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**Symptoms of anxiety and depression
in the Portuguese elderly**

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Resumo

Introdução: O envelhecimento da população é uma tendência a longo prazo que começou há várias décadas em todo o mundo. A ansiedade e depressão nos idosos são consideradas problemas importantes das sociedades modernas.

Objetivos: Este estudo dedicou-se à análise da prevalência de ansiedade e depressão e dos seus factores relacionados, na população idosa portuguesa.

Método: Os dados derivam da coorte EpiDoC – o estudo EpiDoC 2. A coorte EpiDoC, representativa da população adulta portuguesa, é composta por 10.661 adultos. Este estudo incluiu os participantes da segunda avaliação de seguimento do estudo EpiDoC 2 com mais de 64 anos, que responderam ao Hospital Anxiety and Depression Scale (HADS), $n = 1.680$. Foram recolhidos dados sociodemográficos, estilos de vida, doenças crónicas auto-reportadas, qualidade de vida (EQ-5D-3D), funcionalidade (HAQ) e informação sobre o consumo de recursos em saúde. A ansiedade e depressão foram avaliadas através do HADS.

Resultados: A prevalência de ansiedade nos idosos é de 9,59% e 11,77% para depressão. A ansiedade é mais frequente em idosos com baixo nível de escolaridade e em mulheres. Neste trabalho verificámos que a pior qualidade de vida e incapacidade funcional se associam a ansiedade. Relativamente à depressão, verificámos que é mais frequente em idosos do sexo feminino, que vivam sozinhos, com baixo nível de escolaridade e baixo rendimento. Também a depressão se associou a pior capacidade funcional e qualidade de vida.

Conclusão: A ansiedade e depressão são frequentes nos idosos portugueses e associam-se a pior qualidade de vida e a incapacidade funcional independentemente de outras doenças crónicas. O nível de educação é diferenciador desta população em termos de ansiedade e depressão.

Palavras-chave

Idosos; Ansiedade e Depressão; Doenças crónicas não transmissíveis; Estilos de vida; Qualidade de vida

Abstract

Introduction: Population aging is a long-term trend that began several decades ago around the World. Anxiety and depression in the elderly are well studied around the world, and some authors consider them one of the most serious problems faced by modern societies.

Objectives: The present study is dedicated to the analysis of anxiety and depression prevalence, and their related factors, among Portuguese elderly people.

Methods: Data derived from second wave of follow up for EpiDoC Cohort – EpiDoC 2 study. EpiDoC Cohort is representative of adult Portuguese population, composed by 10,661 adults. The current study included all ≥ 65 years old EpiDoC 2 study participants, who responded to Hospital Anxiety and Depression Scale (HADS), $n=1,680$. A structured questionnaire was applied through computed assisted phone call interviews to all EpiDoC participants. Sociodemographic, lifestyles, self-reported non-communicable diseases, health related quality of life (EQ-5D-3D), physical function (HAQ) and health resources consumption information were collected. Anxiety and depression were assessed with HADS. Anxiety and depression prevalence were estimated according to study design. Multivariable linear regression was used to determine anxiety and depression score determinants.

Results: Portuguese elderly have prevalence of 9.59% for anxiety, and 11.77% for depression. Anxiety was more frequent in women and in participants with lower educational level. Depression was also more frequent in women and in elderly with lower educational level, with low household composition and living alone.

Low quality of life and physical disability were independently associated to both anxiety and depression score.

Discussion: Anxiety and depression are frequent among Portuguese elderly. Health-related quality of life and physical function are independently associated with anxiety and depression score.

Key words

Elderly; Anxiety and Depression; Non-communicable chronic diseases; Lifestyles; Quality of life; Function

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Abbreviations

95% CI – 95% confidence interval

BMI – Body Mass Index

CAPI – computer assisted phone interview

EQ-5D-3L – European Quality of Life Questionnaire with Five Dimensions and Three Levels

HADS – Hospital Anxiety and Depression Scale

HAQ – Health Assessment Questionnaire

NUT II – Nomenclature of Territorial Units for Statistics II (Norte, Centro, Lisboa e Vale do Tejo, Alentejo, Algarve, Região Autónoma dos Açores (the Azores), Região Autónoma da Madeira (Madeira))

OR – Odds ratio

SPR – Sociedade Portuguesa de Reumatologia

USA – United States of America

WHO – World Health Organization

1 Introduction

The present study is dedicated to the analysis of anxiety and depression prevalence, and their related factors, among a representative sample of Portuguese elderly.

Ageing

Our world is now old and aging. Population aging is a long-term trend that began several decades ago in Portugal, Europe and around the World. According to United Nations data for 2015, the number of people over 65 has increased considerably in the largest regions of the world and this aging is expected to accelerate in the coming decades (UN, 2015). The same data points out that, in 2015, 1 in 8 people in the world were 60 or older, totalling 901 million elderly people. A hundred seventy-six million of these elderly people live in Europe.

In Portugal, the number of people over 65 years of age doubled in relation to the 1970s and, by 2015, was already over 2 million, with the population over 80 years old increasing fivefold. In concrete terms, there were 836,058 people aged 65 and over in Portugal in 1971. In 1977, they surpassed one million and, in 2012, two million. In 2015 they were 2,122,996 (PORDATA, 2016).

But population aging is, in fact, a success story: it is based on important changes in the birth rate and mortality, which are largely explained by developments in the social, scientific and economic development. Examples of those are the progress in reducing infant mortality, promoting access to education and employment, advances in gender equality, including in the transformation of the role of women into society - placing women in the labour market with its consequences on number of children. Significant improvements in reproductive health and access to family planning contributed decisively to reducing the birth rate (Lunenfeld & Stratton, 2013). In addition, progress in public health and health technologies coupled with the general improvement in living conditions, better hygiene and dietary lifestyle changes, mean that we are now living longer and, in most cases, healthier (Myers, 1987). Actually, babies born after 2000 in developed countries are highly likely to celebrate their 100th birthday if the current annual increase in life expectancy continues throughout the 21st century (Christensen, Doblhammer, Rau, & Vaupel, 2009).

The elderly population, despite its heterogeneity, presents several chronic diseases and medical conditions and, with aging, increases the likelihood multimorbidity. Advanced ages are also

characterized by the emergence of geriatric syndromes, complex health states that do not fit into classified diseases (WHO, 2015).

Portugal faces major economic challenges in the 21st century, but also consequences of greater social relevance such as the quality of life of an aging population and the status of the elderly in society (INE, 2002) .

The way people live their old age depends largely on the how society itself thinks and acts before this population group (Oliveira, 2010). As Pimentel stated in 2001, "(...) the way one gets older, and the better or worse value that is given to this process, depends more on human societies than on Nature " (Pimentel, Afonso, & Pereira, 2012).

Particularly in industrialized countries, aging and the circumstances in which older people live and grow older are taking a central place in public health research.

Anxiety

Although the epidemiological investigation has begun to converge regarding the estimation of the prevalence of anxiety disorder in elderly populations, there are still quite a few discrepancies (Wolitzky-Taylor, Castriotta, Lenze, Stanley, & Craske, 2010) The sampling procedures diverge greatly: some studies use representative samples from the respective country and others use samples of convenience. In addition, there is considerable instability in age cut-offs considered for the definition of the elderly or older adult. On the other hand, there is much variation in the operationalization of anxiety, partly due to the use of different evaluation instruments.

Byrne (2002) argues that differences in anxiety prevalence rates may be owed to differences among populations, but also to differences in assessment tools and algorithms used for diagnosis (Byrne, 2002). Some studies use the hierarchical approach to diagnosis which may lead to lower prevalence by excluding individuals with diagnostic criteria that also have criteria for diagnosing other higher disorders in the hierarchy (Wolitzky-Taylor et al., 2010).

Prevalence of anxiety

Bryant and collaborators (2007) defend that significant anxiety symptoms range from 15% to 52% in community samples, and from 15% to 56% in samples in medical settings (Bryant, Jackson, & Ames, 2008).

Himmerlfarb and Murrell (1984) conducted an important epidemiological study in the United States to estimate the prevalence of self-reported anxiety symptoms in a population aged 55 years or older (Himmelfarb & Murrell, 1984). This assessment was not intended to estimate the prevalence of anxiety disorders but to estimate the proportion of people in this age group who would have anxiety symptoms at sufficient level to be at risk of suffering an anxiety disorder or requiring intervention of some kind. The authors had a prevalence of 20% for anxiety symptoms. Beekman et al (1998), analysing the results of Longitudinal Study of Aging in Amsterdam (LASA), indicate a global prevalence of anxiety disorders of 10.2%, with the most frequent disturbance being Generalized Anxiety Disorder (Beekman et al., 1998).

In Portugal, National Epidemiological Study on Mental Health (J. Almeida et al., 2013) using data collected in 2008-2009, found a prevalence of 2.6% for Generalized Anxiety Disorder in a representative sample of Portuguese elderly constituted by a total 386 participants ≥ 65 years old.

Factors associated with anxiety

Himmerlfarb and colleagues found anxiety symptoms were significantly higher among women (Himmelfarb & Murrell, 1984). The symptoms of anxiety varied inversely with the socioeconomic level. Another conclusion of interest was that 73% of people with significant levels of anxiety symptoms also needed medical services, in contrast to only 55% of those without significant anxiety symptoms (Himmelfarb & Murrell, 1984).

Discussing the role of age in anxiety disorders, Beekman and collaborators (1998), concluded that age itself does not have an impact on the prevalence of anxiety disorders, as opposed to other risk factors such as female sex and low levels of education (Beekman et al., 1998). Factors that are associated with more advanced ages such as chronic illness and family losses are also risk factors for anxiety disorders.

The Epidemiologic Catchment Area (ECA Study) in USA, and Edmonton studies, in Canada, concluded that the prevalence of anxiety disorders was lower in the elderly than in all age groups combined (Bland, Newman, & Orn, 1988; Regier et al., 1988). Henderson and collaborators (1998) in Australia also concluded that anxiety symptoms decreased with age in both sexes along with other potential risk factors such as adverse events and severe economic difficulties (Henderson et al., 1998). However, the authors note that the results may have the bias of the individuals who agreed to participate in the study (Henderson et al., 1998). Bryant and colleagues (2008), in their review on anxiety prevalence in the elderly, runs against Henderson team (1998) and point out that the lower prevalence rates in older individuals may be reflecting the methods

of selection and sampling (Bryant et al., 2008). And indeed, Teachman, in 2006, reported a curvilinear relationship between age and anxiety symptoms, with increases in anxiety and negative affect from the age of 75 years (Teachman, 2006).

Lenze and Wetherell (2011) claim that anxiety disorders are common in older people and cause considerable disability (Lenze & Wetherell, 2011). Considering a large group of epidemiological studies focused on elderly, the authors concluded that generalized anxiety disorder is the most prevalent in this age group, despite of scarce attention is given to this disorder in later life.

Factors associated with aging, such as social isolation, reduced autonomy, financial insecurity, and poor health, cause an increase in the prevalence of anxiety disorders and symptoms (Flint, 1994).

Some studies point to psychosocial risk factors for anxiety disorders and late-onset depression: female gender, cognitive dysfunction, chronic illness, poor health perception, functional limitations, personality traits such as neuroticism and weak coping strategies (Tilburg, 2003; Vink, Aartsen, & Schoevers, 2008). Specifically, for anxiety disorder: not having children, low income, and experiencing traumatic events (Lenze & Wetherell, 2011). Beekman and collaborators (2000) divided the risk factors for anxiety in the elderly into external and internal (Beekman et al., 2000). External factors, or stressors, are the authors chronic illness, disability, and spouse illness. Internal factors, or vulnerability factors, include personality traits of neuroticism and low self-efficacy (Beekman et al., 2000).

In 2005, Brenes and her team studied the relation between physical function reduction – disability – and anxiety, concluding they were significantly associated (Brenes et al., 2005). Years later, the same author in an individual work, demonstrated the strait relation between anxiety and quality of life, as severity of anxiety symptoms increase, quality of life decrease (Brenes, 2007).

Depression

In the last decades, there was a bourgeoning of large-scale epidemiological studies to ascertain the prevalence of depression at later ages. Some authors even consider that one of the most serious problems faced by modern societies is depression among the elderly (e.g. (Chapman & Perry, 2008).

Although depression is fairly common in the last years of life (Blazer & Hybels, 2005), there is great variation in its prevalence in studies worldwide (Castro-Costa et al., 2007). These differences may be due to actual differences in the population studied but may also be due to the different methods adopted by the authors and the different case definitions (Beekman, Copeland, & Prince, 1999).

Prevalence of depression

In his review on the prevalence of depression in older adults, Beekman and colleagues (1999) analysed the literature from the point of view of the case definition of depression (diagnosis or syndrome) to reduce variation (Beekman et al., 1999). Their results showed that Major Depressive Disorder, per the diagnostic criteria, is relatively rare, with an average prevalence of 1.8%. The mean prevalence of the Minor Depressive disorder increases to 10.2% and, when considering all depressive syndromes, the prevalence is 13.3%. He included studies from several European and Asian countries, USA and Canada, and Australia.

A study in India, despite the small number of participants, concluded that elderly have a high prevalence of depressive symptoms (Goyal & Kajal, 2014). And in Brazil, Almeida et al (1997), demonstrated the high prevalence of depressive symptoms and their association with increased impact on primary health care (O. Almeida et al., 1997) . As we zoom in in Europe, we found the Survey of Health, Aging and Retirement in Europe (SHARE), which is a database with health, psychological, economic and social and family support variables with approximately 123,000 individuals aged 50 years or more; it involves 27 European countries and Israel (Castro-Costa et al., 2007). Based on this database, the authors compared the prevalence of depressive syndrome in adults over 50 years of age in 10 European countries: Denmark, Sweden, the Netherlands, Germany, Austria, Switzerland, France, Spain, Italy and Greece (Castro-Costa et al., 2007). The results indicate a higher prevalence of depression in France, Italy and Spain (33%) followed by Greece (24%). In other countries prevalence is around 18-19%. The differences between countries are statistically significant ($p < 0.001$) (Castro-Costa et al., 2007).

In Portugal, Almeida and collaborators (2013), using data collected in 2008-2009, found a prevalence of 12% for depression in the Portuguese with 65 years or more (J. Almeida et al., 2013).

Factors associated to depression

The Longitudinal Study of Aging in Amsterdam (LASA) aimed to study the determinants, course and consequences of cognitive, emotional and physical functioning in aging. The researchers followed a representative group of adults aged 55 to 85 from three regions of the Netherlands (Huisman et al., 2011). Beekman (2002) followed a cohort of elderly people and concluded that, although major depressive disorder is relatively rare among the elderly, depressive symptoms are

severe and chronic (Beekman, Geerlings, et al., 2002). In 2016, Hoogendijk and colleagues, compiling the main results of this cohort, reported that the depressive symptomatology with a clinically significant level (but not corresponding to diagnostic criteria of Major Depressive Disorder) presents an incidence of 24% and significantly influences the quality of life and function in this population (Hoogendijk et al., 2016).

From an epidemiological perspective, the question if increasing age is a risk factor for depression is not clear. The results of the prospective study conducted by Heun (2005) demonstrate that age is a risk factor for depression (Heun & Hein, 2005), as opposed to the study by Steffens et al (2000) that found no age influence on the prevalence of depression (Steffens et al., 2000).

Alameda County is a longitudinal study beginning in 1965 on physical and mental health and mortality, representative of the adult population of Alameda County in California. In the study by Roberts and his team (1997), who analysed the data collected in 1994, points to an increase in prevalence with age (Roberts, Kaplan, Shema, & Strawbridge, 1997). However, multivariate analyses have shown that, when controlled for other psychosocial risk factors, there are no significant age effects. Thus, healthy, normal-function elderly patients are at no increased risk for depression (Roberts et al., 1997). The effects of age on depression are associated with physical health problems and associated disabilities. Also, a study in the Netherlands concluded that depressive symptoms are highly prevalent in the elderly and increase with age (van't Veer-Tazelaar et al., 2008). Nevertheless, more than attributable to increasing age, the authors ascribe this increase in prevalence to changes in age-related risk factors such as functional disability, loneliness, and falling concern (van't Veer-Tazelaar et al., 2008).

In his review of literature, Djernes (2006) systematized the predictors of depressive disorder and depressive symptoms in the elderly described in the literature, concluding that the female sex, chronic diseases, cognitive and functional disability, lack or loss of social contacts and clinical history of depression are strong predictors to consider (Djernes, 2006). Barefoot (2001) also demonstrated that female sex is associated with more depressive disorders and more depressive symptoms (Barefoot, Mortensen, Helms, Avlund, & Schroll, 2001). Being single, separated or divorced is also a predictor of disorders and depressive symptoms for both sexes (Minicuci, Maggi, Pavan, Enzi, & Crepaldi, 2002), and widowhood means increased risk of these disorders and symptoms, especially for men (van Grootheest, Beekman, Broese van Groenou, & Deeg, 1999).

Living alone, according to a study in a population of elderly people in Helsinki, is also associated with depressive symptoms (Valvanne, Juva, Erkinjuntti, & Tilvis, 1996)

Chronic diseases are strongly associated with the appearance of depressive disorders and depressive symptoms, as is the case of cardiac and musculoskeletal diseases (Valvanne et al., 1996).

According to McCall and colleagues (2002), lower levels of education were associated with depressive disorders and depressive symptoms (McCall, Parks, Smith, Pope, & Griggs, 2002), and other studies have shown that they were also associated to lower quality of life scores (Xavier et al., 2002).

Health-related dysfunction or disability is a risk factor for the appearance of depressive symptoms and depressive disorders (Haynie, Berg, Johansson, Gatz, & Zarit, 2001; Mezuk, Edwards, Lohman, Choi, & Lapane, 2012; Schulman, Gairola, Kuder, & McCulloch, 2002), even in very old people (Forsell, Jorm, & Winblad, 1998; Meller, Fichter, & Schroppel, 1997; Päivärinta, Verkkoniemi, Niinistö, Kivelä, & Sulkava, 1999)

Sarris and colleagues (2014) postulate that there is now compelling evidence that a range of lifestyle factors are involved in the pathogenesis of depression such as diet, physical exercise, alcohol intake, sleep and smoking (Sarris, O'Neil, Coulson, Schweitzer, & Berk, 2014).

Objectives

The study objectives are: 1) to determine the prevalence of anxiety and depression symptoms in the Portuguese elderly population, and 2) to identify relevant associations between the symptoms of anxiety and depression and chronic self-reported non-communicable diseases, lifestyles, function, quality of life and healthcare resources consumption in the Portuguese elderly population.

Given the social and economic context of our country, generating relevant evidence on anxiety and depressive symptoms in the Portuguese elderly population, and understanding them from a point of view that goes beyond the mental illness itself, by approaching the possible associated factors, is crucial. Data on elderly mental health and associated factors could be useful to address therapeutic programs and better planning of health care.

2 Method

2.1 Study design

To analyse the older adult Portuguese population in terms of symptoms of anxiety and depression, their association with non-communicable chronic diseases, function, lifestyles, and quality of life we used the second wave of follow up for EpiDoC Cohort – EpiDoC 2 study - done by computer assisted phone interviews (CAPI).

EpiDoC Cohort is a representative study of adult Portuguese population (Figure 1), composed by 10,661 adults (≥ 18 years old) who were non-institutionalized and living in private households in the Mainland and the Islands (Azores and Madeira) (Rodrigues et al., 2015). Recruitment took place between September 2011 and December 2013 and the candidate households were selected using a random route process. The adults with permanent residence in the selected household with the most recently completed birthday were recruited and face-to-face interviewed (one adult per household).

All 10,661 participants of EpiDoC Cohort signed the Informed Consent for 1st wave (EpiDoC 1 study) and 10,153 signed the informed consent for follow ups and provided their telephone number. Subjects unwilling to sign the Informed Consent, unable to speak Portuguese or with an inability to answer the questionnaire, despite being aided, were excluded (P A Laires et al., 2012). Nevertheless, a caregiver could be the one answering the questionnaire.

EpiDoC 1 study was the first wave of data collection and occurred between September 2011 and December 2013, along with the recruitment. It is a national, cross-sectional and population-based study that aimed to determine rheumatic and musculoskeletal diseases (RMD) prevalence and their burden in Portugal.

EpiDoC 2 study consisted on a structured questionnaire (Annex A), applied through phone call interviews to the same 10,153 eligible participants of EpiDoC 1 study who consented to be contacted again for follow-up. This study systematically collected and analysed longitudinal data (the nuclear questionnaire) as well as allowed adding new questions regarding life styles, health innovation and social interactions. Specific domains were addressed for all population, such as sociodemographic and socioeconomic data, anthropometric measures, non-communicable chronic diseases and risk factors for cardiovascular events, anxiety, depression, physical function and quality of life, falls and bone fractures, hospitalizations, home care assistance and medical

appointments, medication and other treatment, alcohol and smoking habits, physical exercise and lifestyles, mortality information, habits regarding new technologies, search for health information, development and adoption of health innovation, trust in conventional healthcare system, alternative medicines, adverse events. The study included 7,591 participants, representative of the adult Portuguese population.

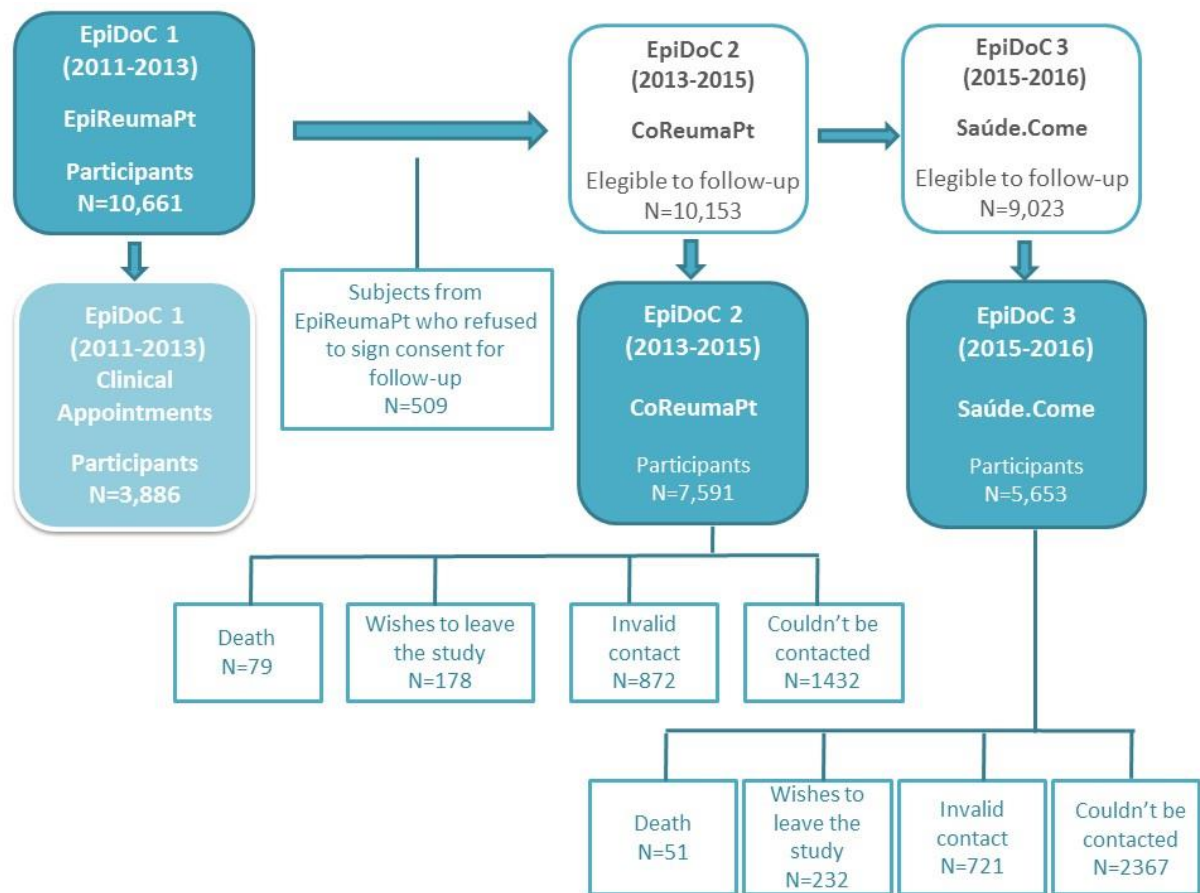


Figure 1: Flowchart of EpiDoC Cohort

The present study included all 65 and more years old EpiDoC 2 study participants, who responded to HADS (Figure 2) (n=1,680).

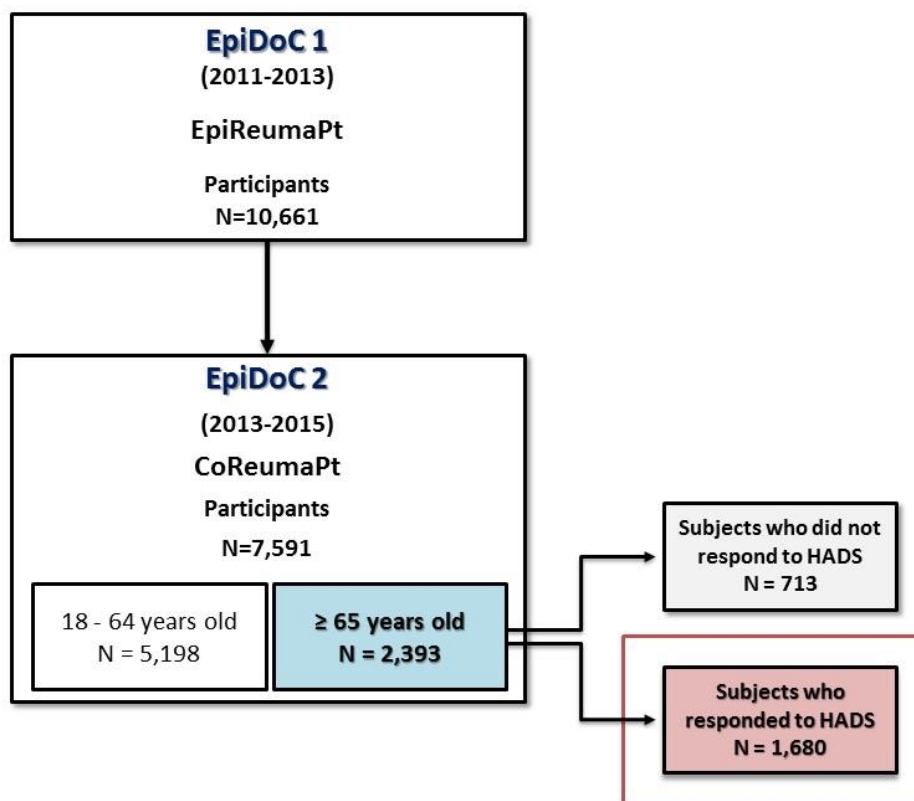


Figure 2. Flowchart describing population eligible for the present study.

2.2 Data Collection

The data collection was performed from March 26th 2013 to July 27th 2015. A trained research assistants' team was responsible for collecting the follow-up data from these subjects, by randomly call all the individuals. When a contact was not available, they would hold more attempts in different moments (morning, afternoon, evening and weekends) to perform six attempts. The last contact had to have at least 1 month of interval from the previous one. Only then the contact would be abandoned. Rescheduling of the telephonic interviews to a more convenient moment was also an option. The interview was telephonically performed with the assistance of a CATI (computed assisted telephone interview) system (an in-house software platform, created by the informatics team of *Sociedade Portuguesa de Reumatologia* (SPR)).

Data was collected in a standardized form and database access is protected by unique username and password, for each research team member, according to Portuguese Law of data collection ("Lei n° 67/98 - Lei da Proteção de Dados Pessoais," 1998).

2.2.1 Measurements, assessment and instruments

2.2.1.1 Sociodemographic and socioeconomic characteristics

Information on sociodemographic (sex, age, years of education, household composition, NUT II), as well as socioeconomic variables (household income) were collected in the 1st wave - EpiDoC 1 study. Subjects were asked in the EpiDoC 2 study interview whether there have been changes.

2.2.1.2 Health characteristics

In EpiDoC 1 study, individuals were asked if they had been previously diagnosed with some chronic disease (high cholesterol level, high blood pressure, rheumatic disease, allergy, gastrointestinal disease, cardiac disease, diabetes, thyroid and parathyroid disease, urolithiasis, pulmonary disease, hyperuricemia, cancer, neurologic disease, hypogonadism) and this information was updated in the EpiDoC 2 study interview.

Self-reported height and weight were collected in EpiDoC 2. Based on these data, Body Mass Index (BMI, $\text{weight}/\text{height}^2$, in kg/m^2) was calculated and categorized according to the World Health Organization (WHO) classification in four categories: underweight (BMI < 18.5 kg/m^2), normal (BMI between 18.5-24.9 kg/m^2), overweight (BMI between 25-29.9 kg/m^2) and obesity (BMI \geq 30 kg/m^2) (WHO, 1995).

To evaluate symptoms of anxiety and depression in EpiDoC 2 study, the Hospital Anxiety and Depression Scale (HADS) Portuguese validated version was applied (Pais-Ribeiro et al., 2007). The HADS was originally developed by Zigmond and Snaith (Zigmond & Snaith, 1983) as a screening tool to apprehend clinically significant states of anxiety and depression in a non-psychiatric hospital setting. “*I get a sort of frightened feeling like something awful is about to happen*” is an example for anxiety subscale item, and “*I still enjoy the things I used to enjoy*” for depression subscale. The HADS was designed to be a short, 14-item, self-assessment scale that was easily understandable and capable of distinguishing between these emotional states (Snaith, 2003). The anxiety and depression sub-scales each consist of seven items with each item having four possible answers scored 0, 1, 2 or 3. Individual anxiety and depression scores are calculated by summation

of the appropriate seven items and thus can range from 0 to 21, with higher scores indicating higher levels of anxiety or depression, respectively. In both subscales, a score between 0 and 7 is “normal”, between 8 and 10 “mild”, between 11 and 14 “moderate” and between 15 and 21 “severe” (idem). To each one the cutoff used for positive symptoms was ≥ 11 , since Snaith (2003) suggested a score ≥ 11 was indicative of “caseness” to a mood disorder (Snaith, 2003).

Pais-Ribeiro in the instrument validation found a Cronbach alpha of .76 was found with the correlation items scale corrected for overlap between .43 and .57 and with the majority of correlation in the range 0.50 – 0.59 for anxiety subscale. In the present study, the Cronbach alpha for anxiety subscale was 0.39 (Pais-Ribeiro et al., 2007).

In instrument validation, for depression, a Cronbach alpha of .81 was found with the correlation item scale corrected for overlap between .37 and .64 and with the majority of correlations in range .60 – .69. In the present study, the depression Cronbach alpha was 0.47.

Health-related quality of life was assessed using the Portuguese validated version of European Quality of Life questionnaire (EQ-5D-3L) (Ferreira, Ferreira, Pereira, & Oppe, 2014a, 2014b) The EQ-5D-3L is a preference-based measure widely used in cost-utility analysis. It comprises five dimensions (mobility e.g. “*I don't have problems walking*”, self-care e.g. “*I have some problems in dressing myself*”, usual activities e.g. “*I have no problem performing my usual activities*”, pain/discomfort e.g. “*I have moderate pain and discomfort*” and anxiety/depression e.g. “*I am not anxious or depressed*) with three levels each, for which a higher score corresponds to a higher quality of life. The Portuguese version of EQ5D has Cronbach alfa of 0.72. In the present study, Cronbach alfa for this tool was 0.65.

Function was evaluated based on the Portuguese version of Health Assessment Questionnaire (HAQ) (Benito-Garcia et al., 2006; Santos et al., 1996) . The Health Assessment Questionnaire (HAQ) is the most widely used and universally accepted questionnaire to evaluate rheumatology function (Fries, Spitz, Kraines, & Holman, 1980). It has been validated in various populations and languages. The Portuguese version (P-HAQ) was created based on the English version of 20 items, and this work was already published in Portugal. Functional ability is measured by nine general component categories (dressing and grooming, arising, eating, walking, hygiene, reach, grip, outside activity, and sexual activity), each of which consists of one or more specific questions. For example, “*Are you able to shampoo your hair?*” is one question asked in the dressing and grooming component. Each question is scored from 0 to 3. The scoring is based on the following scale: “without difficulty” = 0, “with difficulty” = 1, “with some help from another

person or with a device” = 2, and “unable to do” = 3. The higher score, the worse functional ability. In the present study, HAQ had a Cronbach alfa of 0.96.

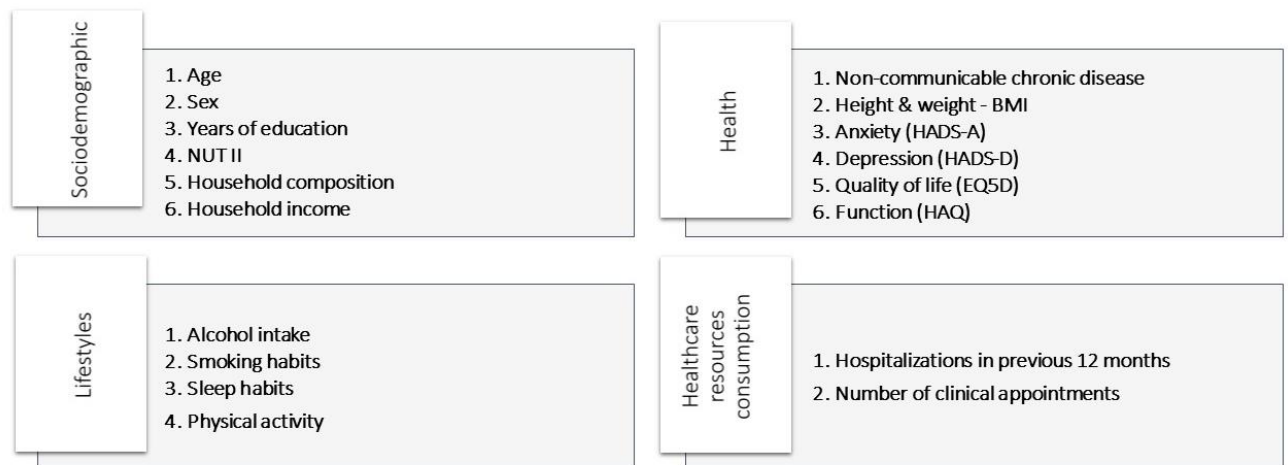
To assess healthcare resources consumption, “number of medical appointments in the previous 12 months” and “hospitalization in the previous 12 months (yes/no)” were asked to participants.

2.2.1.3 Lifestyle characteristics

In EpiDoC 2 study, questions concerning lifestyle habits included frequency of alcohol intake (daily, occasionally, never), smoking habits (current smoker, past smoker, never smoked), sleep habits (number of hours of sleep per day, categorized in < 6 and ≥ 6 hours/day). Physical activity level was classified based on the question related to the reported weekly frequency of physical activity. A frequency of once a week or more was considered “yes” to regular physical exercise.

Figure 3 summarizes all variables collected in EpiDoC 2 study that are relevant for the present study.

Figure 3. Summary of collected variables



2.3 Participants

2.3.1 Sociodemographic characteristics

Our population of interest included 1,680 participants, 908 (54%) of those were females (Table 1). Forty four percent were 75 years old or more. With respect to educational level, almost two thirds of participants (n=1,259; 76.03%) had less or equal to 4 years of education.

Most people with 65 years of age and more reported to live on a household income of less than 1000€ per month; 35,8% reported the lowest income level of 500€/month. Moreover, elderlies tend to live in households composed by only one (25.53%) or two persons (55.89%).

Table 1. Sociodemographic characteristics of the older adult EpiDoC 2 study population who responded to HADS.

	≥ 65 years who responded to HADS n=1,680 mean (SD) or n (%)
Sex	
Female	908 (54%)
Age (mean ± sd)	73.83 (±6.64)
Min	65
Max	102
Age group	
65 - 74 years old	934 (55.56%)
≥75 years old	746 (44.44%)
Education level *	
Years of education (mean ± sd)	3.57 (±0.88)
0-4 years	1,259 (76.03%)
≥5 years	397 (23.97%)
NUTS II	
Norte	543 (32.32%)
Centro	427 (25.42%)
Lisboa	314 (18.69%)
Alentejo	106 (6.3%)
Algarve	60 (3,57%)
Azores	87 (5,17%)
Madeira	143 (8.51%)

Household income *

≤500€	442 (35.85%)
501€ to 750€	332 (26.93%)
751€ to 1000€	168 (15.09%)
> 1000€	291 (23.60%)

Household composition

1 person	429 (25.53%)
2 people	939 (55.89%)
≥3 people	312 (18.57%)

Legend: Sd: standard deviation; %: percentage; Min: minimum age found in sample; Max: maximum age found in sample; Household composition: number of people that live in the house of the participant, including himself/herself. * Sample size is not constant due to missing data: Years of education and Education level (n=1,656), Household income (n=1,233)

2.3.2 Health Characteristics

With respect to health-related characteristics, the observed mean number of non-communicable chronic diseases was 3.10 (± 2.1). The most frequently reported chronic diseases were high blood pressure (57.3%), rheumatic diseases (50.53%), and high cholesterol level (49.7%).

People 65+ years old score EQ-5D-3L on average 0.61 (± 0.77) for quality of life, and Quality of life and 0.72 (± 0.72) in HAQ for physical function.

The high consumption of health care resources by the older age group matches the health status. The average number of appointments was 7.74 (± 8.40), and 24,16% was hospitalized in the last 12 months.

Table 2. Description of the health-related characteristics of the older adults EpiDoC 2 study Population who responded to HADS

	≥ 65 years who responded to HADS n=1,680 mean (SD) or n (%)
Non-communicable diseases **	
Number of non-communicable diseases (self-reported)	3.10 (±2.1)
Non-communicable diseases (self-reported) **	
High blood pressure	953 (57.83%)
Diabetes	288 (17.57%)
High cholesterol level	817 (49.7%)
Pulmonary disease	189 (11.54%)
Cardiac disease	437 (26.71%)
Gastrointestinal disease	452 (27.53%)
Neurologic disease	128 (7.83%)
Allergy	370 (22.54%)
Neoplastic disease	143 (8.70%)
Thyroid and parathyroid disease	197 (12.02%)
Hypogonadism	23 (1.44%)
Hyperuricemia	220 (13.79%)
Renal colic	250 (15.38%)
Rheumatic disease	810 (50.53%)
Quality of life **	
EQ5D score	0.61 (±0.77)
Physical function **	
HAQ score (0-3)	0.72 (±0.72)
BMI **	
Underweighted	11 (0.73%)
Normal	444 (29.63%)
Overweighed	706 (47.13%)
Obese	337 (22.50%)
Healthcare resources consumption **	
Was hospitalized in previous 12 months	403 (24.16%)
Number of medical appointments in previous 12 months	7.74 (±8.40)

Legend: Sd: standard deviation; %: percentage; EQ5D: European Quality of Life questionnaire five dimensions three levels; HAQ: Health Assessment Questionnaire; BMI: Body Mass Index (kg/m²)

**Sample size is not constant due to missing data: Body Mass Index (kg/m²) (n=1,498), EQ5D score (0-1) (n=1,632), Physical function HAQ score (0-3) (n=1,676) High blood pressure (n=1,648), Diabetes (n=1,638), High cholesterol level (n=1,644), Pulmonary disease (n=1,639), Cardiac Disease (n=1,636), Gastrointestinal disease (n=1,642), Neurologic disease (n=1,635), Allergy (n=1,641), Neoplastic disease

(n=1,643), Thyroid and parathyroid disease (n=1,639), Hypogonadism (n=1,594), Hyperuricemia (n=1,595), Renal colic (n=1,626), Rheumatic disease(n=1,603), Was hospitalized (n=1,668), Number of medical appointments (n=1,402).

2.3.3 Lifestyle characteristics

Regarding lifestyle habits, namely in terms of alcohol intake and smoking habits, 36.43% of the individuals had reported a daily intake of alcohol beverages but only 5.39% were current smokers. Among the elderly, 43.65% of the subjects never consume alcohol and 66.35% of people aged 65 and above never smoked.

Almost 60% of individuals above 65 years old do not engage in regular physical exercise, and around 70% of the Portuguese elderly sleep 6 or more hours per day.

Table 3. Description of lifestyle characteristics of the older adult EpiDoC 2 study Population who responded to HADS

	≥ 65 years who responded to HADS n=1,680 n (%)
Alcohol intake ***	
Daily	611 (36.43%)
Occasionally	334 (19.32%)
Never	732 (43.65%)
Smoking habits ***	
Current smoker	91(5.39%)
Past smoker	474 (28.26%)
Never	1,114 (66.35%)
Physical activity ***	
Regular exercise – Yes	697 (41.52%)
Regular exercise – No	982 (58.48%)
Sleep habits ***	
< 6 hours/day	288 (31.82%)
≥ 6 hours/day	617 (68.18%)

Legend: %: percentage;

***Sample size is not constant due to missing data: Alcohol intake (n=1,677), Smoking habits and Physical activity (n=1679), Sleep habits (n=905)

2.4 Statistical analysis

2.4.1 Sample Weights

EpiDoC was designed to obtain a representative sample of the Portuguese population (Rodrigues et al., 2015). In order to guarantee its representativity, weighted proportions have, for this matter, been computed.

For the cohort, the initial extrapolation weights were calculated as the inverse of the inclusion probabilities, taking into account the sampling design, i.e., a stratified two-stage cluster sampling design. The stratification was based on the seven NUTS II regions and on five classes of the number of inhabitants per locality (<2,000; 2,000-9,999; 10,000-19,999; 20,000-99,999; >99,999). In each stratum, the first sampling stage consisted in the selection of localities with a probability proportional to its size (number inhabitants aged 18 years old or more), except for localities where the number of inhabitants was larger than 20,000, where all the localities were selected. In the second stage, households were selected using a pseudo-random selection procedure equivalent to the equal probability selection. These weights were submitted to a calibration process by crossing region (seven classes), size of locality (five classes), gender (two classes) and seven age categories (18-25, 26-35, 36-45, 46-55, 56-65, 66-75 and ≥ 76 years old). This procedure was used to reproduce the known population totals for the crossing margins of these four variables.

In order to maintain the representativeness of the sample in relation to the Portuguese population (Mainland and Autonomic Regions), extrapolation weights were computed and used in further statistical analysis. These were obtained by calibrating the extrapolation weights originally designed for the EpiDoC 1 study sample.

We first compared the participants and non-participants of EpiDoC 2 study, concerning their sociodemographic, socioeconomic and health status characteristics. Based on this comparison, we decided to adjust the weights based on the stratification by NUT II region, sex, and age group. In the present study, we used the extrapolation weights calculated to EpiDoC 2 study since the elderly who responded to HADS did not present different characteristics in terms of sex, age and NUTS II region distribution.

2.4.2 Analysis and Statistical Software

Descriptive data for each categorical variable was presented as the absolute frequency and the correspondent proportion, adjusted for the weight to adjust for study design. The same adjustment has been done for the mean and standard deviation (SD) for each continuous variable.

First step was to perform univariate logistic regressions to approach relations between independent variables and outcomes.

When previous analyses resulted in statistically significant associations, multivariable logistic regressions were performed, adjusting to sociodemographic characteristics: sex, age group (65-74 years old; ≥ 75 years old), region (NUTS II), educational level (0-4 years; ≥ 5 years) and household income ($\leq 500\text{€}$, 501€ to 750€, 751€ to 1000€, $>1000\text{€}$).

Finally, the separate global models for anxiety and depression were conceptualized two ways. A logistic regression was performed with all previous significant or clinically relevant independent variables, adding adjustment for sociodemographic features. In addition, considering the outcome (anxiety and depression) as a continuous variable, linear regressions were performed for all independent variables with statistical significance or considered clinically relevant, holding the adjustment for relevant sociodemographic characteristics.

Significance level was set at 0.05. All analyses were weighted and executed using STATA IC version 12 (StataCorp. 2011. Stata Statistical Software: Release 12. College Station, TX: StataCorp LP).

2.5 Ethical issues and Data protection

EpiDoC 1 study was performed by the principles established by the Declaration of Helsinki ("World Medical Association Declaration of Helsinki: ethical principles for medical research involving human subjects," 2013) and revised in 2013 in Fortaleza. The study was reviewed and approved by the National Committee for Data Protection (*Comissão Nacional de Proteção de Dados*) and by the NOVA Medical School Ethics Committee. The participants provided informed consent to contribute in all phases of the study.

The EpiDoC 2 study was also approved by National Committee for Data Protection (in accordance with the Portuguese law number 67/98, October 26th, regarding protection of personal data) and was submitted to the same Ethics Committee. The study was conducted in accordance with the applicable laws and regulations including, but not limited to, the Guideline for Good Clinical Practice and the ethical principles stated in the Declaration of Helsinki (World Medical Association, 2013).

Participants' confidentiality will be safeguarded by the nonexistence of identifiers on the database (only unique ID participants' codes). Their names and contacts will be stored separately from study data transmitted to the coordinating centre (based on the headquarters of the SPR. Thus, all data for future analysis will be kept anonymously and securely by the EpiDoC 2 study authorized staff. During EpiDoC 1 study, consent was also signed by those accepting to participate in the EpiDoC 2 study. There will be absolutely no disclosure of individual health information to the general public.

3 Results

3.1 Prevalence of anxiety and depression symptoms in the elderly

The current study found 176 elderly out of 1,680 (10.48%) presenting anxiety symptoms (HADS-A ≥ 11), corresponding to a prevalence of 9.59% when weighted to Portuguese elderly population. The mean score for HADS-A was 5.04 (± 3.74) and, considering anxiety, the population distributed as shown in figure 3.

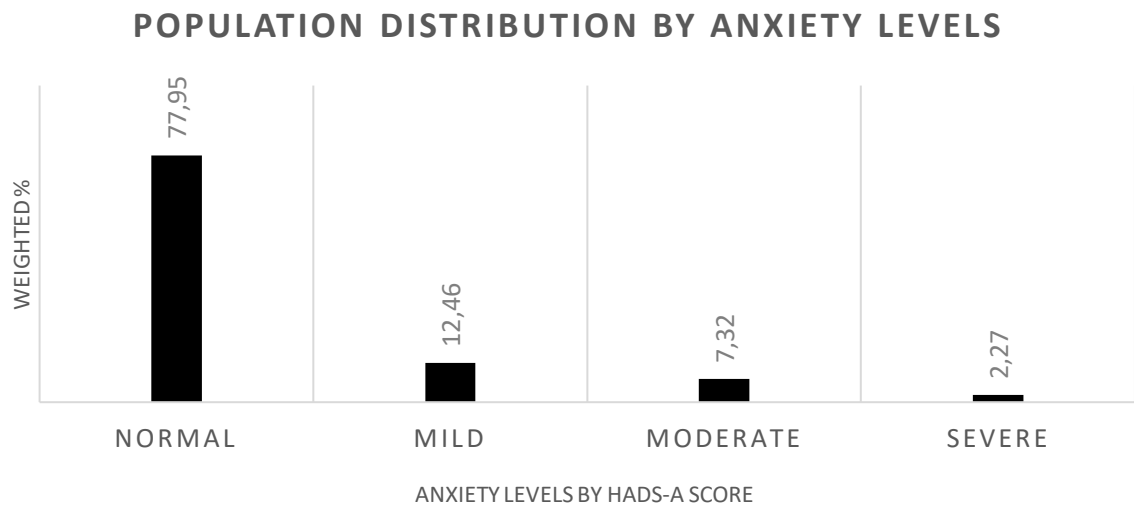


Figure 4. Population distribution by anxiety levels, according to HADS-A score.

Normal: 0-7; Mild: 8-10; Moderate: 11-14; Severe: 15-21.

Sociodemographic and socioeconomic characteristics of the Portuguese elderly population with and without anxiety symptoms are summarized in Table 4.

Table 4: Sociodemographic and socioeconomic characteristics of the Portuguese elderly population with and without anxiety symptoms

Sociodemographic and socioeconomic characteristics		Elderly without anxiety symptoms (HADS-A <11) mean (SD) or n (%) n=1,504 (90.41%)	Elderly with anxiety symptoms (HADS-A ≥11) mean (SD) or n (%) n=176 (9.59%)	p-value
Age (years)		74.24 (±6.60)	73.96 (±6.91)	.0594
Sex	Female	768 (83.85%)	140 (15.15%)	.000
	Male	736 (95.44%)	36 (4.56%)	
NUTS II	Norte	476 (89.88%)	67 (10.12%)	.906
	Centro	378 (89.93%)	49 (10.07%)	
	Lisboa e Vale do Tejo	291 (90.56%)	23 (9.44%)	
	Alentejo	95 (92.11%)	11 (7.89%)	
	Algarve	57 (93.14%)	3 (6.86%)	
	Região Autónoma dos Açores	80 (93.04%)	7 (6.96%)	
	Região Autónoma da Madeira	127 (91.03%)	16 (8.97%)	
Education Level	0-4 years of education	1,103 (88.55%)	156 (11.45%)	.001
	5 ≥ years of education	377 (95.98%)	20 (4.02%)	
Household income	≤500€	384 (89.15%)	58 (10.85%)	.430
	501€ to 750€	301 (91.75%)	31 (8.25%)	
	751€ to 1000€	152 (88.38%)	16 (11.62%)	
	>1000€	275 (94.52%)	16 (5.48%)	
Household composition	1	374 (88.89%)	55 (11.11%)	.388
	≥2	1,130 (90.90%)	121 (9.10%)	
BMI	Underweight	9 (84.23%)	2 (15.77%)	.806
	Normal	397 (91.5%)	47 (8.5%)	
	Overweight	647 (20.2%)	59 (9.8%)	
	Obese	297 (91.32%)	40 (8.68%)	

Legend: SD – standard deviation; % - weighted percentage; NUTS II - Nomenclatura das Unidades Territoriais, level II; BMI – Body Mass Index (kg/m²); € - euro; HADS-A – Hospital Anxiety and Depression Scale – Anxiety subscale; bold: Variables with statistical significance

In terms of depression symptoms, figures rise to 241 (14.34% in the present sample), equivalent to a prevalence of 11.77% of the Portuguese elderly population. This population had a mean score for HADS-D of 5.27 (±4.07). Figure 4 illustrates the population distribution regarding depressive symptoms.

POPULATION DISTRIBUTION BY DEPRESSION LEVELS

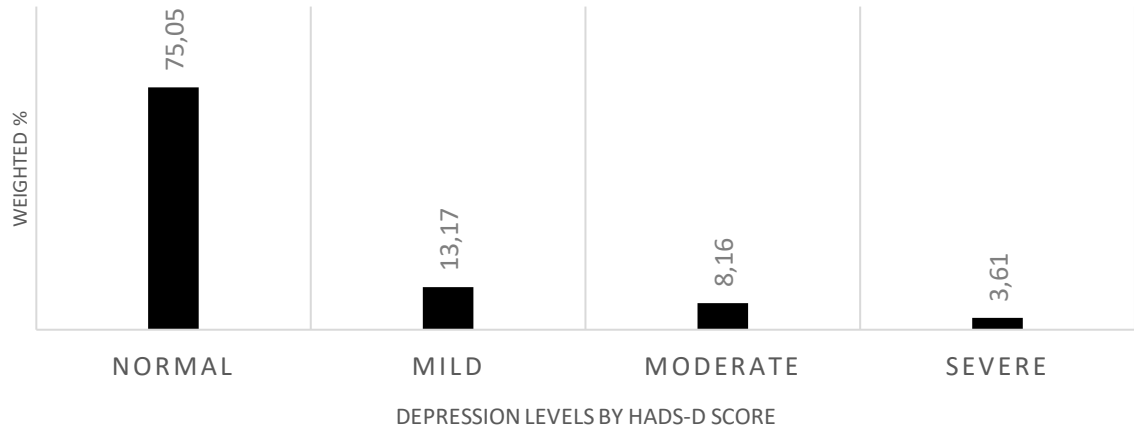


Figure 5. Population distribution by depression levels, according to HADS-D score.

Normal: 0-7; Mild: 8-10; Moderate: 11-14; Severe: 15-21.

Table 5: Sociodemographic and socioeconomic characteristics of the Portuguese elderly population with and without depression symptoms

Sociodemographic and socioeconomic characteristics		Elderly without depression symptoms (HADS-D <11) mean (SD) or n (%) n=1,439 (88,23%)	Elderly with depression symptoms (HADS-D ≥11) mean (SD) or n (%) n= 241 (11,77%)	<i>p</i> -value
Age (years)		73.57 (±6.51)	75.74(±7.23)	.000
Sex	Female	747 (84.47%)	161 (15.53%)	.000
	Male	692 (91.64%)	80 (8.36%)	
NUTS II	Norte	463 (87.84%)	80(12.16%)	.020
	Centro	360 (85.41%)	67(14.59%)	
	Lisboa e Vale do Tejo	281 (93.63%)	33 (6.37%)	
	Alentejo	89 (87.2%)	17 (12.8%)	
	Algarve	50 (86.89%)	10(13.11%)	
	Região Autónoma dos Açores	76 (87.77%)	11 (12.23%)	
	Região Autónoma da Madeira	120 (85.62%)	23 (14.38%)	
	Education Level	0-4 years of education	1,046 (65.37%)	
	5≥ years of education	373 (76.84%)	24 (23.16%)	
Household income	≤500€	342 (80.53%)	100 (19.47%)	.000
	501€ to 750€	291 (88.06%)	41 (11.94%)	
	751€ to 1000€	154 (96.26%)	14 (3.74%)	
	>1000€	271 (93.22%)	20 (6.78%)	
Household composition	1	347 (84.05%)	82(15.95%)	.009
	≥2	1,092 (89.58%)	159 (10.42%)	
BMI	Underweight	9 (74.53%)	2 (24.47%)	.293
	Normal	388 (89.99%)	56 (10.01%)	
	Overweight	620 (89.98%)	86 (10.02%)	
	Obese	284 (86.98%)	53 (13.02%)	

Legend: SD – standard deviation; % - weighted percentage; NUTS II - Nomenclatura das Unidades Territoriais, level II; BMI – Body Mass Index; € - euro; HADS-D – Hospital Anxiety and Depression Scale – Depression subscale. bold: Variables with statistical significance

3.2 Anxiety & depression symptoms and non-communicable chronic diseases in the elderly

Regarding anxiety symptoms in Portuguese elderly and their association with self-reported non-communicable chronic diseases, diabetes, pulmonary disease, cardiac disease, neurologic disease, neoplastic disease, hypogonadism, hyperuricemia, and renal colic were not statistically significant in a univariate analysis (Table 6).

Table 6: Association of anxiety symptoms with self-reported non-communicable diseases in Portuguese elderly

Non-Communicable chronic diseases	HADS-A (yes vs no)		
	OR	95% CI	
High blood pressure	2.03	1.18	3.49
Diabetes	0.94	0.56	1.58
High cholesterol	1.22	0.69	2.19
Pulmonary disease	1.64	0.94	2.85
Cardiac disease	1.50	0.89	2.52
Gastrointestinal disease	1.80	1.03	3.13
Neurologic disease	1.85	0.93	3.67
Allergy	2.42	1.23	4.79
Neoplastic disease	0.89	0.46	1.72
Thyroid and parathyroid disease	2.51	1.50	4.19
Hipogonadism	0.75	0.17	3.44
Hyperuricemia	1.14	0.65	1.98
Renal colic	1.48	0.86	2.55
Rheumatic disease	4.36	2.65	7.15

Legend: HADS-A: Hospital Anxiety and Depression Scale – Anxiety subscale; OR: Odds Ratio; CI: Confidence interval, bold: Variables with statistical significance

The multivariable analysis using the previous significantly associated self-reported non-communicable chronic diseases with anxiety symptoms, showed that only high blood pressure

(OR=1.72, 95% CI 1.05, 2.80) and rheumatic disease (OR=2.70, 95% CI 1.63, 4.71) remained statistically significant.

After adjusting for sociodemographic characteristics (sex, age, region, education level, and household income), only rheumatic diseases (OR=2.58, 95% CI 1.44, 4.61) remained significantly associated with anxiety symptoms.

Considering depressive symptoms and their association with non-communicable chronic diseases, the non-adjusted analysis showed depression symptoms had a significant association with diabetes, high cholesterol, pulmonary disease, cardiac disease, gastrointestinal disease, neurologic disease, thyroid and parathyroid disease, hyperuricemia, and rheumatic disease (Table 7).

Table 7: Association of depression symptoms with self-reported non-communicable diseases in Portuguese elderly

Non-Communicable chronic diseases	HADS-D (yes vs no)		
	OR	95% CI	
High blood pressure	1.35	0.95	1.92
Diabetes	1.50	1.02	2.21
High cholesterol	1.53	1.09	2.14
Pulmonary disease	1.71	1.07	2.73
Cardiac disease	1.83	1.27	2.64
Gastrointestinal disease	1.56	1.07	2.27
Neurologic disease	1.97	1.06	3.63
Allergy	1.07	0.73	1.57
Neoplastic disease	1.12	0.65	1.94
Thyroid and parathyroid disease	2.01	1.31	3.08
Hipogonadism	1.64	0.53	5.10
Hyperuricemia	1.74	1.14	2.65
Renal colic	1.41	0.90	2.21
Rheumatic disease	2.94	2.04	4.23

Legend: HADS-D: Hospital Anxiety and Depression Scale – Depression subscale; OR: Odds Ratio; CI: Confidence interval; bold: Variables with statistical significance

The multivariable analysis using the previous significantly associated non-communicable chronic diseases with depressive symptoms, showed that only cardiac (OR=1.65, 95% CI 1.10, 2.49) and rheumatic diseases (OR=2.12, 95% CI 1.41, 3.20) remained statistically significant.

When adjusted to sex, age group, education level, region, household income, rheumatic disease was the one chronic disease conserving significant association with depressive symptoms (OR=2.21, 95% CI 1.35, 3.60).

3.3 Anxiety & depression symptoms and Lifestyles in the elderly

To understand lifestyles, data was collected on smoking habits, alcohol intake, physical exercise and sleep habits as described previously.

Smoke

Regarding smoking habits, none of the groups (“never smoked”, “past” and “current” smoker) presented a significant relationship with the presence of anxiety or depressive symptoms, after adjusting for sociodemographic variables (sex, age group, region, education level, and household income).

Alcohol intake

Regarding alcohol intake and anxiety, first logistic regression without adjustments for sociodemographic characteristics presented significant association between “daily” (OR=0.36, 95% CI 0.20, 0.62), when compared to “never” consuming alcohol beverages, and anxiety symptoms, suggesting daily intake was associated with lower levels of anxiety in the elderly. This was not observed in the comparison to “occasionally” intake.

The logistic regression adjusted to sex, education level, region, and income, exposed no significant association between any kind of alcohol intake and anxiety.

With respect to depressive symptoms, multivariable analysis for alcohol intake categories (“never”, “occasionally”, “daily”) revealed significant associations to depressive symptoms. However, when adjusted to sociodemographic features, only “never” consumes alcohol holds the statistical significance (OR=0.027, 95% CI 1.08, 0.76) suggesting that never consuming alcoholic beverages was associated with higher levels of depression in the elderly.

Quantity or quality of beverages was not analysed in the present study.

Physical exercise

Regular physical exercise wasn't significantly associated with anxiety symptoms (OR=1.17, 95% CI 0.65, 2.10) but was relevant regarding depressive symptoms (OR=0.48, 95% CI 0.34, 0.69) in univariate logistic regression. When adjusted to sex, education level, region and household income, in a multivariable analysis, "regular exercise – yes" keeps significant association with depressive symptoms (OR=0.61, 95% CI 0.39, 0.95), indicating that doing physical exercise was associated with less depressive symptoms in this population.

Sleep

Univariate analysis demonstrated negative significant association between sleep ≥ 6 hours/day and anxiety (OR=0.31, 95% CI 0.195, 0.58) and depressive symptoms (OR=0.52, 95% CI 0.32, 0.85). This significant relation ($p=0.02$) with anxiety was unaltered after multivariable analyses adjusting for sociodemographic variables (sex, education level, region, and household income) maintaining that sleeping less than 6 hours/day was associated with the presence of anxiety in the elderly. However, the association between sleep and depressive symptoms lost significance after multivariable analyses adjusting for sociodemographic variables (OR=0.65, 95% CI 0.36, 1.17).

3.4 Anxiety & depression symptoms and Function in the elderly

Univariate analyses show that function, measured by HAQ, is closely related ($p=0.00$) to anxiety (OR=3.37, 95% CI 2.67, 4.26) and depressive symptoms (OR=3.63, 95% CI 2.83, 4.66).

Logistic regressions adjusted to sociodemographic features, underlined the close relationship ($p=0.00$) between lower function and presence of anxiety (OR=3.86, 95% CI 1.66, 5.60) as well as depressive symptoms (OR=3.62, 95% CI 2.69, 4.88).

3.5 Anxiety & depression symptoms and quality of life in the elderly

In terms of quality of life (EQ-5D-3L score), and its association with anxiety and depression, univariate analyses demonstrated OR= 0.02 (CI 0.01, 0.48) and OR= 0.02 (CI 0.01, 0.04), respectively.

Multivariable analyses adjusting to sex, educational level, region, household income sustained a very significant association ($p=0.00$) between poor quality of life (EQ5D score) and anxiety (OR=0.02, 95% CI 0.01, 0.07) and depressive symptoms (OR=0.02, 95% CI 0.01, 0.05).

Deepening our observation over the several domains of quality of life, we found anxiety symptoms were associated to worse scores in “usual activities” (OR= 1.68; 95% CI 1.01, 2.80), “anxiety/depression” (OR=1.63, 95% CI 1.13, 2.35), and “global perception of health” (OR= 0.97, 95% CI 0.96, 0.98).

Regarding depressive symptoms, “usual activities” (OR= 1.72; 95% CI 1.02, 2.88) and “global perception of health” (OR= 0.96; 95% CI 0.95, 0.98) were also relevant.

3.6 Anxiety & depression symptoms and healthcare resources consumption in the elderly

Regarding hospitalizations in the previous 12 months, univariate analyses showed statically significant differences between elderly with and without anxiety (OR=2.18, 95% CI 1.14, 4.16) but not in elderly with depressive symptoms (OR=1.27, 95% CI 0.86, 1.87).

Logistic regression adjusted to sociodemographic features, stressed that having anxiety symptoms was associated with hospitalization in the previous 12 months (OR=3.27, 95% CI 1.81, 5.9, $p=0.00$).

In terms of number of medical appointments in the previous 12 months, there is no significant differences between elderly with and without anxiety (OR=1.05, 95% CI 0.98, 1.11) or depressive symptoms (OR=1.00, 95% CI 0.98, 1.02).

3.7 Anxiety and Depression in the elderly - Global Models

Anxiety

Multivariable logistic regression, including all previous significant independent variables, as well as sociodemographic characteristics showed that worse quality of life (EQ5D: OR=0.06, 95% CI 0.01, 0.60), being a man (OR=0.33, 95% CI 0.11, 0.96), and 75 years old or older (OR=0.40, 95%

CI 0.16, 1) were significantly associated with anxiety symptoms (Table 8). On the other hand, looking at anxiety score as a continuous variable, the multivariable linear regression revealed that worse function (HAQ: $\beta= 0.62, p=0.04$), and worse quality of life (EQ5D: $\beta= -2.97, p=0.00$) were associated with more anxiety symptoms. Sleep 6 or more hours/day ($\beta=-0.78, p=0.02$), being a man ($\beta=-0.89, p= 0.00$), 75 years old or more ($\beta=-1.25, p= 0.00$), and have a higher level of education ($\beta=-0.97, p= 0.01$) were associated with less anxiety (Table 8).

Table 8: Global model for anxiety symptoms – a comparison between logistic and linear regression

	HADS-A (yes/no)			HADS-A score				
	Multivariable logistic regression			Multivariable linear regression				
	OR	95% IC		<i>p</i> -value	β coef	95% IC		<i>p</i> -value
High blood pressure								
Rheumatic disease								
HAQ score					0.62	0.02	1.21	0.042
EQ5D score	0.06	0.01	0.60	0.017	-2.97	-4.35	-1.60	0.000
Sleep (≥ 6hours/day)					-0.78	-1.41	-0.14	0.017
Hospitalization (yes)								
Sex (male)	0.33	0.11	0.96	0.043	-0.89	-1.40	-0.37	0.001
Age group								
70-74 y.o.					-1.04	-1.69	-0.39	0.002
≥ 75 y.o.	0.40	0.16	1.00	0.050	-1.25	-1.92	-0.58	0.000
NUTS II								
Centro								
Lisboa								
Alentejo								
Algarve	--	--	--	--				
Azores								
Madeira								
Level of education								
≥ 5 years					-0.97	-1.69	-0.25	0.008
Household income								
501€ to 750€								
751€ to 1.000€								
>1.000€								

Legend: HADS-A: Hospital Anxiety and Depression Scale – Anxiety subscale; OR: Odds Ratio; CI: Confidence interval; HAQ: Health Assessment Scale (0-3); EQ5D: European Quality of Life questionnaire five dimensions three levels (0-1); y.o: years old; €: euros; bold: Variables with statistical significance

Depression

All previous significant independent variables, as well as sociodemographic characteristics were included in a multivariable logistic regression to depression symptoms. In this analysis, only poor quality of life was associated with depression (EQ5D: OR=0.05, 95% CI 0.01, 0.19) (Table 9).

The multivariable linear regression, showed a greater number of significant relations to depression. In this population, worse function (HAQ: $\beta= 1.06, p=0.00$), and worse quality of life (EQ5D: $\beta=-3.97, p= 0.00$) were associated with more depressive symptoms. The regions of Centro ($\beta=0.93, p= 0.00$) and Alentejo ($\beta=0.93, p= 0.05$), as well as education level ($\beta=-0.56, p= 0.05$), the household income between 751 and 1000€ ($\beta=-1.04, p= 0.01$), and living alone (household composition = 1) ($\beta=0.65, p= 0.03$) were related with depression.

Table 9: Global model for depression symptoms – a comparison between logistic and linear regression

	<i>HADS-D (yes/no)</i>			<i>HADS-D score</i>		
	Multivariate logistic regression			Multivariate Linear regression		
	OR	95% IC	<i>p</i> -value	β coef	95% IC	<i>p</i> -value
Rheumatic disease						
HAQ score				1.06	0.46 1.66	0.001
EQ5D score	0.05	0.01 0.19	0.000	-3.97	-5.10 - 2.84	0.000
Regular exercise (yes)						
Alcohol intake						
“Never”						
“Daily”						
Sex (male)						
Age group						
70-74 y.o.						
≥ 75 y.o.						
NUTS II						
Centro				0.93	0.37 1.49	0.001
Lisboa						
Alentejo				0.93	0.01 1.84	0.048
Algarve						
Azores						
Madeira						
Level of education (≥5 years)				-0.56	-1.12 -0.00	0.050
Household income						
501€ to 750€						
751€ to 1.000€				-1.04	-1.79 -0.29	0.007
>1.000€						
Household composition =1				0.65	0.05 1.25	0.034

Legend: HADS-D: Hospital Anxiety and Depression Scale – Depression subscale; OR: Odds Ratio; CI: Confidence interval; HAQ: Health Assessment Scale (0-3); EQ5D: European Quality of Life

questionnaire five dimensions, three levels (0-1); y.o: years old; €: euros; Household composition: number of people that live in the house of the participant, including himself/herself; bold: Variables with statistical significance.

4 Discussion

The present study aimed at determining the prevalence of symptoms of anxiety and depression in the Portuguese elderly population. We also wanted to identify factors associated with these disorders, within the scope of non-communicable chronic diseases, lifestyles, quality of life and physical function, and finally the healthcare resources consumption.

Prevalence of anxiety and depression

This study showed a prevalence of 9.59% of anxiety symptoms among the Portuguese with 65 or more years old. This number is lower than the ones found in international studies over European and American countries, and Australia (Bryant et al., 2008). These authors refer prevalence of significant anxiety symptoms between 15% and 52% in the elderly living in the community. Beekman and colleagues (1998) found a global prevalence of anxiety disorders of 10.2% in Amsterdam (Beekman et al., 1998). Ten years later, an epidemiological study in Portugal, whose data were collected between 2008 and 2009, found the prevalence of generalized anxiety disorder in people over 65 years of age at 2.6% and the prevalence of any anxiety disorders 20% for the same age group (J. Almeida et al., 2013).

Regarding Depression, the estimated prevalence is of 11.77% for the Portuguese elderly living in the community, in line with the result of 12% for Major Depressive Disorder of the National Epidemiologic Study of Mental Health (J. Almeida et al., 2013). In the Netherlands, however, depressive symptoms had a prevalence of 24% for older adults – 55 years old and older (Hoogendijk et al., 2016), and Castro-Costa (2007) exposed a prevalence of depressive symptoms ranging from 33% in France, Italy, and Spain, to 18-19%, in Sweden, Denmark, Netherlands, Germany, Austria, and Switzerland in adults over 50 years old (Castro-Costa et al., 2007).

As we go deep in the literature, we can find a huge number of epidemiological studies and cohorts with conclusions on anxiety and depression in the older adults. Longitudinal Study of Aging in Amsterdam (LASA) in the Netherlands, HUNT study in Norway, Alameda County study in the USA, Epidemiologic Catchment Area (ECA) study also in the USA, just to name a few.

Although the presented figures may suggest that Portuguese elderly are less anxious and depressed than other peoples in Europe and around the globe, we should be very carefully when comparing this numbers. There are core discrepancies regarding methods of data collection, different instruments of assessing depression and anxiety, different nosological entities considered (Major Depression Disorder, Minor Depression Disorder, Generalized anxiety disorder *vs* symptoms of depression and anxiety), and finally different age groups cut-offs (≥ 50 and ≥ 55 *vs* ≥ 65).

As Byrne (2002) stressed, differences in anxiety prevalence rates may be due to differences among populations, but also to differences in assessment tools and algorithms used for diagnosis (Byrne, 2002). Some studies use the hierarchical approach to diagnosis, which may lead to lower prevalence by excluding individuals with diagnostic criteria that also have criteria for diagnosing other higher disorders in the hierarchy (Wolitzky-Taylor et al., 2010).

Sociodemographic and socioeconomic characteristics

Our study showed that being a woman and have less than 5 years of education is significantly associated with presence of anxiety disorders in the Portuguese elderly. Beekman and colleagues (1998) had already pointed this out in their study with LASA cohort data (Beekman et al., 1998). Also, other studies found a significant higher rate of anxiety in women with 55 or more years old (Himmelfarb & Murrell, 1984).

Previous studies posed socioeconomic level to be inversely related to anxiety symptoms (e.g. (Himmelfarb & Murrell, 1984). In the present study, both univariate and multivariable analyses did not confirm the relevance of the household income to the presence of anxiety symptoms.

Sociodemographic and socioeconomic characteristics seem to play a different role in depression. Univariate analyses show that the age - being older -, being a woman, have a lower education level, lower income, and living alone is related to the presence of significant depressive symptoms. The fact that some of these aspects lose significance when adjusted to other factors will be further discussed later.

Alameda County Study demonstrated a raise of depression prevalence with age (Roberts et al., 1997). But multivariable analyses showed that the effect of age was related to physical health problems and disability associated with aging. Several studies concluded the same way, indicating

that although depression prevalence increases with age, it should be due to age-related factors than age itself (e.g.(Steffens et al., 2000; van't Veer-Tazelaar et al., 2008).

The female sex is also described in literature as an important determinant of depression (e.g. (Barefoot et al., 2001; Djernes, 2006). In our study, it was strongly significant even with multivariable analyses with single factors separately, such as non-communicable chronic diseases, quality of life or function. But within a global model including all significant variables for depression, it loses its previous relevance.

Our results indicated that low educational level is associated with depression, in agreement with McCall and colleagues (2002) findings in USA. These authors also corroborate the conclusions that relate low income to higher scores of depression (McCall et al., 2002). (idem)

Living alone, on the other hand, revealed to be an important factor associated with higher scores of depression. This is in line with what Valvanne and collaborators (1996) defended in their elderly population-based study in Finland (Valvanne et al., 1996).

Non-communicable chronic diseases

There are countless studies dedicated to describe the relation between non-communicable chronic diseases and their relation to anxiety and depression as shown Clarke and Currie (2009) literature review. Authors concluded that the evidence for the association of physical illness and depression and anxiety, and their effects on outcome, is very strong (Clarke & Currie, 2009).

Willem and colleagues (2003) in their study after an Australian survey, defend that having a disease is one of the most important risk factors for depression (Wilhelm, Mitchell, Slade, Brownhill, & Andrews, 2003).

This work analysed thoroughly a range of self-reported non-communicable chronic diseases and their relation to these psychological symptoms. Our conclusions after univariate analyses indicate that this kind of illnesses are very common within the groups of elderly with anxiety and depression.

However, after adjusting for sociodemographic characteristics, only rheumatic diseases were significantly associated with anxiety; rheumatic and cardiac diseases were associated to depression in this population.

Although literature often expresses a relationship between anxiety and/or depression and diabetes (Barnard, Skinner, & Peveler, 2006), pulmonary (Gudmundsson et al., 2006) and neoplastic diseases (Rodin et al., 2007), these conclusions were not confirmed in Portuguese elderly population.

Our study confirms, however, conclusions of previous studies on rheumatic diseases (e.g. (Branco et al., 2016; Margaretten, Julian, Katz, & Yelin, 2011) stressing their important association with both anxiety and depression.

In terms of the association between cardiac diseases and depression symptoms find in the present study, it is in line with several reviews (Khawaja, Westermeyer, Gajwani, & Feinstein, 2009; Sørensenf, Friis-Hasché, Haghfelt, & Bech, 2005)

Lifestyles

Smoking habits

Although Bonnet and colleagues (2005) have found interesting correlates on smoking habits and anxiety and depression (Bonnet et al., 2005), smoking habits were not associated with mental disorders in this population. Noteworthy is the fact that a great proportion of Portuguese elderly is not a current smoker (94.61%).

Alcohol

Regarding alcohol intake, literature shows that alcohol abuse was related to other psychopathologies ((Boden & Fergusson, 2011). The data collected could not capture if “daily” or “occasionally” alcohol intake was case of abuse. However, our results seem to indicate that “never” consume alcohol was related to more depressive symptoms in the elderly. Although this implication could probably be understood from a diet and culture point of view of the Portuguese elderly, the quality and quantity of beverages should be detailed in further research.

Physical exercise

This study demonstrated that the practice of regular physical exercise was associated with less depressive symptoms in this population, when adjusted to sociodemographic characteristics. This

finding agrees with several worldwide studies (e.g. (Lucas et al., 2011) and reviews (e.g. (Sarris et al., 2014).

Sleep

In terms of sleep, this work demonstrated that sleep less than 6 hours was significantly related with anxiety. Cross-sectional data from a large cohort of patients with anxiety and depression (Netherlands Study of Depression and Anxiety – NESDA) revealed that people with anxiety had a significant association with sleep disturbances, namely insomnia and alteration of sleep duration (van Mill, Hoogendijk, Vogelzangs, van Dyck, & Penninx, 2010).

Physical Function

Lenze and collaborators (2001) performed a literature review on the association of late life depression and anxiety with physical disability. Their findings indicated that depression was a risk factor for disability, but also in the other way, being disability a risk factor for depression (Lenze et al., 2001).

Brenes and colleagues (2005) studied the influence of anxiety on the progression of physical disability in a community-based observational work, concluding that, after adjusting for confounders, anxiety continued to predict the development of daily life activities' disability (Brenes et al., 2005).

Our study, being cross-sectional, does not allow to elaborate on risk factors and direction of causality. However, the results of association between physical function and both anxiety and depressive symptoms are unequivocal, even in multivariable models, suggesting that low physical function (HAQ scores) were significantly associated with the presence of anxiety and depression symptoms.

Quality of life

The univariate and multivariable analyses exposed in this study that a worse quality of life, measured by EQ5D, was highly associated with both anxiety and depression disorders in Portuguese elderly people. Sivertsen and colleagues (2015), in their review article of 74 studies, concluded the same, demonstrating that depressed older people had poor global quality of life

than non-depressed individuals. They added that this association was stable overtime and independent of how quality of life was measured (Sivertsen, Bjorklof, Engedal, Selbaek, & Helvik, 2015). Brenes (2007) also considered anxiety in relation to quality of life and her conclusions were similar: anxiety were significantly associated with all domains of quality of life, and as severity of anxiety symptoms increased, quality of life decreased (Brenes, 2007).

Healthcare resources consumption

Regarding the healthcare resources consumption and its relation to anxiety and depression, our finding demonstrated that, when adjusted to sociodemographic characteristics, only the occurrence of at least one hospitalization during the previous 12 months was associated with anxiety in the elderly Portuguese people. Number of medical appointments had no association with these disorders in our population. Wade (2012) showed how greatly mood and anxiety disorders impact in economy of the patient, the healthcare system, and society in general in several countries all over the world (Wade, 2012). His findings, however, were not specific for elderly. An important reflexion should be centred in this population range concerning how other health conditions, disability and quality of life compete with anxiety and depression disorders themselves in terms of healthcare resources consumption. Beekman (2002) suggested, after data of LASA cohort, that the steeply rising prevalence of competing health risks in later life does not influence the significance of depression (Beekman, Penninx, et al., 2002) but the results in Portuguese elder do not confirm this assumption. Discrepancies may be due to different age ranges (55+ vs 65+ years old) and tools to assess healthcare resources consumption.

Global models for anxiety and depression

After analysing the variables independently associated with anxiety and depression, we wanted to understand how would them relate to this disorder when combined in a multivariable regression. To achieve this goal, a model using all significant factors (at 0.05% level) after the adjustment for sociodemographic features was developed.

Anxiety

The results considering the outcome as a categorical variable “Anxiety disorders (Yes/No)” showed worse quality of life, being a woman, and being 75 years old or older were associated with the anxiety diagnosis in Portuguese elder.

The linear regression, however, captured other important factors to understand variability of anxiety score. Our study concluded that worse physical function and quality of life, sleeping less than 6 hours/day, being a woman, being 70 years old or older, and having less than 5 years of education were factor highly associated to higher scores of anxiety.

AMSTEL study share some of these conclusions pointing to psychosocial risk factors for anxiety disorders and late-onset depression: female gender, cognitive dysfunction, chronic illness, poor health perception, functional limitations, and personality traits such as neuroticism and weak coping strategies (Schoevers, Beekman, Deeg, Jonker, & van Tilburg, 2003)

Depression

When considering the cut-off for depression symptoms, and combining all previous significant factors, only quality of life score was negatively associated with depression diagnosis, signalling that quality of life would be the only determinant for depression in later life.

A global model using linear regression is also useful to better capture other important factors related to depression scores variability in Portuguese elderly.

This analysis demonstrated that physical function, quality of life, level of education, household income and household composition should be taken into account when considering depression in this population.

In fact, worse physical function, worse quality of life, and less than 5 years of education were associated with higher levels of depression. Living alone was also related to higher depression. Regarding household total income, considered a proxy of economic level, results suggest that comparing to a very low income ($\leq 500\text{€}/\text{month}$), an income within 751€ and 1000€ was associated with lower depressive symptoms. Interestingly, higher income ($>1000\text{€}$) was not relevant to the variation of depression.

Limitations

Study limitations should be considered when debating results. Being cross-sectional, this study does not allow to draw conclusions about the effects of causality between the variables and the chronological order of the events. On the other hand, the present study derives from a more extensive one – EpiDoC 2 – whose objective was to carry out the first follow up of the representative sample of the adult Portuguese population regarding rheumatic diseases, studying their progression, new cases and burden. This fact conditioned the choice of instruments to assess variables and method of data collection (computer-assisted telephone interview). From this fact derives the use of HADS to measure anxiety and depression.

Although Breeman (2015) defended HADS being used for clinical and non-clinical population (Breeman, Cotton, Fielding, & Jones, 2015), the use of a specific instrument to assess anxiety and depression in this particular age group is arguable.

Despite of what has been referred, several strengths related to both internal and external validity should be pointed out. Data come from large, nationally representative sample of the Portuguese elder population followed since 2011, allowing its generalization for the age group in our country. It should also be noted that data was collected by a team of 10 interviewers who were extensive and properly trained, whose proceedings were standardized, and regular and rigorously monitored to reduce bias.

In conclusion, key findings of this study are 1) Portuguese elderly population have prevalence of anxiety and depression around 10% and 12%, respectively; 2) anxiety and depression are associated to different factors; 3) more than chronic illnesses, health-related quality of life and physical function play an important role to depression and anxiety; 4) level of education differentiates elderly people in terms of anxiety and depression scores variation; 5) anxiety and depression do not add more Portuguese elderly healthcare resources consumption.

Future research could involve new data collection in this cohort to investigate causality and impact, as well as risk and protective factors for anxiety and depression in this population from a longitudinal approach. Also, it could be interesting to explore some features that weren't considered in this study, namely personality traits and coping strategies.

Our conclusions are relevant to give inputs to design and implementation of global therapeutic programs in care and support networks to elderly populations, but can also be used in better planning of health care, necessary in the definition of the health policy strategy and support for the elderly with anxiety and depression.

The possibility of a national prevention program can be suggested to decision-makers to promote mental health and healthy lifestyles in older age groups, downsizing its prevalence as well as improving their wellbeing and care. A well-designed prevention strategy, based on the evidence generated by the present research, could have an effective action in raising the quality of life of the elderly, and reducing costs for our society.

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6 Annexes

6.1 Annex a – Structured questionnaire for data collection

6.2 Annex b – STATA Outputs