-Wilk test p-value (a = 0.05)	<0.001			
Dental anxiety level		**Frequencies**		
(according to M-DAS score)	**n**	**%**	**Valid %**	**Cumulative %**
No anxiety (5)	18	6.5	6.5	6.5
Low anxiety (6-10)	132	47.5	47.5	54
Moderate anxiety (11-14)	65	23.4	23.4	77.3
High anxiety (15-18)	39	14	14	91.4
Total of non-phobic patients (<19)	254	91.4	91.4	91.4
Extreme anxiety/phobic patient (19-25)	24	8.6	8.6	100
Missing	–	–	–	–

The MDAS scores ranged from the lowest to the highest possible value (5 to 25), and their distribution diverged from normality (Shapiro-Wilk p-value <0.001). The median score was 10 points, indicating low dental anxiety, and the interquartile range was 6 points.

The majority of the participants (47.5%) experienced low dental anxiety, 23.4% had scores indicative of moderate dental anxiety, 14% had high dental anxiety, and 6.5% were classified as having no dental anxiety. According to the empirically established cut-off point, a significant number of participants (8.6%) experienced extreme dental anxiety and were classified as –potentially– phobic.
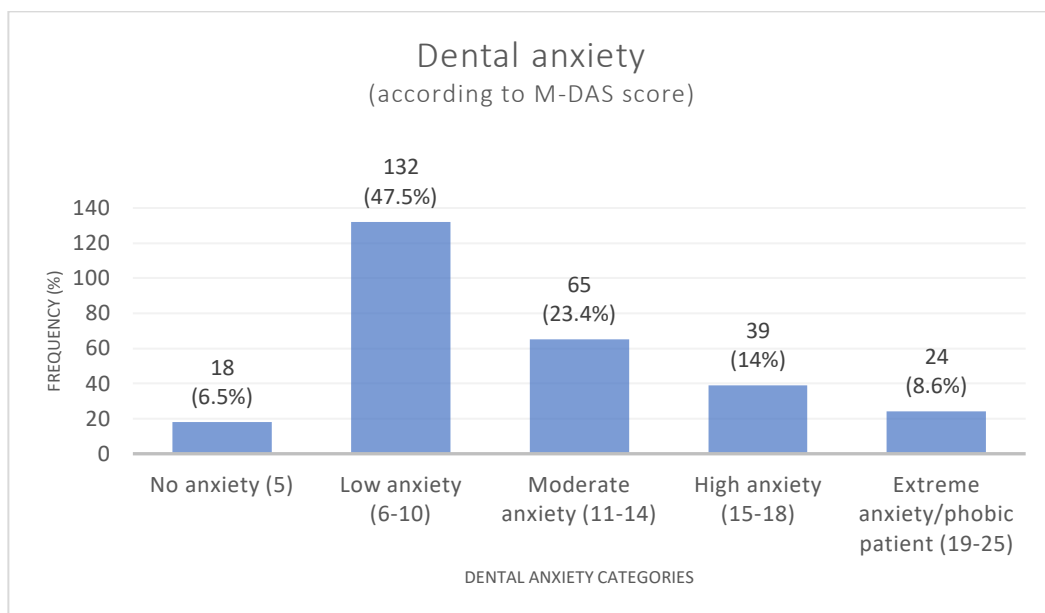
Figure 19. Dental anxiety — absolute and relative frequency distribution of the sample.

5.4 Bivariate associations between oral health literacy (OHL-AQ score) and sociodemographic factors/oral health-related characteristics

The associations between oral health literacy, as measured through the OHL-AQ scores of the participants, and several sociodemographic factors/oral health-related characteristics were explored with bivariate analyses. The OHL-AQ scores within the subcategories of each of the recoded sociodemographic and dental health-related variables were compared and appropriately tested for statistical significance (α = 0.05). The OHL-AQ score distributions were statistically and graphically evaluated for each comparison. The findings did not support normality in all instances; thus, non-parametric tests were employed, as stated in the *Materials and Methods* data analysis section. The resulting bivariate associations are summarised in *Table 10.*

Age

Spearman's correlation indicated a significant weak positive correlation between participants' oral health literacy and age, $\rho(278)$ = 0.13, *p* = 0.037.

Sex

A Mann-Whitney U test indicated that female students (*Md* = 12) had significantly higher oral health literacy, when compared with their male colleagues (*Md* = 11), *U* = 6.927, *p* < 0.001, η^2 = 0.06.

Year of study

A Kruskal-Wallis test revealed no significant association between oral health literacy and the participants' year of study, *H* = 5,391, *p* = 0.15, ε^2 = 0.02.

Place of origin

A Mann-Whitney U test indicated that the participants' oral health literacy and place of origin were not significantly associated, *U* = 9,145, *p* = 0.59, η^2 = 0.001.

Parental education level

The levels of parental education were regrouped in order to facilitate further analyses and interpretation, as shown in *Table 10*. The new subcategories were "primary/secondary education" and "tertiary education/post-graduate studies".

Participants' oral health literacy does not appear to have a significant association with paternal education level, according to the performed Mann-Whitney U test, U = 8,890.5, p = 0.25, η^2 = 0.005.

On the contrary, a Mann-Whitney U test indicated that students with tertiary/post-graduate maternal education level (*Md* = 12) had significantly higher oral health literacy than their colleagues with a maternal education level corresponding to primary/secondary education (*Md* = 10.5), U = 7,321.5, p = 0.001, η^2 = 0.04.

Financial situation of the household

The levels of the "financial situation of the household" variable were regrouped in order to facilitate further analyses and interpretation, as displayed in *Table 10*. The new subcategories were "facing insurmountable/great financial difficulties", "able to cover expenses without having substantial savings" and *"financially comfortable"*.

The financial situation of the household was shown to have a significant effect on students' oral health literacy, according to the corresponding Kruskal-Wallis test, H = 11.764, p = 0.003, ε^2 = 0.04. Post-hoc analyses using the Dunn-Bonferroni procedure (*Table 11*) indicated that oral health literacy was lower for participants with insurmountable/great financial difficulties *(Md* = 9) than for participants who were financially comfortable (*Md* = 12, *p* = 0.004) or were able to cover expenses without having substantial savings (*Md* = 11, *p* = 0.006). Oral health literacy did not differ significantly between participants who were financially comfortable and those who were able to cover expenses without having substantial savings (*p* = 1).

Previous traumatic dental experience

A Mann-Whitney U test revealed no significant association between the presence of an earlier traumatic dental experience and oral health literacy, $U = 8,545$, $p = 0.14$, $\eta^2 = 0.01$.

Self-perceived oral health status

The levels of the "self-perceived oral health status" variable were regrouped in order to facilitate further analyses and interpretation, as shown in *Table 10.* The new subcategories were "very good/good" and *"*moderate/poor/very poor".

According to a Mann-Whitney U test, participants who perceived their oral health as very good/good *(Md* = 12) had significantly higher oral health literacy than those who assessed their oral health as moderate/poor/very poor (*Md* = 11), $U = 5,580.5$, $p = 0.014$, $\eta^2 = 0.02$.

Tooth brushing frequency

The levels of the "tooth brushing frequency" variable were regrouped in order to facilitate further analyses and interpretation, as displayed in *Table 10.* The new subcategories were "twice per day (at least)" and "once per day or less".

A Mann-Whitney U test indicated that participants who brushed their teeth at least twice a day (*Md* = 12) had significantly higher oral health literacy than those who brushed their teeth once per day or less (*Md* = 11), $U = 6,958.5$, $p = 0.002$, $\eta^2 = 0.03$.

Frequency of dental visits

The levels of the "frequency of dental visits" variable were regrouped in order to facilitate further analyses and interpretation, as shown in *Table 10.* The new subcategories were "every six months/every year" and "only when facing a dental problem/even less frequently", reflecting regular versus irregular dental attendance.

A Mann-Whitney U test indicated that participants who visited the dentist every six months/every year (*Md* = 12) had significantly higher oral health literacy when compared to

those who visited the dentist only when facing a dental problem/even less frequently (Md = 11), U = 8,196.5, p = 0.049, η^2 = 0.01.

Age of first dental visit

The levels of the "age of first dental visit" variable were regrouped in order to facilitate further analyses and interpretation, as shown in Table 10. The new subcategories were "up to 12 years old (primary/mixed dentition)" and "over 12 years old (permanent dentition)". Even though the second category has only a few observations (n = 21), they were grouped as such to reflect whether the participants had their first dental care experience before or after adolescence.

A Mann-Whitney U test indicated no significant association between oral health literacy and participants' age of first dental visit, U = 2,014, p = 0.06, η^2 = 0.01.

Construct validity of OHL-AQ

The OHL-AQ discriminated well among subgroups separated on the basis of self-perceived oral health status and tooth brushing frequency.

Participants with moderate/poor/very poor (Md = 11) self-perceived oral health status had significantly lower oral health literacy, than the participants who perceived their oral health status as very good/good *(Md = 12)*, U = 5,580.5, p = 0.014, η^2 = 0.02.

Participants who brushed their teeth once per day or less (Md = 11) had significantly lower oral health literacy than those who brushed their teeth at least twice a day (Md = 12), U = 6,958.5, p = 0.002, η^2 = 0.03.

Table 10. Bivariate associations between oral health literacy (OHL-AQ score) and sociodemographic factors/oral health-related characteristics.

	OHL-AQ Score							
	Shapiro-Wilk p value	Mean (SD)	95% CI	Median	IQR	Mean Rank	p value	Effect size
Sex								
Male	<0.001	10 (3.4)	(9.4, 10.6)	11	5	118.9	**<0.001**[†]	0.06*
Female	0.001	11.7 (2.6)	(11.3, 12.2)	12	3	157.9		
Year of study								
1st	0.14	10.7 (2.5)	(10.1, 11.3)	11	4	127.0	0.15[††]	0.02**
2nd	<0.001	10.7 (3.5)	(10.1, 11.4)	11	4	136.6		
3rd	0.004	11.7 (2.9)	(11, 12.4)	12	3.3	158.0		
4th or greater	0.002	10.5 (3.8)	(9.1, 11.9)	11	5.5	138.0		
Place of origin								
City/urban area	<0.001	11 (3.1)	(10.5, 11.5)	12	4	141.8	0.59[†]	0.001*
Town/Village	0.001	10.9 (3.2)	(10.3, 11.4)	11	4	136.6		
Father's education								
Primary/Secondary education	0.001	10.7 (3.2)	(10.2, 11.3)	11	4	133.9	0.25[†]	0.005*
Tertiary education/Postgraduate studies	<0.001	11.1 (3.1)	(10.6, 11.6)	12	3	144.9		
Mother's education								
Primary/Secondary education	<0.001	10.3 (3.2)	(9.7, 10.8)	10.5	4	121.5	**0.001**[†]	0.04*
Tertiary education/Postgraduate studies	<0.001	11.4 (3.1)	(11, 11.9)	12	3	153.2		
Financial situation of the household								
Insurmountable/great financial difficulties	0.017	9.1 (4.2)	(7.9, 10.3)	9	6.5	104.7	**0.003**[††]	0.04**
Able to cover expenses w/o substantial savings	0.027	11.3 (2.7)	(10.9, 11.8)	11	3	145.2		
Financially comfortable	<0.001	11.4 (2.8)	(10.8, 12)	12	3	150.3		
Previous traumatic dental experience								
Yes	<0.001	10.6 (3.4)	(10, 10.7)	11	4	131.3	0.14[†]	0.01*
No	0.001	11.3 (2.9)	(10.8, 11.8)	11	4	145.2		
Self-perceived oral health status								
Very good/Good	<0.001	11.3 (2.8)	(10.9, 11.7)	12	3	144.7	**0.014**[†]	0.02*
Moderate/Poor/Very Poor	0.004	9.8 (4)	(8.9, 10.8)	11	6	117.3		
Tooth brushing frequency								
Twice per day (at least)	<0.001	11.4 (3)	(11, 11.9)	12	4	149.8	**0.002**[†]	0.03*
Once per day or less	0.001	10.2 (3.3)	(9.5, 10.8)	11	5	119.6		
Frequency of dental visits								
Every six months/every year	<0.001	11.3 (2.9)	(10.8, 11.8)	12	3.3	147.36	**0.049**[†]	0.01*
Only when facing a dental problem/less frequently	<0.001	10.5 (3.4)	(9.9, 11.1)	11	4	128.6		
Age of first dental visit								
Up to 12 years old (primary/mixed dentition)	<0.001	11.1 (3)	(10.7, 11.5)	12	4	141.1	0.06[†]	0.01*
Over 12 years old (permanent dentition)	0.08	9.1 (4.2)	(7.2, 11.1)	10	8	106.9		

[†] p value obtained from Mann-Whitney U test

[††] p value obtained from Kruskal-Wallis test

* value obtained from eta-squared (η^2) statistic

** value obtained from epsilon-squared (ε^2) statistic

Table 11. Bivariate associations between oral health literacy (OHL-AQ score) and sociodemographic factors — post–hoc testing.

Post hoc testing – Pairwise comparisons (OHL-AQ score)			Dunn – Bonferroni p value
Household financial situation			
Facing insurmountable or great financial difficulties	–	Able to cover expenses w/o substantial savings	**0.006**
Facing insurmountable or great financial difficulties	–	Financially comfortable	**0.004**
Able to cover expenses w/o substantial savings	–	Financially comfortable	1

5.5 Bivariate associations between dental anxiety (MDAS score) and sociodemographic factors/oral health-related characteristics

Bivariate analyses were used for the exploration of the associations between the MDAS scores and several sociodemographic factors/oral health-related characteristics. All variables levels that were merged for the previous bivariate analyses remained as such. The MDAS scores within the subcategories of each of the recoded sociodemographic and dental health-related variables were compared and appropriately tested for statistical significance ($\alpha = 0.05$). The MDAS scores distributions were statistically and graphically evaluated for each comparison. Since the findings did not support normality in all instances, non-parametric tests were employed, as stated in the *Materials and Methods* data analysis section. The resulting bivariate associations are summarised in *Table 12.*

Age

Spearman's correlation revealed no significant correlation between participants' dental anxiety and age, $\rho(278) = -0.07$, $p = 0.2$.

Sex

A Mann-Whitney U test indicated that female students (*Md* = 11) had significantly higher dental anxiety, when compared with their male colleagues (*Md* = 9), $U = 7,629$, $p = 0.003$, $\eta^2 = 0.03$.

Year of study

A Kruskal-Wallis test revealed no significant association between dental anxiety and the participants' year of study, $H = 0.532$, $p = 0.9$, $\varepsilon^2 = 0.002$.

Place of origin

According to a Mann-Whitney U test, the participants' dental anxiety and place of origin were not significantly associated, $U = 8,588$, $p = 0.16$, $\eta^2 = 0.007$.

Parental education level

According to a Mann-Whitney U test, participants with tertiary/post-graduate paternal education background (*Md* = 9) had lower dental anxiety than those with paternal education level that corresponded to primary/secondary education, (*Md* = 11), *U* = 8,032, *p* = 0.015, η^2 = 0.02.

Furthermore, a Mann-Whitney U test indicated that students with tertiary/post-graduate maternal education background (*Md* = 9) had significantly lower dental anxiety than their colleagues with a maternal education level corresponding to primary/secondary education, (*Md* = 11), *U* = 7,752.5, *p* = 0.009, η^2 = 0.02.

Financial situation of the household

A Kruskal-Wallis test indicated that the financial situation of the household had no significant effect on participants' dental anxiety, *H* = 1.983, *p* = 0.4, ε^2 = 0.007.

Previous traumatic dental experience

A Mann-Whitney U test denoted that participants with traumatic dental experience in their past (*Md* = 11) exhibited significantly higher dental anxiety when compared with participants who had no similar experience (*Md* = 9), *U* = 7,211, *p* < 0.001, η^2 = 0.04.

Self-perceived oral health status

A Mann-Whitney U test revealed no significant association between participants' dental anxiety and their self-perceived oral health status, *U* = 5,972.5, *p* = 0.08, η^2 = 0.01.

Tooth brushing frequency

A Mann-Whitney U test indicated that participants who brushed their teeth at least twice a day (*Md* = 9) had significantly lower dental anxiety than those who brushed their teeth once per day or less (*Md* = 11), *U* = 6,700, *p* = 0.001, η^2 = 0.04.

Frequency of dental visits

A Mann-Whitney U test indicated that participants who visited the dentist every six months/every year (*Md* = 9) had significantly lower dental anxiety than the participants who visited the dentist only when facing a dental problem/even less frequently (*Md* = 11), *U* = 7,351, *p* = 0.001, η^2 = 0.04.

Age of first dental visit

A Mann-Whitney U test indicated no significant association between dental anxiety and participants' age of first dental visit, *U* = 2,3330, *p* = 0.3, η^2 = 0.004.

Table 12. Bivariate associations between dental anxiety (MDAS) and sociodemographic factors/oral health-related characteristics.

	MDAS Score							
	Shapiro-Wilk p value	Mean (SD)	95% CI	Median	IQR	Mean Rank	p value	Effect size
Sex								
Male	<0.001	10.5 (4.3)	(9.8, 11.3)	9	4.5	124.2	**0.003**[†]	0.03*
Female	<0.001	12.1 (4.8)	(11.3, 12.9)	11	5.3	153.1		
Year of study								
1st	<0.001	11.9 (5)	(10.7, 13.2)	10	8	145.6	0.9[††]	0.002**
2nd	<0.001	11.1 (4.3)	(10.3, 11.9)	10	5	137.2		
3rd	0.001	11.2 (4.6)	(10, 12.3)	10	6	137.3		
4th or greater	0.025	11.5 (5.2)	(9.6, 13.5)	10.5	6.5	139.2		
Place of origin								
City/urban area	<0.001	11.1 (4.6)	(10.3, 11.8)	10	6	133.7	0.17[†]	0.007*
Town/Village	<0.001	11.8 (4.7)	(10.9, 12.6)	11	7	147		
Father's education								
Primary/Secondary education	<0.001	12.1 (5)	(11.3, 12.9)	11	7.8	151.4	**0.015**[†]	0.02*
Tertiary education/Postgraduate studies	<0.001	10.7 (4.2)	(10, 11.4)	9	5	128.1		
Mother's education								
Primary/Secondary education	<0.001	12.3 (5)	(11.4, 13.2)	11	7	153.9	**0.009**[†]	0.02*
Tertiary education/Postgraduate studies	<0.001	10.7 (4.3)	(10, 11.4)	9	5	128.6		
Financial situation of the household								
Insurmountable/great financial difficulties	0.003	12.3 (5)	(10.8, 13.8)	11	8	153.2	0.4[††]	0.007**
Able to cover expenses w/o substantial savings	<0.001	11.2 (4.5)	(10.5, 12)	10	4.8	138.4		
Financially comfortable	0.001	11.1 (4.5)	(10.1, 12)	10	6	133.4		
Previous traumatic dental experience								
Yes	<0.001	12.2 (4.6)	(11.4, 13)	11	6	155.8	**<0.001**[†]	0.04*
No	<0.001	10.6 (4.6)	(9.8, 11.3)	9	5	122.4		
Self-perceived oral health status								
Very good/good	<0.001	11.1 (4.5)	(10.5, 11.7)	10	5	133.2	0.08[†]	0.01*
Moderate/Poor/Very Poor	0.005	12.3 (5)	(11, 13.5)	11	7	152.9		
Tooth brushing frequency								
Twice per day (at least)	<0.001	10.6 (4.3)	(10, 11.3)	9	4.8	125.7	**0.001**[†]	0.04*
Once per day or less	<0.001	12.6 (5)	(11.7, 13.6)	11	7	160		
Frequency of dental visits								
Every six months/every year	<0.001	10.6 (4.3)	(9.9, 11.3)	9	5	123.9	**0.001**[†]	0.04*
Only when facing a dental problem/less frequently	<0.001	12.3 (4.9)	(11.4, 13.1)	11	7	155		
Age of first dental visit								
Up to 12 years old (primary/mixed dentition)	<0.001	11.3 (4.7)	(10.7, 11.9)	10	6	137.1	0.3[†]	0.004*
Over 12 years old (permanent dentition)	0.04	12.2 (4.3)	(10.3, 14.2)	11	8.5	155.1		

[†] p value obtained from Mann-Whitney U test

[††] p value obtained from Kruskal-Wallis test

* value obtained from eta-squared (η^2) statistic

** value obtained from epsilon-squared (ε^2) statistic

5.6 Bivariate associations between oral health literacy and dental anxiety

Bivariate analyses were used to explore the relationship between oral health literacy and dental anxiety, as measured by OHL-AQ and MDAS scores, respectively. Both constructs are expressed as scales that can be divided into categories. In order to further elucidate the hypothesised association, the correlation between the two variables and the distribution of the MDAS scores among the OHL-AQ score subcategories were estimated ($\alpha = 0.05$). The score distributions were statistically and graphically evaluated. Since the findings were not in favour of normality in all instances, non-parametric tests were employed. The results are summarised in *Table 13*.

Table 13. *Bivariate association between dental anxiety (MDAS score) and oral health literacy (OHL-AQ score).*

	MDAS Score							
	Shapiro-Wilk p value	Mean (SD)	95% CI	Median	IQR	Mean Rank	p value	Effect size
Oral health literacy								
Inadequate	0.04	13.4 (5)	(12.3, 14.5)	13.5	7.8	173.3		
Marginal	<0.001	11.7 (4.7)	(10.5, 12.8)	10	5	145.2	**<0.001**[†]	0.09*
Adequate	<0.001	10 (3.9)	(9.4, 10.7)	9	4	116.8		

† p value obtained from Kruskal-Wallis test

* value obtained from epsilon-squared (ε^2) statistic

Spearman's correlation revealed a significant weak negative correlation between participants' dental anxiety and oral health literacy, $\rho(278) = -0.295$, $p < 0.001$.

A Kruskal-Wallis test showed a significant main association between participants' dental anxiety and oral health literacy, $H = 25.335$, $p < 0.001$, $\varepsilon^2 = 0.09$. Post-hoc analyses, using the Dunn-Bonferroni procedure (*Table 14*), indicated that dental anxiety was significantly lower for participants who had adequate oral health literacy *(Md = 9)* than for participants with inadequate oral health literacy (*Md* = 13.5, *p* < 0.001). Dental anxiety did not differ significantly between participants who had marginal oral health literacy when compared with those that had adequate (*p* = 0.06) or inadequate (*p* = 0.11) oral health literacy.

Table 14. *Bivariate association between dental anxiety (MDAS score) and oral health literacy (OHL-AQ score) —*
post–hoc testing.

Post hoc testing – Pairwise comparisons (MDAS score)			
			Dunn – Bonferroni p value
Oral health literacy			
Inadequate	–	Marginal	0.11
Inadequate	–	Adequate	**<0.001**
Marginal	–	Adequate	0.06

5.7 Multivariable association between oral health literacy and dental anxiety

A multiple linear regression model was constructed to assess further the robustness of the association between oral health literacy (OHL-AQ score) and dental anxiety (MDAS score) on a multivariable level. In order to test the 4th Hypothesis, the MDAS score functioned as the dependent variable and the OHL-AQ score as the main independent variable.

The sociodemographic and oral health-related variables that were independently associated with dental anxiety at a p value < 0.25, were all considered possible confounders/modifiers and were included in the preliminary model (Chowdhury and Turin, 2020). The aforementioned variables comprised:

- sex (p = 0.003),
- place of origin (p = 0.17),
- father's education level (p = 0.015),
- mother's education level (p = 0.009),
- previous traumatic dental experience (p < 0.001),
- self-perceived oral health status (p = 0.08),
- tooth brushing frequency (p = 0.001) and
- frequency of dental visits (p = 0.001).

The qualitative variables were dummy coded before their inclusion in the multiple linear regression model in order to ensure interpretability. An array of models was computed with backward stepwise elimination techniques, utilising the Akaike Information Criterion (AIC) as a selection criterion for optimal fit, as described in *Materials and Methods*. The model with the lowest AIC value included six independent variables; "oral health literacy – OHL-AQ score", "sex", "mother's education level", "previous traumatic dental experience", "tooth brushing frequency" and "frequency of dental visits". In order to mitigate the risk of including redundant variables and omitting important ones, this model was further appraised for conceptual relevance on the basis of earlier published literature. It was found to be comprehensive enough and bibliographically supported. The final multiple linear regression model is presented in *Table 16.*

A significant regression equation was found (F(6, 268) = 12.758, $p < 0.001$), with an adjusted R^2 of 0.205. Therefore, the resulting model interpreted 20.5% of independent variable's (MDAS score) variance.

All IVF values were below 5, and all tolerance values were above 0.2, thus indicating absence of multicollinearity. The graphic appraisal did not raise substantial concerns regarding heteroskedasticity.

Participants' predicted mean MDAS score is equal to 14.91 − 0.42 (OHL-AQ score) + 2.54 (Sex) − 1.16 (Maternal education level) − 1.1 (Traumatic dental experience) + 1.47 (Tooth brushing frequency) + 0.85 (frequency of dental visits), where OHL-AQ score is measured in a scale ranging from 0 to 17 and the rest of the predictors are coded as follows:

- Sex as 0 = Male, 1 = Female.
- Mother's education level as 0 = Primary/Secondary education, 1 = Tertiary education/ Postgraduate studies.
- Previous traumatic dental experience as 0 = Yes, 1 = No.
- Tooth brushing frequency as 0 = At least twice per day, 1 = Once per day or less.
- Frequency of dental visits as 0 = Every six months/every year, 1 = Only when facing a problem/less frequently.

According to the multiple linear regression model, oral health literacy was still significantly associated with dental anxiety, after the effects of the selected confounders/predictors were taken into consideration. The two variables have a significant negative association at α = 0.05; for each point added in the OHL-AQ score (oral health literacy), the MDAS score (dental anxiety) falls by 0.42 points, on average, ceteris paribus.

Significant multivariable associations with dental anxiety were discovered for the rest of the predictors, with the exception of "frequency of dental visits" ($p = 0.1$). According to the model, female students have higher dental anxiety than their male colleagues, by 2.54 points on the MDAS scale ($p < 0.001$). Students who have a tertiary/post-graduate maternal education have lower dental anxiety than their colleagues who have primary/secondary maternal education level, by 1.16 points on the MDAS scale ($p = 0.025$). Students with no previous traumatic dental

experience have lower dental anxiety than those who had such an experience, by 1.1 points on the MDAS scale ($p = 0.032$). Students who brush their teeth once per day or less have higher dental anxiety when compared with students who brush the recommended amount of twice per day, by 1.47 points on the MDAS scale, ($p = 0.008$).

We can thus infer that oral health literacy, sex, mother's education level, previous traumatic dental experience and tooth brushing frequency are all significant predictors of dental anxiety on a multivariable level.

Table 15. Multiple linear regression model for dental anxiety

(independent variables; oral health literacy, sex, maternal education level, previous traumatic dental experience, tooth brushing frequency, dental attendance frequency).

		Unstandardized Coefficients		Standardized Coefficients	t	p value	95% Confidence Interval for B	Correlations		Collinearity Statistics	
		B	SE	beta				Zero-order	Part	Tolerance	IVF
	Intercept	14.91	1.04		14.26	**<0.001**	(12.85, 16.97)				
	Oral health literacy	-0.42	0.08	-0.28	-4.91	**<0.001**	(-0.59, -0.25)	-0.29	-0.27	0.86	1.17
Sex	**Male**	reference level									
	Female	2.54	0.53	0.27	4.82	**<0.001**	(1.5, 3.57)	0.18	0.26	0.91	1.1
Mother's education level	**Primary/Secondary education**	-2.22									
	Tertiary education/Postgraduate studies	-1.16	0.51	-0.12	-2.25	**0.025**	(-2.17, -0.15)	-0.17	-0.12	0.96	1.04
Previous traumatic dental experience	**Yes**	reference level									
	No	-1.1	0.51	-0.12	-2.16	**0.032**	(-2.1, -0.1)	-0.18	-0.12	0.89	1.04
Tooth brushing frequency	**Twice per day (at least)**	reference level									
	Once per day or less	1.47	0.55	0.15	2.69	**0.008**	(0.39, 2.55)	0.21	0.15	0.89	1.12
Frequency of dental visits	**Every six months/every year**	reference level									
	Only due to dental problem/less frequently	0.85	0.52	0.09	0.092	0.1	(-0.17, 1.88)	0.18	0.09	0.93	1.07

R-squared = 0.222
Adjusted R-squared = 0.205

6. Discussion

The present thesis aimed to assess oral health literacy of UoM students and explore its relationship with dental anxiety. In order to comprehensively evaluate oral health literacy levels, the English version of a reliable and valid measurement instrument –the Oral Health Literacy-Adults Questionnaire (OHL-AQ)– was translated into Greek and subsequently validated. Furthermore, the possible associations of the two main constructs, i.e., oral health literacy and dental anxiety, with several sociodemographic characteristics and oral health-related variables were explored.

6.1 Sample characteristics

The sample consisted of 278 university students with a median age of 20 years (*IQR* = 2), the majority of whom were female (52.9%), on the second year of their studies (41%), had city/urban background origins (56.5%) and had at least one parent with higher education level (51% and 56,9% regarding paternal and maternal education respectively). Most of the participants came from households that afforded them the ability to cover current expenses, though without maintaining substantial savings (50.7%) and a considerable proportion faced significant financial difficulties (18%); this finding is consistent with the general economic hardships observed in Greece.

The majority of the sample did not have a previous traumatic dental experience (51.8%) and perceived their oral health as good or very good (75,7%). The latter is justified by the young average age of the participants, as oral health issues tend to accumulate and worsen progressively; it should be noted that this is a subjective measure that does not necessarily represent their clinical oral health status. Most students brushed their teeth at the recommended twice-per-day frequency (62.7%) and 52,9% visited their dentist regularly, at least once per year. These findings are in accordance with results of previous studies in Greek population samples, that reported the majority of the participants abiding by the twice-per-day brushing recommendation (Mamai-Homata et al., 2010; Fragkioudakis et al., 2021) and attending a dentist at least once per year (Chatzopoulos and Koidou, 2014). The vast majority of our sample (92.4%) had their first dental visit at a relatively young age (up to 12 years old).

However, the proportion that had first visited the dentist at an age younger than 5 years (32.7%) is markedly lower than the one observed in a study among 5-year-old Greek children, where 83.56% of the sample had already experienced professional dental care (Mantonanaki et al., 2013). This discrepancy could be attributed to possible recall bias on the students' part with regard to the exact age of their first dental visit, a rather common issue in cross-sectional study designs (Raphael, 1987).

6.2 Oral health literacy

The Oral Health Literacy-Adults Questionnaire (OHL–AQ) is a specialised measurement instrument that incorporates crucial aspects of the OHL construct, such as oral comprehension and decision making, and its measuring style is compatible with the idiosyncrasies of the Greek language. The Greek version of OHL–AQ demonstrated good face and content validity and had adequate internal consistency (Cronbach's alpha = 0.72). The construct validity of the instrument was satisfactory; OHL–AQ successfully discriminated among subgroups by levels of self-perceived oral health status tooth-brushing frequency. These favourable psychometric properties are in line with those observed across studies that translated and validated the instrument in other languages (Flynn et al., 2016; Vyas et al., 2016; Ho et al., 2020). Thus, the Greek version of OHL-AQ can be considered a valid instrument for the assessment of oral health literacy in the Greek population. Further research should consider additional aspects, such as test-retest reliability, that could not be included in this study.

According to published studies, lower education levels are associated with lower oral health literacy (Atchison *et al.*, 2010; Blizniuk *et al.*, 2015; Flynn *et al.*, 2016). Conversely, a higher education does not provide an absolute assurance of high oral health literacy. In an Irish study among third-level university students, only 23% of the participants had adequate oral health literacy (Mathew and Kabir, 2021). This divergence between formal education and oral health literacy levels is evident, even if less prominent, in our sample: 28.8% of the participants demonstrated inadequate and 22.7% marginal oral health literacy, even though they belong to a highly educated university population. While the majority has adequate oral health literacy (48%), the prevalence of limited/inadequate oral health literacy is still significant. ***Ergo, the first research hypothesis is accepted.*** The average OHL-AQ score corresponds to a marginal level of

oral health literacy (*Mean* = 10.9) and it is comparable to the results of an Iranian study of medical and pharmacy students that also used the OHL-AQ instrument (*Mean is* 12.09 and 10.48 for medical and pharmacy students, respectively) (Yazdani, Mohebbi and Chehree, 2017).

Aiming to investigate how different levels of education may affect oral health literacy in our uniform –in this aspect– sample, parental education was used as a proxy. The level of parental education appears to have a significant longitudinal effect on child numeracy and literacy outcomes (Dickson, Gregg and Robinson, 2016) in general and having a father with a university degree has been associated with higher oral health literacy among students (Yazdani, Mohebbi and Chehree, 2017). Among the participants of this study, a higher level of maternal education was associated with higher oral health literacy. However, no significant association with paternal education was found.

Participants with lesser economic means had lower oral health literacy. In particular, the students who faced severe financial difficulties and had significantly lower levels of oral health literacy than both their colleagues who could cover current expenses without maintaining savings and those who were financially comfortable; thus, the results confirm the socioeconomic gradient reported in other studies (Horowitz and Kleinman, 2012; Naghibi Sistani *et al.*, 2013; An *et al.*, 2019; VanWormer, Tambe and Acharya, 2019).

Female participants had higher oral health literacy than their male colleagues, a finding consistent with other reports (Naghibi Sistani *et al.*, 2013; Blizniuk *et al.*, 2014, 2015). Nevertheless, the relationship between sex/gender and oral health literacy is ambiguous. Several research teams have reported no significant association between the two, after controlling for other factors (Sabbahi *et al.*, 2009; Atchison *et al.*, 2010).

A significant weak positive correlation between age and oral health literacy (Spearman's ρ = 0.13) was found. Divaris *et al.* (2011), in their study assessing the relationship between oral health literacy and oral health-related quality of life, reported a progressive increase in oral health literacy scores (REALD-30) for gradually older participant subcategories. It is important to notice that both in that study and the present one, the oldest participants were younger than 60 years; thus, the increased oral health literacy in older groups could be related to

greater experience and knowledge, without the increased risk for cognitive decline associated with the elderly (Mayo Foundation for Medical Education and Research, 2021). However, in terms of the present thesis, this finding should be perceived with caution since the majority of the participants fell within a limited age range, apart from a few individual students that were rather older and may unduly influence the result.

Regarding oral health-related outcomes, the participants who perceived their oral health as good or very good had higher oral health literacy. This coincides with findings that suggest a significant association between limited/lower oral health literacy and adverse oral health outcomes, whether they are self-reported or clinically diagnosed (Lee *et al.*, 2007; Wehmeyer *et al.*, 2014; Dutra *et al.*, 2019). Higher levels of oral health literacy may indicate an enhanced understanding of beneficial oral health-related behaviours and decision-making that could lead to an objectively improved oral health status through complex pathways like the ones previously described (in the Literature review chapter) linking higher health literacy with better health outcomes; furthermore, higher oral health literacy may also improve the individuals' attitude and motivation towards their own oral health, thus contributing to an even more favourable subjective self-perception (Rademakers and Heijmans, 2018).

Adherence to the recommended tooth brushing frequency (twice per day) was associated with higher levels of oral health literacy among participants, further supporting the link between high oral health literacy and improved engagement in preventive oral health behaviours (Ueno *et al.*, 2013; Naghibi Sistani *et al.*, 2014; Yazdani, Mohebbi and Chehree, 2017).

Higher oral health literacy was marginally associated with regular dental attendance (p = 0.049) in contrast to dental visitation only upon presentation of oral health issues. This is in line with studies reporting that people with lower oral health literacy adhere less to routine or preventive dental visits and eventually use more emergency oral health care services (Batista, Lawrence and Sousa, 2017; Henderson *et al.*, 2018; VanWormer, Tambe and Acharya, 2019). Conversely, Burgette *et al.* (2016) did not find an association between oral health literacy and dental utilisation; however, they provided the absence of distinction between preventive and problem-based reasons for dental visits as a possible justification.

In summary, oral health literacy was associated on a bivariate level with several sociodemographic characteristics and oral health-related variables, including: sex, age, mother's education level, the financial status of the household, self-perceived oral health status, tooth brushing frequency and frequency of dental visits. No significant associations were observed regarding the place of origin, father's education level, previous traumatic dental experience and age of first dental visit. *Thus, the second research hypothesis is partially accepted.*

6.3 Dental anxiety

The evaluation of dental anxiety was performed with the Modified Dental Anxiety Scale (MDAS). Forty six per cent of the sample experienced moderate to extreme dental anxiety, with the rest reporting no or low dental anxiety. The proportion of participants that had extreme dental anxiety and could be considered as phobic was 8.6% (cut-off value: 19). Furthermore, using the score 15 as a secondary cut-off for highly dentally anxious individuals (Giri *et al.*, 2017), an additional 14% of the students experienced high levels of dental anxiety. The average MDAS score of 11.4 was indicative of moderate dental anxiety. These findings are comparable with those reported in two studies of Greek patients that used the MDAS instrument (Makri, Alexias and Togas, 2020; Tsimpiris, Triadafyllidou and Anagnostopoulos, 2020). There is a significant divergence in participants with moderate anxiety (23.4% in our study and 16.5% in the study of Tsimpiris *et al.*). A likely justification is a difference in population parameters –the present study had a community sample– or a possible divergence in cut-off scores. The levels of dental anxiety in our sample were lower (Al-Omari and Al-Omiri, 2009; Sghaireen *et al.*, 2013) or comparable (Storjord *et al.*, 2014; Gunjal, Pateel and Parkar, 2017) to other studies of non-dental university students.

Female participants experienced higher levels of dental anxiety. This finding is almost universal across dental anxiety research (Hakeberg, Berggren and Carlsson, 1992; Coolidge, Arapostathis, *et al.*, 2008; Heidari, Banerjee and Newton, 2015), and it remained significant on a multivariable level; it has been explained by researchers on the basis of true gender-related differences in the development and expression of anxiety and phobias (Curtis *et al.*, 1998) and as result of the higher willingness of women to admit their fears and anxieties (Pierce and

Kirkpatrick, 1992), among others. Nevertheless, there are studies that found no significant sex differences and a cultural modulating effect has been proposed as a possible justification (Folayan, Idehen and Ojo, 2004).

Participants who had at least one parent with tertiary/postgraduate education level experienced lower dental anxiety, when compared to their colleagues who had parents with lower education levels. The parental pathway of dental anxiety has been well-documented (Carter *et al.*, 2014). Parents with higher educational attainment may experience lower dental anxiety themselves (Moore *et al.*, 1993; Heidari, Banerjee and Newton, 2015) and thus be less likely to involuntarily propagate it to their children. The association with mother's education level remained significant on a multivariable level and it is in line with a Russian study of 285 undergraduate students that reported the lower maternal education as a risk factor for dental anxiety (Drachev, Brenn and Trovik, 2018).

Regarding the association between dental anxiety and oral health-related variables, the results corroborated previous findings showing that individuals who have experienced a traumatic dental event tend to have higher dental anxiety (De Jongh *et al.*, 1995; Oosterink, de Jongh and Hoogstraten, 2009; Milgrom *et al.*, 2010; White, Giblin and Boyd, 2017). Adherence to the recommended tooth-brushing frequency of at least twice a day and regular dental attendance were associated with lower dental anxiety, in accordance with published literature that suggests an association of higher dental anxiety with poor adherence to preventive behaviours (Pohjola *et al.*, 2008; Drachev, Brenn and Trovik, 2018) and dental visits only for emergencies/dental avoidance (Armfield, Stewart and Spencer, 2007; Pohjola *et al.*, 2007; Appukuttan, 2016). Coolidge *et al.* (2010), in their study validating the Greek version of MDAS, reported that patients whose most recent visit was due to a dental problem rather than a routine check-up had significantly higher MDAS scores. However, the association with the frequency of dental visits did not remain significant on a multivariable level, possibly due to methodological differences with other studies.

High dental anxiety has been associated with lower socioeconomic status (Armfield, Spencer and Stewart, 2006; Appukuttan *et al.*, 2012). Conversely, in the present study, no significant

association between dental anxiety and the financial situation of the household could be established.

In the published literature, high dental anxiety has been associated with adverse oral health outcomes and poor oral health status through a vicious cycle of dental avoidance and progressive oral health deterioration (Armfield, Stewart and Spencer, 2007; Drachev, Brenn and Trovik, 2018). However, in this study, the relationship between dental anxiety and self-perceived oral health status was marginally non-significant (p = 0.08). This could be partially ascribed to the young average age of the sample, which has hitherto prevented the accumulation of dental problems.

Overall, dental anxiety had a significant bivariate association with sociodemographic and oral health-related characteristics, i.e., sex, father's and mother's education level, previous traumatic experience, tooth brushing frequency and frequency of dental visits. All associations remained significant on a multivariable level, apart from the frequency of dental visits and father's education level (was not included in the model). No significant association was observed in terms of age, year of study, place of origin, the financial situation of the household, self-perceived oral health status and age of first dental visit. ***Thus, the third hypothesis is partially accepted.***

6.4 Oral health literacy and dental anxiety

A central focus of the present thesis was the investigation of the relationship between oral health literacy (OHL) and dental anxiety (DA). To the author's knowledge, only three published studies have attempted to establish an association between the two concepts; all of them focused on parent/caregiver-child dyads seeking dental care and investigated possible effects on children oral health outcomes (Shin, Braun and Inglehart, 2014; Barasuol *et al.*, 2017; Kadambari and Leelavathi, 2019).

According to the results of this study, the OHL–AQ and MDAS scores were negatively yet weakly correlated on a bivariate level and participants who were classified as having adequate oral health literacy scored significantly higher on the MDAS than their colleagues who had inadequate oral health literacy. This association between these two variables remained

significant on a multivariable level, after controlling for the effects of important predictors/confounders. These results corroborate the findings of the two previous studies that found a significant negative multivariable association between OHL and DA (Shin, Braun and Inglehart, 2014; Barasuol *et al.*, 2017) and further demonstrate the strength of the association across different populations, countries and cultures, as suggested by Barasuol *et al.* (2017). ***Thus, the fourth hypothesis is accepted.*** A significant difference is that, in both those studies, household income had a significant multivariable association with dental anxiety – further confirming a relationship between dental anxiety and socioeconomic status–while in the present study, the association was non-significant on both a bivariate and multivariable level. This differentiation could be due to methodological differences (the other studies used quantitative categories for income rather than qualitative) or different population characteristics.

The findings of this study regarding the relationship between dental anxiety and oral health literacy are of exploratory nature. One could argue that the limited comprehension of diagnosis, treatment plans and general oral information during a dental visit can create a feeling of uncertainty and helplessness that may fuel the development or exacerbation of dental anxiety (Humphris and King, 2011; Shin, Braun and Inglehart, 2014). At the same time, anxious patients may exhibit certain behavioural and emotional responses, such as inattentiveness, confusion and poor memory, that may hamper certain functions integral to the concept of oral health literacy (e.g. comprehension and processing of oral health information, decision-making). Additional research is needed to develop a conceptual model of the specific pathways between oral health literacy and dental anxiety and further elucidate their underlying causality and dynamic.

6.5 Implications for dental practice and public health policy

The significant prevalence of inadequate oral health literacy even among highly educated adults and its suggested relationship with dental anxiety should raise concerns, in terms of counteracting their negative consequences on both an individual and a public health level.

Clinicians should be aware of those challenges and be vigilant in order to detect and amend any related shortcomings in a timely fashion. A combination of screening instruments that can

alert to the need for special management of certain patients and universal precautions that render dental care and information accessible regardless of personal characteristics may constitute an appropriate approach (Hadden and Kripalani, 2019). The dental team should aim to create a friendly environment, as less anxiety-inducing as possible and maintain an empathic, caring and non-judgemental attitude towards patients. Special attention should be paid to effective dentist-patient communication strategies; constructive and supportive communication addresses the needs of patients with lower oral health literacy and it has been shown to act as an alleviating factor for dental anxiety (Bernson *et al.*, 2011). In accordance, under- and postgraduate dental education programmes should incorporate the management of low oral health literacy and dental anxiety in their curricula and foster their students' interpersonal and communication skills.

From a public policy approach, the reshaping of health care systems and dental care settings into (oral) health literate organisations would render them more easily navigable and sensitive towards the needs of patients. It is an essential step towards the goal of integrated people-centred health services that, according to WHO (2020), can lead to more effective, cost-efficient health systems that improve health literacy and increase patient engagement. Additional strategies could include the cooperation with dental associations for the funding and implementation of context-specific oral health literacy interventions targeting vulnerable populations, such as children or underprivileged communities (Ju *et al.*, 2017), as well as public oral health messages attuned to the needs of people with limited oral health literacy.

Ultimately, addressing the issues of limited oral health literacy and dental anxiety could play a significant role in the effort to lower oral health literacy barriers, alleviate oral health disparities and empower citizens to take ownership of their health.

6.6 Strengths and limitations of the study – Suggestions for future research

The standardised approach to gathering the data via two specialised and comprehensive measurement instruments (OHL-AQ and MDAS) in the Greek language should be considered among the strengths of the study. Oral health literacy is a topic only sparsely researched in the Greek population. To the author's knowledge, up until the time when the survey was conducted, there was no published study attempting to systematically quantify oral health

literacy in Greece with a previously validated instrument. In the meantime, a study on the development and validation of a Greek oral health instrument was published (Taoufik *et al.*, 2020). This instrument (GROHL), as previously described, is a word pronunciation and recognition assessment tool that focuses mainly on the knowledge component of oral health. The Greek translation of OHL-AQ is a valuable addition, since it represents a functional oral health literacy-oriented instrument, able to assess a variety of factors, such as comprehension of verbal dental instructions and decision-making.

The study sample represents a university population not actively pursuing dental care. The common level of formal education among participants and the non-clinical setting of the survey provide control of certain confounding effects, limit bias and corroborate the credibility of the outcomes.

This exploratory study is one of the few investigating the interplay between oral health literacy and dental anxiety in any population. The correlation indicated by the results may offer insight towards an alternative pathway of managing dental anxiety, a common problem in daily dental practice.

The results should be considered in light of the limitations associated with this study. The cross-sectional design of the study provides evidence of association but cannot establish a cause-effect relationship. The data were collected from a university student population via a non-probabilistic convenience sampling method, possibly affecting external validity. Due to time and setting limitations that hindered a face-to-face survey on a single participant basis, the researcher opted to hold the questionnaire administration procedure in auditoriums, addressing several students concurrently. We cannot exclude the possibility that these conditions may have interfered with the accuracy of the results. However, the steps that were taken to avoid cross-contamination of the results and miscommunication during the oral component of OHL-AQ (as detailed in the Data collection subchapter) support the internal validity of the study.

This study did not focus extensively on the validation of the translated instrument for oral health literacy; only face validity, content validity, construct validity via known-groups comparisons and internal consistency were evaluated for the Greek version. The psychometric

properties of OHL-AQ have been previously validated in other languages (Naghibi Sistani *et al.*, 2014; Flynn *et al.*, 2016; Vyas *et al.*, 2016; Flynn, John and Naghibi Sistani, 2018; Ho *et al.*, 2020), and the translation in Greek followed a robust approach. Nonetheless, further research in more diverse populations and settings is needed to thoroughly test the psychometric properties of the Greek version of OHL-AQ and provide a more comprehensive and systematic view of oral health literacy in Greece.

The attempt to assess the relationship between dental anxiety and oral health literacy is exploratory; it was based on associations established in previous papers rather than on a specific conceptual model. Furthermore, the multiple linear regression model for dental anxiety is limited by its assumptions. While no strong evidence of multicollinearity or heteroscedasticity was detected, the presence of endogeneity (such as unobserved or omitted variable bias) is possible.

Additional research with longitudinal study designs is encouraged to further establish the correlation between oral health literacy and dental anxiety. The development of a conceptual model would be an essential step in the effort to portray and understand the specific pathways of this relationship. Furthermore, in studies investigating the impact of oral health literacy on variables such as oral health outcomes and the use of oral health services, dental anxiety should be considered as a possible mediating factor. Interventional studies, preferably randomised controlled trials, could illuminate the potential of managing dental anxiety via OHL interventions.

7. Conclusions

As corroborated by the present thesis, limited oral health literacy is an important public health issue with significant prevalence even among highly educated adults. Among UoM students, 28.8% had inadequate, and 22.7% had marginal oral health literacy. Lower oral health literacy was associated with male sex, lower maternal education, worse financial status, poorer self-perceived oral health and less engagement in preventive behaviours (tooth brushing, routine dental visits). The Greek version of OHL–AQ seems to be a valid instrument for the assessment of oral health literacy that can be used for the assessment of oral health literacy in Greek-speaking populations.

Regarding dental anxiety, the potentially phobic individuals comprised 8.6% of the sample, while an estimated 14% experienced high dental anxiety. Students who had a previous traumatic dental experience were female, had parents with lower educational attainment and infrequently engaged in preventive behaviours had higher dental anxiety than their colleagues.

This study aimed to contribute to the rather limited literature about the relationship between oral health literacy and dental anxiety. According to our results, these two constructs are negatively correlated and their association remains significant even after adjusting for other variables. Future research is encouraged to provide insights into the specific pathways of this complex relationship and explore the potential use of oral health literacy interventions for the management of dental anxiety.

Clinicians should be mindful of oral health literacy, dental anxiety and their possible interconnection. It is not always obvious which patients are in need of particular assistance. Emphasis should be placed on effective dentist-patient communication strategies that provide empathy and support to the patient and take into account possible oral health literacy barriers. Dental professionals could play a significant role in people-centred care by helping patients overcome their oral health-related adversities and become empowered to make educated health decisions.

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Appendix 1: Approval of the research protocol by the University of Macedonia

Ethics Committee (in Greek)

ΠΑΝΕΠΙΣΤΗΜΙΟ
ΜΑΚΕΔΟΝΙΑΣ

Επιτροπή Ηθικής και Δεοντολογίας της Έρευνας

Θεσσαλονίκη, 27/09/2019
Αρ. Πρωτ.:12

Αξιότιμη κυρία Σεκερτζή,

Σας ενημερώνουμε ότι στην υπ' αρ. 3/25-9-2019 συνεδρίαση της *Επιτροπής Ηθικής και Δεοντολογίας της Έρευνας* του Πανεπιστημίου Μακεδονίας συζητήθηκε και εγκρίθηκε το υπ' αρ. 7/28-8-2019 αίτημά σας για εκπόνηση ερευνητικής μελέτης με τον τίτλο "An empirical investigation of the relationship between oral health literacy and dental anxiety". Η Ε.Η.Δ.Ε. του Πανεπιστημίου Μακεδονίας κατέληξε ομόφωνα στο συμπέρασμα ότι η συγκεκριμένη μελέτη δεν αντιβαίνει στην κείμενη νομοθεσία και συνάδει γενικά με τους κανόνες ηθικής και δεοντολογίας της έρευνας ως προς το περιεχόμενο και τον τρόπο διεξαγωγής.

Με εκτίμηση

Βασιλική Καζαβάκου
Πρόεδρος της Ε.Η.Δ.Ε.
Πανεπιστημίου Μακεδονίας

ΕΡΩΤΗΜΑΤΟΛΟΓΙΟ

Το παρόν ερωτηματολόγιο έχει συνταχθεί στο πλαίσιο εκπόνησης διπλωματικής εργασίας του Μεταπτυχιακού Προγράμματος Διοίκησης Υπηρεσιών Υγείας του Πανεπιστημίου Μακεδονίας.

Η συμπλήρωση του ερωτηματολογίου είναι προαιρετική. Τα δεδομένα που θα συλλεχθούν θα χρησιμοποιηθούν για επιστημονικούς λόγους, στο πλαίσιο της παρούσας έρευνας. Τα έντυπα του ερωτηματολογίου είναι ανώνυμα και επισημαίνεται η αυστηρή τήρηση του απορρήτου των απαντήσεων.

Η συμβολή σας στην επιτυχή διεξαγωγή της έρευνας είναι ανεκτίμητη.

Σας ευχαριστώ εκ των προτέρων για τη συνεργασία και τον χρόνο σας.

Με εκτίμηση,

Σεκερτζή Χριστίνα

Μεταπτυχιακή φοιτήτρια Πανεπιστημίου Μακεδονίας

Θεσσαλονίκη, ΤΚ. 54638

e-email: ch.sekertzi@gmail.com

1. Ερωτηματολόγιο Ενηλίκων για Θέματα Στοματικής Υγείας
(OHL-AQ)

ΜΕΡΟΣ Α

Σε αυτό το μέρος θα ακούσετε κάποιες οδηγίες σχετικά με το πως πρέπει να δράσετε μετά από μία εξαγωγή δοντιού. Παρακαλείστε <u>να γράψετε ή να επιλέξετε την απάντηση που θεωρείτε σωστή</u> κάτω από κάθε ερώτηση.

Ε1- Εάν η εξαγωγή του δοντιού σας έγινε στις 8 π.μ., πότε θα πρέπει να βγάλετε τη γάζα;

     1. Στις _____ .
     2. Δε γνωρίζω.

Ε2- Εάν η εξαγωγή του δοντιού σας έγινε στις 8 π.μ., μπορείτε να φάτε ζεστό φαγητό στις 2 μ.μ.;

    Ναι ☐   Όχι ☐   Δε γνωρίζω ☐

ΜΕΡΟΣ Β

Σε αυτό το μέρος θα διαβάσετε προτάσεις σχετικές με γνώσεις στον τομέα της στοματικής υγείας. Παρακαλείστε να συμπληρώσετε το κενό, επιλέγοντας τη ***μία*** λέξη/φράση που θεωρείτε σωστή για κάθε κενό και <u>κυκλώνοντας το αντίστοιχο γράμμα</u>.

Ε3- Επιστημονικές έρευνες δείχνουν ότι πιθανώς υπάρχει σύνδεση μεταξύ των στοματικών ασθενειών και άλλων προβλημάτων υγείας όπως _____.

     1. οι δερματικές παθήσεις
     2. το έμφραγμα του μυοκαρδίου
     3. οι ψυχικές ασθένειες
     4. η μυϊκή δυστροφία
     5. Δε γνωρίζω.

Ε4- Κάθε άνθρωπος έχει 32 _____ και αποκτά _____ στην ηλικία των έξι ετών.

1. τομείς	1. τα περισσότερα από αυτά
2. νεογιλά δόντια	2. το πρώτο από αυτά
3. γομφίους	3. το τελευταίο από αυτά
4. μόνιμα δόντια	4. το σύνολο τους
5. Δε γνωρίζω.	5. Δε γνωρίζω.

E5- Η τερηδόνα είναι μία από τις πλέον συχνές οδοντικές παθήσεις. Το βούρτσισμα με χρήση οδοντόκρεμας που περιέχει _____ τουλάχιστον δύο φορές _____ , η χρήση νήματος και →

1. γευστικές ουσίες
2. λευκαντικούς παράγοντες
3. απορρυπαντικές ουσίες
4. φθόριο
5. Δε γνωρίζω.

1. τον μήνα
2. ανά γεύμα
3. την ημέρα
4. την εβδομάδα
5. Δε γνωρίζω.

→ η αποφυγή τροφών που περιέχουν μεγάλη ποσότητα _____ , μπορούν να αποτρέψουν τον τερηδονισμό των δοντιών.

1. αλατιού
2. μπαχαρικών
3. λιπαρών
4. σακχάρων
5. Δε γνωρίζω.

ΜΕΡΟΣ Γ

Σε αυτό το μέρος θα διαβάσετε μία ιατρική συνταγή για χρήση αντιβιοτικού. Παρακαλείστε <u>να γράψετε ή να επιλέξετε την απάντηση που θεωρείτε σωστή</u> κάτω από κάθε ερώτηση.

> Διάγνωση: Λοίμωξη και οδοντικό απόστημα
>
> Θεραπεία: Αμοξυκιλλίνη (500 mg) σε δισκία, δύο κουτιά (24 δισκία)
>
> Οδηγία: Λάβετε ένα δισκίο από το στόμα 3 φορές την ημέρα (ανά 8 ώρες), για 7 ημέρες.

↓

E6- Εάν πάρετε το πρώτο δισκίο στις 2 μ.μ., τι ώρα θα πρέπει να πάρετε το επόμενο;

1. Στις _____ .
2. Δε γνωρίζω.

E7- Εάν τα συμπτώματα σας υποχωρήσουν την 4η ημέρα που λαμβάνετε την αντιβίωση, θα πρέπει να σταματήσετε τη λήψη της;

Ναι ☐   Όχι ☐   Δε γνωρίζω ☐

Σε αυτό το μέρος θα διαβάσετε οδηγίες για τη χρήση ενός στοματικού διαλύματος. Παρακαλείστε <u>να γράψετε ή να επιλέξετε την απάντηση που θεωρείτε σωστή</u> κάτω από κάθε ερώτηση.

Στοματικό διάλυμα φθοριούχου νατρίου 0,2%.

Χρησιμοποιήστε 5ml για στοματόπλυση επί 1 λεπτό και φτύστε (1 φορά την εβδομάδα).

Μη φάτε και μην πιείτε τίποτα για 30 λεπτά.

↓

E8- Σύμφωνα με τις παραπάνω οδηγίες, μπορείτε να καταπιείτε το διάλυμα;

Ναι ☐   Όχι ☐   Δε γνωρίζω ☐

E9- Εάν χρησιμοποιήσετε το διάλυμα στις 12 π.μ., τι ώρα μπορείτε να φάτε ή να πιείτε;

1. Στις _____ .
2. Δε γνωρίζω.

ΜΕΡΟΣ Δ

Σε αυτό το μέρος θα διαβάσετε κάποιες ερωτήσεις σε σχέση με προβλήματα στοματικής υγείας και μεθόδους οδοντιατρικής εξέτασης. Παρακαλείστε να επιλέξετε τη *μία* απάντηση/απόφαση που θεωρείτε καλύτερη και <u>να κυκλώσετε το αντίστοιχο γράμμα</u>.

E10- Ποια είναι η καλύτερη απόφαση, σε περίπτωση που παρατηρήσετε λίγη αιμορραγία μετά το βούρτσισμα ή τη χρήση νήματος;

1. Να μη βουρτσίζω ούτε να χρησιμοποιώ νήμα καθημερινά.
2. Να μασάω μαστίχα αντί να βουρτσίζω ή να χρησιμοποιώ νήμα.
3. Να συνεχίσω να βουρτσίζω και να χρησιμοποιώ νήμα καθημερινά.
4. Να χρησιμοποιώ οδοντογλυφίδα αντί να βουρτσίζω ή να χρησιμοποιώ νήμα.
5. Δε γνωρίζω.

E11- Ποια είναι η καλύτερη απόφαση, σε περίπτωση που διαπιστώσετε πόνο όταν καταπίνετε;

1. Να χρησιμοποιήσω κάποιο αντιβιοτικό.
2. Να χρησιμοποιήσω παυσίπονο.
3. Να συμβουλευτώ την οικογένεια μου.
4. Να απευθυνθώ σε γιατρό ή οδοντίατρο.
5. Δε γνωρίζω.

E12- Ποια από τις παρακάτω μεθόδους είναι η καλύτερη για την απομάκρυνση χρωστικών και τρυγίας (πέτρας) από τα δόντια κάποιου ατόμου;

1. Η κατανάλωση σκληρών τροφών (π.χ. μήλο).
2. Η στοματόπλυση με κάποιο στοματικό διάλυμα.
3. Η χρήση οδοντόκρεμας κατά της πέτρας η οποία να έχει και έξτρα λευκαντική δράση.
4. Ο οδοντικός καθαρισμός.
5. Δε γνωρίζω.

E13- Ποια είναι, κατά τη γνώμη σας, η σημασία της πρότασης «Απαλλάσσω τον οδοντίατρό μου από την ευθύνη μη σκοπούμενων επιπλοκών της θεραπείας.»;

1. Ο οδοντίατρός μου είναι υπεύθυνος για πιθανές αθέλητες επιπλοκές της θεραπείας.
2. Συναινώ στη θεραπεία που μου προτείνει ο οδοντίατρός μου.
3. Επιτρέπω στον οδοντίατρό μου να μου παρέχει κάθε απαραίτητη θεραπεία.
4. Ο οδοντίατρός μου δε φέρει ευθύνη για πιθανές αθέλητες επιπλοκές της θεραπείας.
5. Δε γνωρίζω.

E14- Ποια είναι, κατά τη γνώμη σας, η σημασία της πρότασης «Έχω ιστορικό αλλεργίας σε κάποιες φαρμακευτικές δραστικές ουσίες.»;

1. Δυσκολεύομαι να μιλήσω και έχω σπασμούς μετά από την κατανάλωση κάποιων φαρμάκων.
2. Νιώθω έντονο πόνο στο στήθος μετά από την κατανάλωση κάποιων φαρμάκων.
3. Νιώθω ότι δεν μπορώ να αναπνεύσω και το δέρμα μου κοκκινίζει μετά από την κατανάλωση κάποιων φαρμάκων.
4. Αισθάνομαι άγχος και ζαλάδα μετά από την κατανάλωση κάποιων φαρμάκων.
5. Δε γνωρίζω.

2. Ερωτηματολόγιο MDAS
Modified Dental Anxiety Scale

Μπορείτε να περιγράψετε το πόσο αγχώνεστε (εάν αγχώνεστε) κατά την επίσκεψη στον οδοντίατρο; Παρακαλείστε να επιλέξετε το αντίστοιχο κουτί.

E15- Εάν επρόκειτο να επισκεφθείτε τον οδοντίατρο για θεραπεία αύριο, πως θα αισθανόσασταν;

Καθόλου αγχωμένος/η ☐   Ελαφρά αγχωμένος/η ☐   Μέτρια αγχωμένος/η ☐   Πολύ αγχωμένος/η ☐   Φοβερά αγχωμένος/η ☐

E16- Εάν καθόσασταν στην αίθουσα αναμονής (περιμένοντας για οδοντιατρική θεραπεία), πως θα αισθανόσασταν;

Καθόλου αγχωμένος/η ☐   Ελαφρά αγχωμένος/η ☐   Μέτρια αγχωμένος/η ☐   Πολύ αγχωμένος/η ☐   Φοβερά αγχωμένος/η ☐

E17- Εάν επρόκειτο να σας τροχίσουν ένα δόντι, πως θα αισθανόσασταν;

Καθόλου αγχωμένος/η ☐   Ελαφρά αγχωμένος/η ☐   Μέτρια αγχωμένος/η ☐   Πολύ αγχωμένος/η ☐   Φοβερά αγχωμένος/η ☐

E18- Εάν επρόκειτο να καθαρίσουν και να στιλβώσουν («γυαλίσουν») τα δόντια σας, πως θα αισθανόσασταν;

Καθόλου αγχωμένος/η ☐   Ελαφρά αγχωμένος/η ☐   Μέτρια αγχωμένος/η ☐   Πολύ αγχωμένος/η ☐   Φοβερά αγχωμένος/η ☐

E19- Εάν επρόκειτο να σας κάνουν ένεση τοπικής αναισθησίας στα ούλα, πάνω από ένα επάνω πίσω δόντι, πως θα αισθανόσασταν;

Καθόλου αγχωμένος/η ☐   Ελαφρά αγχωμένος/η ☐   Μέτρια αγχωμένος/η ☐   Πολύ αγχωμένος/η ☐   Φοβερά αγχωμένος/η ☐

3. Δημογραφικά Χαρακτηριστικά

Παρακαλείστε να <u>επιλέξετε τη σωστή απάντηση</u>.

Δ1- Φύλο:

Άνδρας ☐   Γυναίκα ☐

Δ2- Ηλικία:

Είμαι _____ ετών.

Δ3- Έτος φοίτησης:

1ο ☐   2ο ☐   3ο ☐   4ο και άνω ☐

Δ4- Καταγωγή:

Αστικό κέντρο / πόλη ☐   Κωμόπολη / χωριό ☐

Δ5- Εκπαίδευση γονέων:

<u>Πατέρας</u>

1. 1οβάθμια Εκπαίδευση (Δημοτικό)
2. 2οβάθμια Εκπαίδευση (Γυμνάσιο – Λύκειο)
3. 3οβάθμια Εκπαίδευση (Πανεπιστημιακές σπουδές / ΑΕΙ – ΤΕΙ)
4. Μεταπτυχιακές σπουδές / Διδακτορικό

<u>Μητέρα</u>

1. 1οβάθμια Εκπαίδευση (Δημοτικό)
2. 2οβάθμια Εκπαίδευση (Γυμνάσιο – Λύκειο)
3. 3οβάθμια Εκπαίδευση (Πανεπιστημιακές σπουδές / ΑΕΙ – ΤΕΙ)
4. Μεταπτυχιακές σπουδές / Διδακτορικό

Δ6- Ποια από τις παρακάτω φράσεις εκφράζει καλύτερα την κατάσταση του οικογενειακού σας νοικοκυριού;

1. Δεν τα βγάζουμε πέρα.
2. Τα βγάζουμε πέρα με πολύ μεγάλες δυσκολίες.
3. Τα βγάζουμε πέρα αλλά δε μας μένουν και πολλά στην άκρη.
4. Είμαστε άνετοι οικονομικά.
5. Δεν ξέρω / Δεν απαντώ.

Δ7- Είχατε ποτέ οδοντιατρική εμπειρία που θα χαρακτηρίζατε τραυματική;

Ναι ☐   Όχι ☐

Δ8- Πώς θα αξιολογούσατε την κατάσταση της στοματικής σας υγείας;

1. πολύ καλή
2. καλή
3. μέτρια
4. κακή
5. πολύ κακή
6. Δεν ξέρω / Δεν απαντώ.

Δ9- Συχνότητα βουρτσίσματος / στοματικής υγιεινής:

1. 2 φορές/ημέρα ή περισσότερο
2. 1 φορά/ημέρα
3. λιγότερο από 1 φορά/ημέρα
4. καθόλου

Δ10- Πόσο συχνά επισκέπτεστε τον οδοντίατρο;

1. ανά εξάμηνο
2. ανά έτος
3. μόνο όταν παρουσιαστεί κάποιο πρόβλημα
4. σπανιότερα

Δ11- Ηλικία πρώτης επίσκεψης στον οδοντίατρο:

1. σε ηλικία έως και 5 ετών
2. 6-12 ετών
3. 13-18 ετών
4. σε ηλικία μεγαλύτερη των 18 ετών

Σας ευχαριστούμε πολύ για τη συμμετοχή σας!

Appendix 3: The post-extraction instructions recited to the participants by the researcher during the Listening component of OHL-AQ.

Δαγκώστε σφιχτά μία νοτισμένη γάζα στο σημείο της εξαγωγής για 30 λεπτά.

Μη φτύνετε για 12 ώρες.

Φάτε κρύες και μαλακές τροφές (όπως κρύα σούπα) για τις επόμενες 12 ώρες μετά την εξαγωγή.