



Estimating Mental Health Production Functions:

What does explain the mental health status of the Portuguese population?

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Jury

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Abstract

According to the World Health Organization, the spread of mental illnesses is increasing. For Portugal, little is known about the determinants of mental health state in the Portuguese population and there is few epidemiologic related data. This study aimed at studying the determinants of mental health state in the Portuguese population.

We first developed an explanatory model for mental health, so as to structure how different determinants might contribute for explaining the mental health state of an individual. Data from the 4th Portuguese National Health Survey (2005/2006) has been used to test hypothesis defined in the model, whereas diagnosed depression was taken as the proxy variable for mental health state. We developed descriptive studies and multivariate logistic regressions to explain the determinants on the prevalence and incidence of depression; and a Bayesian network tool is proposed to support general practitioners in the detection of depression in an individual (using information from the Survey).

We found out that the following population groups have higher prevalence rates of diagnosed depression: females, divorced, retired, unemployed, middle-aged, low education, with chronic anxiety or obesity, live alone or with one person, living in the Centre region, and having high and low income. The following explanatory factors have a positive statistically significant impact on the probability of a prevalent individual being depressed: females, unemployed, retired, divorced, middle-aged, having hypertension, chronic pain, anxiety, obesity and bronchitis, and presenteeism. As opposite, the following explanatory factors were found to have a negative impact: family size and hours of work per week. For incidence, we found out that: incidence is affecting a much younger population in comparison to the prevalent population; and the determinants of incidence and prevalence quite differ. We have also illustrated how a Bayesian network can be easily used by general practitioners for diagnosing depression and by health care planners for planning health services.

Evidence points for an underestimation of prevalence and incidence rates in the Portuguese population, which might be due to stigma of individuals seeking mental health related services, or because of lack of access of individuals to those services. It seems that special attention should be given to the incident population being at risk; and there is a need for developing additional studies so as to produce more detailed information for decision-makers in the area.

Keywords: Mental Health, Determinants of Health, Production functions.

Resumo

Segundo a Organização Mundial de Saúde, a presença de doenças mentais está a aumentar. Para Portugal, pouco se sabe sobre os determinantes da saúde mental na população portuguesa e poucos são os dados epidemiológicos relacionados disponíveis. Este estudo pretende estudar os determinantes do estado de saúde mental na população portuguesa.

Primeiro desenvolveu-se um modelo explicativo para a saúde mental, estruturado pelos diferentes determinantes que possam contribuir para explicar o estado de saúde mental de um indivíduo. Dados do 4º Inquérito Nacional de Saúde português foram usados, possibilitando o desenvolvimento de estudos descritivos e econométricos de prevalência e incidência da depressão; e uma rede Bayesiana foi proposta para apoiar os profissionais de saúde na detecção da depressão.

Encontraram-se os seguintes grupos com elevada taxa de prevalência para a depressão diagnosticada: mulheres, divorciados, reformados, desempregados, idade média, baixo nível de educação. Verificou-se ainda uma elevada taxa de prevalência para indivíduos com obesidade e ansiedade crónica, que vivem sozinhos ou com uma pessoa; vivem na região NUTs Centro e apresentam elevado ou baixo nível de rendimento. Os seguintes factores explicativos apresentam um impacto positivo e estatisticamente significativo na probabilidade de um indivíduo estar deprimido: mulheres, desempregados, reformados, divorciados; idade média, hipertensão, dor crónica, ansiedade, obesidade ou bronquite e presentismo. Os seguintes factores explicativos têm um impacto negativo e estatisticamente significativo: dimensão familiar e número de horas de trabalho por semana. Relativamente à incidência, verificou-se que há uma maior proporção de jovens na população incidente em relação à sua proporção na população prevalente, e também que os determinantes da prevalência e da incidência da depressão são diferentes. Por último, mostrou-se como uma rede Bayesiana pode ser usada por médicos de clínica geral na detecção da depressão e por técnicos de saúde no planeamento dos serviços.

As evidências disponíveis apontam para uma subestimação dos resultados de prevalência e da incidência, a qual pode ser justificada pelo estigma na procura de apoio nos serviços associados à Saúde Mental, ou devido à dificuldade da população em aceder a estes serviços. Observa-se que uma especial atenção deve ser dada à população incidente em risco de depressão; e para a necessidade de realização de mais estudos para informar os decisores a trabalharem na área de política de saúde mental.

Palavras-chave: Saúde Mental, Determinantes em Saúde, Funções de produção.

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Autor's Message

If the reader wishes to contact me to have further information about the development of this work, I invite him/she to get in contact with me.

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List of Abbreviations

BMI - Body Mass Index

DALYs - Disability-Adjusted Life-Years

EU- European Union

EU-15 – First 15 European Union countries

ICD-10 - International Statistical Classification of Diseases and Related Health Problems 10th Revision (Mental and behavioural disorders are a set of disorders as defined by the International statistical classification of diseases and related health problems.)

INE – Instituto Nacional de Estatística

INSA -Instituto Nacional Saúde Dr. Ricardo Jorge

GAD - Generalized Anxiety Disorder

GBP - The ISO currency code for the British Pound.

GPs – General Practitioners

MHI-5 - 5-Items of Mental Health Index

MHEEN – Mental Health Economic Network

NIMH - National Institute of Mental Health

NGOs – Non-Governmental Organizations

NHS - United Kingdom's National Health Service

NUT II region – Nomenclature of Territorial Units for Statistics, second division, representing Coordinated Regional Commission

OLS – Ordinal Least Square model.

WHO – World Health Organization

WLD - Workdays Lost

YLD - Years Lived With Disability .

1 Introduction

Mental illnesses are currently considered the illnesses of the XXI century. The recognition and awareness of their burden in the society and in the economy make it a policy topic in the international and national health policy agendas. Key facts are: mental health disorders represent 5 out of a group of 10 leading causes of disability worldwide (WHO, 2002); 25% of individuals develop one or more mental disorders at some stage of their life (WHO, 2001). Mental health illnesses create a high burden of disease in terms of suffering, disability and economic loss. The leading contributors are depression, substance abuse, schizophrenia and dementia.

This work aims to provide information about mental health in Portugal, in order to develop more effective mental health policies. In particular, it focuses its analysis on depression, generating data on the risk of depression for the Portuguese population and for subgroups of that population, as well as on the causes of depression. All the information might assist public entities to improve detection, promotion and prevention programs within mental health.

Therefore, our work collected information from different documents and this information was later used in the development of a model that aims to explain the mental health status of the Portuguese population. The purpose of this model was to test how social and individual contexts contribute for mental health, in order to shed some light on how public interventions in several areas – such as education, environmental, urban planning, finance, housing, workplace, health care services and social welfare - might contribute to improve mental health. Literature suggests that all these factors might contribute for the production of mental health (Jané-Llopis and Anderson, 2005), and we test for this.

Recently, the Portuguese National Mental Health Council has developed a plan to implement policies to improve mental health services and to measure key mental health objectives. Despite that, there is neither a study examining the explanatory multisystem of mental health nor of depression in Portugal. Therefore, this study differs from the remaining studies both on its purpose, and on the information that aims at producing. Consequently, an objective of the study is to produce mental health related information useful for Portugal and for other developed countries (WHO, 2002).

In order to show the importance of health and mental health in the community, we begin by presenting definitions and summarizing information from policy documents. The definition of health ratified on the first World Health Assembly mentions that health is a “*state of complete physical, mental and social well-being and not merely the absence of disease or infirmity*”. The same document also states that “*The health of all individuals is fundamental to the attainment of peace and security and is dependent upon the fullest co-operation of individuals and States. The achievement of any State in the promotion and protection of health is of value to all. Governments have a responsibility for the health of their individuals, which can be fulfilled only by the provision of adequate health and social services*” (WHO, 2006). To achieve this aim, it is necessary to have a society that is organized so as to promote and maintain health.

In the specific case of mental health, there is no single "official" agreed definition due to cultural differences, subjective assessments and competing professional theories (WHO, 2003a). A positive definition of mental health makes use of the following set of characteristics: “*subjective well-being*,

perceived self-efficacy, autonomy, competence, recognition of ability to realize one's intellectual and emotional potential; whereby individuals recognize their abilities, are able to cope with normal stresses of life, work productively and fruitfully, and make a contribution to their communities, their self-determined goals" (WHO, 2003a).

A variety of mental health policies and interventions have been started in the last decade. Many initiatives have followed pressure from international non-governmental organizations - such as the World Health Organization (WHO) –which have alerted countries for the burden and consequences of mental health illnesses, and the importance of taking effective measures. These organizations have requested for: interventions in almost all sectors of society, with the enhancement of legislation, policies, services and information developments; adequate and specialized training of personnel that are required to answer to the population in need of mental health services; educational programs to improve individuals' behaviour and habits; and information about advantages of mental health treatment. Despite mental illnesses affect societies as a whole, available evidence suggests that some groups of individuals are more vulnerable. The risk is higher among those living in extreme circumstances and with the least resources (WHO, 2003b). Therefore, achieving mental health gains cannot be accomplished through treating mental disorders alone - through mental health promotion and prevention policies, overall health is improved, leading to economic gains, social inclusion and state productivity (WHO, 2004). Nevertheless, there has been a lack of information on the main determinants of the mental health status of populations (WHO, 2002).

Within this context, this thesis gathers and analyses knowledge with respect to the economics of mental health production. It explores the role of different groups of determinants on the production of mental health, like the utilization of health care services, economic conditions, lifestyle indicators, medical history, area of residence, family outcome, family structure, age, level of education, level of physical health. It explains the mental health status of the Portuguese population through the analysis of prevalence and incidence indicators for different population groups (e.g. age groups, socio-economic groups, disease-based groups, gender groups). The thesis also shows how that information can be used to analyze the probabilities of a certain individual having a mental health disorder; and applies methods to analyze the determinants of the mental health status of a population through the estimation of mental health production functions, and for that uses parametric models to Portuguese National Health Survey data.

This thesis is organized as follows. Chapter 2 presents some background information on mental health issues and context, including some historical information and key concepts on mental health: the early to nowadays mental health policies; the origin of stigma; the heterogeneity of concepts in the area; the magnitude of mental health illnesses in society and its impact on the economy; some findings and facts on mental health; and a brief introduction to the depression condition. Chapter 3 presents the methodology followed to achieve the research objectives set for this thesis: it describes how explanatory indicators were chosen, so as to build an explanatory model of mental health state and the options used and decisions taken to test the explanatory model to data of the 4th Portuguese National Health Survey; and finally it also describes the methods used for statistical analysis and used to propose tools for analysis. Chapter 4 presents the obtained results with a statistical descriptive

analysis of data along with the econometric methods used.

In chapter 5, we discuss the main findings, the methods used and present some policy suggestions. At last, in chapter 6, we present some concluding remarks and future research that follow the development of this thesis.

2 Context of Mental Health

This chapter aims at introducing the reader to some background information on mental health issues and context: the origin of stigma; the heterogeneity around mental health concepts; evidence on the magnitude of mental health disorders which affect several sectors of the society and the global economy; information on mental health in Portugal; a literature review on the factors explaining mental health; and finally an introduction on depression which is a specific mental health disorder.

In the introduction we have presented a positive definition of mental health, and now we present other definition of mental health illnesses. According to World Health Report of 2001, *mental illnesses are understood as clinically significant conditions characterized by alterations in thinking, mood (emotions) or behaviour associated with personal distress and/or impaired functioning. Mental and behavioural disorders are not just variations within the range of “normal”, but are clearly abnormal or pathological phenomena. In order to be categorized as disorders, such abnormalities must be sustained or recurring and they must result in some personal distress or impaired functioning in one or more areas of life. Specific symptoms and signs also characterize mental and behavioural disorders* (WHO, 2001). Therefore, mental health disorders are considered a psychological or behavioural pattern that occurs in an individual, causing distress or disability when not expected as part of normal development or culture.

Nowadays, governments, Non-Governmental Organizations (NGOs), national and international organizations recognise that mental health disorders and problems are an issue concerning all the society sectors and affecting different population groups. They also acknowledge that no group is immune to mental disorders, although available evidence indicates that the risk might be higher amongst the poor, the homeless, the unemployed, persons with low education, victims of violence, migrants and refugees, indigenous populations, children and adolescents, abused women and the neglected elderly (Jané-Llopis and Anderson, 2005; WHO, 2001). Furthermore, mental, physical and social determinants are closely interwoven and have a strong impact in mental health of individuals and on their well being (WHO, 2003a).

The need to have an improved understanding of these interdependent relationships is leading the world to develop research on the determinants of mental health, so as to inform emerging policies in mental health that might be defined by ministries of health or by other governmental entities. Governments aim at promoting the well being and health of their citizens (WHO, 2003a). Mental health problems have been associated in the past with stigma.

In the next section we describe the historical path of mental health and its consequences.

2.1 What is the stigma problem

In order to explain the origin of stigma around mental illness, we describe the origin of treatments and explanations of mental health disorders that evolved during several centuries.

Before the 17th century, mental illnesses were explained by religious and spiritual reasons. Most poor individuals with mental illnesses were confined in public jails, workhouses¹ poorhouses², general

¹ Workhouse is a public institution in which the destitute of a parish received board and lodging in return for work.

² Poorhouse is an institution where paupers were maintained with public funds

hospitals and private asylums (WHO, 2003b). Only after the 17th century did the first medical explanations emerged. Nevertheless, they did not encourage compassion or tolerance - mental health problems were considered to be self-inflicted physical states, caused by excess of passion and demanding a justified punishment (WHO, 2003b). The mentally ill were put in places of confinement with poor living conditions. During the 18th century, humanitarian concerns arose, and some asylums were built throughout Europe.

During the 1950s, some countries started a process of transition, with some patients moving from mental asylums to community care. This process is known as deinstitutionalization and has been occurring until recently. However, in some countries this process has not been well developed due to the lack of community services (WHO, 2003b). Nevertheless, despite these changes, mental health continues to be identified with mental asylums, leading to negative associations, which are reflected by generalized stigma regarding this matter (WHO, 2003b).

In recent decades, sets of psychotropic medications and psychosocial interventions have been developed for a range of mental disorders (WHO, 2003b), mainly in hastening and sustaining recovery from common mental disorders such as depression and anxiety. Over times, it was been verified stigma and behaviour improvements of the overall population towards mental health disorders and behaviours (WHO, 2003b).

2.2 Heterogeneity in the Definitions of Mental Health

This sub-section shows the heterogeneity of the concepts, situations and definitions associated with mental health. First, there is no agreement in a single definition of mental health. Second, there is no agreement on the causes, symptoms and consequences of mental disorders, since individuals tend to report different experiences about their health states ^{3,4}. Most mental illnesses are frequent and usually cause severe disability (WHO, 2001). The level of severity is measured by the gravity of symptoms and quantified by the loss in quality of life, which means that the diagnosis depends on the self-perception of symptoms, which also contributes for the heterogeneity in the definition. As opposed to other medical areas, mental health lacks precise information and medical devices that may help the physician to carry out an accurate diagnosis ⁵.

Mental disorders are characterized by a set of symptoms that vary substantially through a combination of abnormal thoughts, emotions, and behaviour, as well as in relationships between these elements. There is no consensus among experts on these definitions and relationships. Modern scientific evidence indicates that mental and behavioural disorders are the result of genetics plus environment, i.e. the interaction of biology with psychological and social factors (WHO, 2001).

Despite depressive disorders, substance abuse, schizophrenia, epilepsy, Alzheimer's disease and mental retardation are considered as the most common disorders, there is also a designation for severe or long-term and for common mental disorders. Schizophrenia is a severe disorder and anxiety and depression are common mental disorders. In this thesis, we focus on common mental disorders.

³<http://www.nimh.nih.gov/health/topics/depression/men-and-depression/signs-and-symptoms-of-depression/index.shtml>

⁴ <http://www.nimh.nih.gov/health/topics/older-adults-and-mental-health/index.shtml>

⁵ <http://www.min-saude.pt/portal/conteudos/enciclopedia+da+saude/saude+mental/depressao.htm>

Furthermore, mental health issues have different ways of manifesting. On one hand, they arise through mental disorders/diseases, such schizophrenia and depression; on the other hand, it might be through behavioural disorders, such as substance abuse - which include tobacco, alcohol and other stimulants. Often individuals with poor mental health deliberately indulge in an activity that causes them harm (WHO, 2001).

Another point to take into account is the existence of comorbidity disorders. Mental disorders often are identified in individuals suffering of other disorders, either physical or mental. For instance, anxiety and depression are frequently detected together, which can lead to underdiagnose of one of them.

Another point is related to common sense, for example: doctors are more likely to diagnose depression in women compared with men, even when they have similar scores on standardized measures of depression or present with identical symptoms; proneness to emotional problems in women and alcohol problems in men.

The following sections explain how the lack of positive mental health might result on a threat to public health, to quality of life of those in suffering and to those around them, as well as it can negatively affect the economy (Jané-Llopis and Anderson, 2005).

2.3 Magnitude of Mental Health Disorders

This subsection presents information on the overall burden of mental health disorders in societies and in the economy. Tables 2.1 and 2.2 display information on the order of magnitude and costs of mental illnesses.

Table 2.1: Some indicators of the global burden of mental health problems and disorders

Indicators of the Global Burden of Mental Health
About 450 million people in the world suffer from a mental or behaviour disorder (WHO, 2003a).
More than 150 million people suffer from depression at some point in time and nearly 1 million commit suicide every year; more than 90 million suffer from alcohol or drug use disorders (WHO, 2003a).
Estimates indicate that mental disorders account of nearly 12% of the global burden of disease, and in 2020 it is expected that mental health disorders will affect 15% of disability-adjusted life-years (DALYs) lost to illness (WHO, 2003b).
By 2020, the burden of mental health illnesses is expected to be maximal among young adults, which are the most productive part of a population (WHO, 2003b).
It is known that 33% of years lived with disability (YLD) are due to neuropsychiatric disorders and 2,1% due to intentional injury (WHO, 2003a).
The six leading causes of years living with disability include four mental disorders: depression, alcohol use related disorders, schizophrenia and other dementias (Jané-Llopis and Anderson, 2005).
Major depression is twice as common among medical patients in a general hospital than in general population (Directorate-General for Health & Consumers, 2008)
Depression is the second leading cause of disability, after ischemic heart disease (Jané-Llopis and Anderson, 2005).
Today, one in four (132 million) Europeans are affected by mental health problems each year, costing every European household more than €2,200 per annum (D. McDaid, et al., 2007).

We will focus here on a key impact of mental health that affects directly the economy and the life of individuals –we consider the impact of mental health problems in the labour market. Since work is a key aspect of an individual's life, by providing financial security, social status and identity; individual's health allows for higher productivity. Research in this area has shown that there are economic indicators related to the workplace that clearly indicate the negative consequences of mental health in

the economy (Jané-Llopis and Anderson, 2005; WHO, 2005). This is captured by the indicators of absenteeism, work loss days taken for short-term disability and presenteeism.

Absenteeism is defined as the unscheduled employee absences from the workplace. Presenteeism can be defined as the situation where the employee goes to work, despite being ill or unable to work, instead of taking a leave^{6,7} (Murphy, 2004). Both phenomena imply costs to employer. Regarding economic indicators in developed countries, it is estimated that 35% to 45% of absenteeism is due to mental health disorders (WHO, 2003a). Table 2.2 displays several economic indicators concerning mental disorders cost.

Table 2.2:Some indicators of the global cost of mental heath illnesses

Indicators of global cost of mental health	
U.S.A	Studies indicate that the direct costs in treatments represent nearly 2,5% of the gross national product, and that the indirect costs are approximately two to six times larger (WHO, 2003). In 1997, spending on mental health treatments reached US\$ 85,3 billion, of which US\$ 73,4 billion were for mental illness and US\$ 11,9 billion for substance abuse (WHO, 2003). In a large financial services company, depression was responsible for an average of 44 work-days per year taken for short-term disability, comparing with 42 days taken due to heart disease, 39 days due to lower back pain and 21 days due to asthma (WHO, 2003); A study conducted by the Harvard Medical School examined work days loss due to psychiatric disorder among major occupational groups in US. The average was 6 days per month per 100 workers (absenteeism) and getting less done than usual was estimated to be 31 days per month per 100 workers (presenteeism) (WHO, 2003).
Canada	A report from in a Canadian university showed that absences for psychological reasons had increased 400% since 1993 to 1999 (WHO, 2003). In 1998, there was a cost of Can\$ 14,4 billion, with 8,1 billion being due to productivity losses and Can\$ 6,3 billion due to treatments (WHO, 2003).
U.K.	In 1996, studies carried out with reference to the NHS revealed that the absolute cost of care (including inpatient, outpatient, primary care, pharmaceuticals, community health and social services in several disorders), indicated psychosis and neurosis as the two main causes of mental health illness, with costs of 850 million GBP and 1150 millions GBP (WHO, 2003). In 1998, the estimated cost for all mental disorders was £32 billion, with 45% of that amount attributed to productivity losses (WHO, 2003).
Sweden	In 2005, the costs of depression were explained by 83% of productivity losses, 3% by drugs and 14% by other health care spending (McDaid <i>et al.</i> , 2008).
E.U.	The total cost of depression in EU has been estimated at €118 billion per annum, of which 66% are due to productivity losses. In addition this last value is more than twice than the one estimated for cardiovascular disease in the EU (McDaid <i>et al.</i> , 2008).

2.4 Determinants of Mental Heath Disorders

Biological, psychological and social factors are now understood as describing a complex interlinked system with mental health and as determining the prevalence, onset and the course of mental and behavioural disorders. Their main determinants are poverty, sex, age, conflicts and disasters, presence of major physical diseases, and the family environmental (WHO, 2001). In the next paragraphs we show how some of these determinants might influence mental health and their consequences even in future generations.

Firstly, poor people usually face environmental and psychological adversities that may increase their vulnerability towards mental disorders. They might face barriers on getting access to mental health services, since the use of health care services might show be unaffordable, or mental health services

⁶ <http://www.nimh.nih.gov/health/outreach/coalition/coalition-meeting-march-2007.pdf>

⁷ http://wellergize.ca/workplace_wellness_glossary.phtml?term=presenteeism

might be unavailable or show a lack of responsiveness to health care needs of those individuals (WHO, 2003b).

Secondly, family members with chronic mental illness often are at greater risk of being unemployed, and also have an increased likelihood of being socially excluded or being homeless (McDaid *et al.*, 2008). Figure 2.1 illustrates the association between poverty and mental disorders. This figure briefly displays the mechanisms of the poverty cycle.

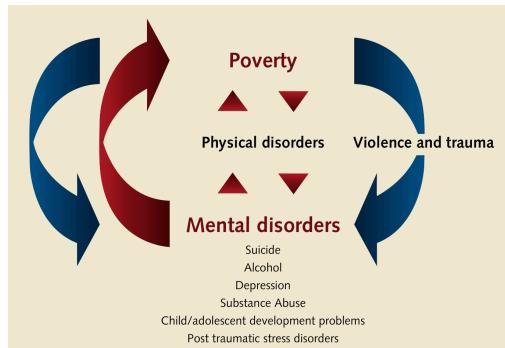


Figure 2.1: Poverty and mental disorders cycle (WHO, 2003).

Children with early poor school performance or with mental health illness often show an increased risk of anti-social behaviour, delinquency, substance abuse, teenager pregnancy, driving problems and involvement in crime (Jané-Llopis and Anderson, 2005). As a result, these children are likely to show an increased contact with criminal justice system, reduced levels of employment, lower salaries when employed, and difficulties with personal relationships. In addition, those children show higher probabilities of dropping out of their studies and not developing their careers. The expectable costs of mental health disorders within this group are tremendous, and will likely affect future generations (WHO, 2003a). Studies indicate that a third of children with parents suffering mental illnesses have a 50% increased chance of developing mental health problems later in their lifetime (WHO, 2003a; Jané-Llopis and Anderson, 2005)

Furthermore, substance abuse disorders associated with alcohol and drugs consumption present a high burden of disease, since they are likely to induce productivity losses in the workplace (for example through absenteeism and job losses), they may increase costs due to vehicle crashes and subsequently through healthcare and social support. These illnesses also create additional costs to the criminal justice system through crime, violence and injuries, directly affecting the future and health of family members and surrounding individuals. Figure 2.3 illustrates the several stages in which a family may get through when one of the family members has an alcohol problem. Substance abuse often leads to extra spending, inducing lower family income (WHO, 2003a). As a result, it increases the probability of children leaving formal education, suffering from posttraumatic stress as well as malnutrition and additional infections; resulting in higher probability of depression and of suicide. To sum up, mental health problems affect all family members and contribute for higher poverty, and to more mental disorders.

Beyond that, the carers of family members with mental health disorders and problems often bear the major part of treatment expenses. They support a substantial part of the economic and social cost, carry the emotional load, spend a significant amount of their time looking after the patients, and often

face problems in maintaining or finding a job, as well as seizing opportunities for self-improvement (WHO, 2003b; McDavid, 2008).

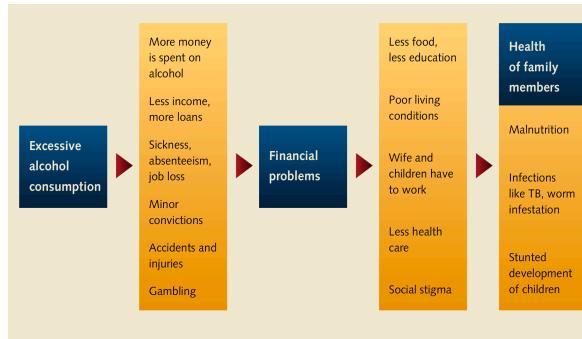


Figure 2.2: Excessive alcohol consumption and family health

Families and those who suffer from mental illness tend to be rejected by friends, relatives, and neighbours, frequently leading to a sense of isolation, restricted social activities, denial of equal participation in normal social networks (McDavid, 2008). Evidence points that:

- One out of four families has at least one member with a mental disorder (WHO, 2003a).
- Unemployed people show an increasing risk of depression as well as of suicide and self-harming.

This is especially true with older individuals, whose entrees in market-work are low (WHO, 2003b).

Individuals with chronic physical conditions are more likely to develop mental illness (mainly depression), hence developing comorbidities. Figure 2.4 presents the prevalence rates of major depression for several chronic conditions.



Figure 2.3 Prevalence of major depression in patients with other physical illnesses (WHO, 2003a).

2.5 Mental Health facts and findings

As shown in previous sections, acting on mental health is important to decrease the emotional, social and economic costs. In order to understand which policies should be applied to reduce the burden and expenses, it is essential to understand which groups have been affected and which will be affected in the future, as well as to find the explanations for the mental health patterns found.

Recent studies revealed social and economic determinants as possible explanations for mental disorders. Hence, research analysis should take into account implications on relative or absolute poverty, such as unemployment, low education, welfare services, criminal justice, urbanization and others public sectors (WHO, 2003b). Subsequently, there is a need for the design and development of adequate policies for detection, prevention and promotion programs, to treat and monitor individuals with mental illness. The following evidence shows the importance of acting on mental health: mental

well-being may help increase life expectancy and reduce the risk of engaging in harmful activities, such as alcohol and substance abuse; those with the highest levels of positive mental health have lower levels of cardiovascular disease. Effective promotion of well being and effective prevention of mental health problems might avoid lifetime costs of €116,000 and €232000 for each individual benefiting (McDaid et al., 2008b).

The information that follows summarises results of several studies on the epidemiology of developed countries and on the performance of mental health services.

A study analyzing the effectiveness in mental health care services (MingsShan, 1999) indicated an important impact for the following factors on the probability of improvement in mental health state: severity level of mental state, previous treatment, sex, marital status and education.

Another study has evaluated the effectiveness of treatment in a community mental health care service and found out that (Healey et al., 2000): the contact with its services (visits made to patients' or relatives' homes, visits to temporary patients made by other agencies home, visits of clinical staff, or of other social services) is associated with a statistically significant improvement on the general functioning of the patients; the productivity of specific types of consultations is dependent on the type of patient being treated – for example, inpatient care is more effective for patients with schizophrenia.

In a Norwegian psychiatric epidemiological study (Kringlen, 2003), using a sample of Oslo residents between 18-65 years, interviewed residents using the Composite International Diagnostic Interview between 1994 and 1997. This study showed, for this population sample that for all the disorders the 12-month prevalence was 32,8%, and the lifetime prevalence, also for all the disorders, was 52,4%. In addition, it has shown that alcohol abuse and major depression as having the highest lifetime prevalence in 12-month prevalence. Finally, all mental disorders were more prevalent in female than in male, with the exception of alcohol and drug abuse/dependence.

A German study analysing the prevalence of mental illness, using a meta analysis of previous datasets estimated about 27% (equalling 82.7 million adult individuals, with a 95% confidence interval of 78.5–87.1) of the adult EU population (between 18 and 65 years old) as having been affected by at least one mental disorder in the past 12 months. Concerning the level of comorbidity, about one third of individuals had more than one disorder, the most frequent being anxiety, depression, somatoform⁸ and substance dependence disorders. With regard to disability and treatment, the study found an association between all mental disorders and a substantial disability burden measured by the number of workdays lost (WLD) and generally low use of services and treatment rates. Only 26% of all cases had had any appointments with professional health care services, suggesting a considerable degree of unmet need for mental health services. Portuguese data was not included in this study since service register data only relied on identified patients, whereas it is known that people with mental or psychiatric disorders often do not seek treatment, or do not present their mental health problems as the reason for consultation and are therefore not identified as cases (Wittchen, 2005).

Another study revealed that one of the most prevalent anxiety conditions seen in primary care is the

⁸ Somatoform disorder is a condition in which the physical pain and symptoms a person feels are related to psychological factors. These symptoms can not be traced to a specific physical cause. In order to meet the criteria for a somatoform disorder, the physical symptoms must be serious enough to interfere with the patient's employment or relationships, and must be symptoms that are not under the patient's voluntary control. <http://medical-dictionary.thefreedictionary.com/Somatoform+disorders>

generalized anxiety disorder (GAD). Despite the high incidence of GAD, only 30% of sufferers were found as being diagnosed (Allgulander, 2006).

Furthermore, we have encountered the following evidence about the depression disorder: depression, the major cause of suicide, is a prevalent but under-detected, under-diagnosed and under-treated illness, a fact that is particularly true for depressed suicide victims (Rihmer, 2001). However, several studies have consistently shown that successful treatment of depression not only relieves symptoms, but also decreases and nullifies suicidal tendencies. If the rate of treated depression in the population increases gradually, at a given point appears a decline will be evident in suicidal rates. Also, increasing utilization of antidepressant drugs is one of the most important contributing factors in the decrease of suicide rates. A significant positive correlation was found between the rate of working physicians and the rate of diagnosed depression, and both parameters showed a strong significant negative correlation with suicide rate. The higher the number of physicians, the better the recognition of depression and the lower the suicidal rate in the given region (Rihmer *et al.*, 2007).

In 1983 and 1984, the Swedish Committee for Prevention and Treatment of depression organized a postgraduate training programme on the diagnosis and treatment of depression to all general practitioners on Gotland, Sweden. In the following years, the frequency of suicide and number of inpatients decreased significantly, as well as the frequency of sick leave for depression. The results of this study provided evidence that early recognition and adequate treatment is essential for suicide prevention. Evidence of a robust decrease of depressive suicides on the areas served by trained GPs was provided (Rihmer *et al.*, 2000).

According to another study, the prevalence for depressive disorders on the overall population of five European countries is 8,56%, in which 10,05% was found for female and 6,61% was found for male set (Mateos *et al.*, 2001).

At last, research carried out by the Mental Health Economics European Network (MHEEH) has shown that the interfaces between the health and non-health sectors differ across and within European countries. The provision and funding of services is often highly fragmented and poorly coordinated, with little incentive for funding to follow individuals along the care pathway; out-of-pocket payments for non-health sector services can be substantial and may be a burden for families; there has been a poor coordination between health and non-health services which might act as a barrier to an holistic approach to the delivery of mental health services across Europe (McDavid *et al.*, 2007); despite the fact that the number of evaluations for mental health has continued to grow, their quality is patchy (Evers *et al.*, 2007); although the impact of mental health problems on lost of productivity is substantial (and it is growing across Europe) and despite the development of several policies to address these challenges, data and information on mental health is still scarce (Curran *et al.*, 2007).

2.6 Mental Health facts and findings in Portugal

With regard to mental health in Portugal, in this section we present some available facts and data on mental health research and policies in Portugal.

The Portuguese health care system is based on a tax funded NHS, which is expected to provide universal access to health care, nearly free at the point of use. The Portuguese government is responsible for ensuring equal and good access to mental health services. Nevertheless Portuguese

user charges account for approximately a third of all health costs, and given the strong correlation between mental health problems, unemployment and deprivation, user charges for mental health services in Portugal are highly inequitable (Knapp *et al.*, 2007).

Provision of mental health related services is the joint responsibility of the Ministry of Health and of the Ministry of Labour and Social Security. Both ministries are accountable for specific social care: domiciliary care, day centres, integration of families, nursing homes and occupational care. In Portugal, there is no tradition of state intervention in mental health services which are partly included in the social sector; and the available social services vary according to type and geography. The mental health law established in 1998 defines that mental health care should be provided at the community level: less restrictive provision, local services with basic assistance, mental health treatments for inpatient should be available in general hospital, long-term mental care and psychosocial rehabilitation should be provided in psychiatric hospital. With regard to psychosocial rehabilitation, the state cost shares services under official structures of the health, social security and employment sectors (Oliveira, 2003).

Within the EU-15, Portugal was the country with the lowest level of expenditure in mental health care, with mental health accounting only for 4,6% of total expenditure of the health budget in 2002 (Medeiros *et al.*, 2007). Table 2.3 shows indicators regarding provision of mental health services per 100,000 individuals with Portugal presenting low values for the average in all the indicators (Medeiros *et al.*, 2007).

Table 2.3 Some indicators of provision of mental health services per 100 000 individuals

Country	Psychiatrists	Psychiatric nurses	Psychologists working in mental health	Social Workers working in mental health
Portugal	4,7	10,1	2,0	1,6
All MHEEN ⁹	11,4	45,3	22,2	60,0
Phase 1 MHEEN	12,9	63,0	31,7	101,6
Phase 2 MHEEN	87,9	61,3	33,0	3,6

A Eurobarometer Survey published by the European Commission in April 2003 indicated that almost a quarter of those questioned reported mental health problems, that practical help was difficult to obtain, and there is often little or limited social support for sufferers (The European Opinion Research Group, 2003). The highest proportion of mental health problems was identified for Italy and Portugal (with strong differences between gender and with higher rates amongst women) and the lowest figures in Finland and Sweden. Scores of mental health problems by marital status indicated higher rates in Southern Europe countries - generally those with a more traditional vision of the family (Italy, Portugal, Greece), especially for divorced and widowed - and lower rates for Nordic countries (The European Opinion Research Group, 2003).

Until 1993, Portugal had the highest per capita usage of anxiolytics (anxiolytics prescribing rate –

⁹ The MHEEN countries for phase 1 are: Austria, Belgium Denmark, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, U.K; Phase 2 are: Bulgaria, Cyprus, Czech Republic, Estonia, Hungary Latvia, Liechtenstein, Lithuania, Malta, Poland, Romania, Slovakia, Slovenia, Switzerland and Turkey.

standard dosage unit per 1000 individuals) in all EU-15, and this has increased by about 30% over the last decade (Knapp *et al.*, 2007).

Children with disabilities in Portugal –including those with mental health problems– tend not to go beyond primary school because there is a lack of resources to support their education: young people with mental health problems are disproportionately likely to leave school without qualifications, to be excluded from school, to be underestimated and to lower their standards and aspirations regarding their own future (Knapp *et al.*, 2007).

We also found out a Portuguese policy report (Comissão Nacional para a Restruturação dos Serviços de Saúde Mental, 2007), which indicated the following information for Portugal:

- A study on the primary care sector using the Bedford College Criteria in 927 users detected a prevalence rate of 31,6% for depressive disorders, of which 12% were clinical depression cases and 19,6% were sub-clinic depression cases.
- Also for primary care services, another study shows for European countries the following prevalence rates of depression: 18% for female and 7% for male.
- Prevalence results of the 2001 Psychiatric Census for Portugal showed: for ambulatory patients, 21,5% had depressive symptoms, 12,4% had neurotic disorders, 12,4% had schizophrenia, and 10,5% had adjustment reactions; regarding patients within inpatients units, 36,2% had schizophrenia, 28,1% had oligophrenia, 7,0% had an alcohol associated disorder, 5,4% had an emotional depressive disorders, 5,3% had a dementia syndrome, and 4,9% had a depressive disorders; as for patients admitted to emergency care (general and psychiatric hospitals), 21,3% had an alcohol associated disorder, 12,2% had a depressive disorder, and 9,2% had adjustment reactions.

Analysis of Eurobarometer of 2003 using a 5-item Mental Health Index (MHI-5) on a sample of 16.000 residents of fifteen European countries has shown a prevalence rate for positive cases of depression of 29,8% for Portugal, where the European average was 23,4%. In this study, females had a higher risk of being depressed in comparison to males, as well as retired citizens, the widowed and individuals with low social support had a higher risk of getting depression.

Finally, we briefly describe which policies have been defined in mental health in Portugal. First, Portugal had a period of Psychiatric Hospitalization from 1848 until 1945. This period began with the first medical institution for mental health patients, till the publication of psychiatric assistance law in 1945, which defined the creation of first mental services open to the community (Graça, 1996). Between 1945 and 1970, it was established a period of regionalization and decentralization of mental health services. During this period, the Psychiatric Assistance Institute was created to formalise a supporting network at primary care level in general hospitals and on establishments for collection of the mentally ill (Graça, 1996).

The mental health law of 1963 led to the creation of some mental health services in most Portuguese districts, meaning that for the first time mental health care became available at a local level (Comissão Nacional para a Reestruturação dos Serviços de Saúde Mental, 2007).

In 1971, there was a period of integration of mental health services into the network of public health services and in the primary care sector. However, in the following decades few efforts were made to

improve the difficulties and challenges that afterwards appeared. In 1998 a new mental health law was introduced, defining the principles and the path for the reorganization of mental health services. Unfortunately its impact was weak, and most idealised measures were not implemented (Comissão Nacional para a Reestruturação dos Serviços de Saúde Mental, 2007). Thus, until 2007, the majority of human and financial resources were concentrated in Lisbon, Porto and Coimbra, since most psychiatric hospitals were built in those areas during the 1940's and 1950's. Outside these cities, specialised mental health services almost did not exist, and this was mainly due to the lack of mental health professionals and other resources. Nowadays there is a low supply of mental health related community care, and this applies even to the largest Portuguese cities. A large part of the population does not have access to community care, nor benefits from interventions and programs that are currently taken as fundamental to promote mental health. Finally, in 2005, during the European Meeting in Helsinki, the Portuguese government has accepted to complete the reform of mental health services. Following this, in 2007 an action plan was developed, aiming to restructure and improve the access of mental health services to the Portuguese population. Whereof its main aspect is the transition between the institutional model to a community base model, involving institutional changes, reallocation of resources, training of professionals and the creation of new services (Comissão Nacional para a Reestruturação dos Serviços de Saúde Mental, 2007).

To sum up, evidence shows that mental disorders and problems can affect the society as well as to affect the overall economy of a country.

Furthermore, we conclude that there is lack of information concerning depression and mental disorders in general, and also about mental health services and results of implemented policies.

2.7 What is depression disorder?

Of all mental disorders, this work focuses on the depression disorder. Depression is a common mental disorder that presents depressed mood, loss of interest or pleasure, feelings of guilt or low self-worth, disturbed sleep or appetite, low energy, and poor concentration. These problems can become chronic or recurrent and lead to substantial impairments in an individual's ability to take care of his or her everyday responsibilities. At its worst, depression can lead to suicide, a tragic fatality associated with the loss of about 850 000 thousand lives every year ¹⁰.

By the year 2020, depression is projected to reach the 2nd place of the ranking of DALYs calculated for all ages and for both sexes ¹⁰.

Depression is also a serious illness, and most people who experiences it, require treatment so as to improve their health state. Despite the fact that the majority of people with depression could benefit from treatment, many individuals with depression do not seek treatment (Weel-Baumgarten *et al.*, 2005). Evidence indicates that the lack of treatment of depression means that 20% of cases becomes recurrent and chronic without remission (Weel-Baumgarten *et al.*, 2005).

Antidepressant medications (Antidepressant drugs work to normalize natural occurring of brain chemicals called neurotransmitters) and brief, structured forms of psychotherapy are effective for 60-80 % of those affected and can be delivered in primary care. However, fewer than 25 % of those

¹⁰ http://www.who.int/mental_health/management/depression/definition/en/

affected (in some countries fewer than 10 %) receive such treatments.

Barriers to effective care include the lack of resources, the social stigma associated with mental disorders including depression¹⁰, no recognition of mental illness and lack of trained providers (Knapp *et al.*, 2007).

Primary care based quality improvement programs for depression have been shown to improve the quality of care, satisfaction with care, health outcomes, functioning, economic productivity, and household wealth at a reasonable cost¹⁰.

Furthermore, there is no major known cause for depression. Causes vary from person to person, but we can say that there are several risk factors that may induce the appearance and maintenance of depression¹¹. These risk factors may result from a combination of genetic, biochemical, environmental, and psychological factor (WHO, 2001). It is also very difficult to define a specific list of symptoms of depression, since they usually vary: from person to person – variations in the way it is felt and experienced. Symptoms of depression frequently interfere with a person's ability to work, sleep, study, eat, as well as with enjoyable activities once–pleasurable. Consequently they are obstacles for an individual's quality of life¹².

In the following chapter we present a more detailed analysis on the main symptoms of common mental disorders as well as of depression. We show which are the main vulnerable groups and risk factors of mental health disorders and behavioural problems and describe the methods developed in this thesis to analyse the health status of the Portuguese population.

To conclude, this chapter has summarised evidence on the effect of mental health in the life of individuals, as well as in the economy and in the community, therefore presenting the reasons why this subject is so important to policy-makers. Moreover this chapter has presented some background information in several areas of mental health, main paradoxes, determinants, findings and the historical context of Portuguese mental health policies. We consider that the above information is useful for explaining the general population's mental health state of Portuguese population and in understanding results achieved.

¹¹ <http://www.min-saude.pt/portal/conteudos/enciclopedia+da+saude/saude+mental/depressao.htm>

¹² <http://www.nimh.nih.gov/health/publications/depression-easy-to-read/index.shtml>

3 Methodology

This chapter presents the methods chosen to address the research questions proposed in chapter One. The main purpose of this work is to analyse the mental health status of the Portuguese population, focusing on the depression disorder. Therefore, we aim at analysing the characteristics of the depressed population, exploring the explanatory factors for depression, measuring their influence in the probability of diagnosed depression and generating underlying information, which might help to improve the mental health status of the Portuguese population.

This work attempts to answer the following questions: what is the burden of depression on the overall Portuguese Population and main subgroups? Which symptoms and behavioural features are typical in the Portuguese depressed population? What is the incidence of depression in the Portuguese population in the 2005/06 period? Do the incident and the prevalent population with depression have the same characteristics, or the new incident cases have different characteristics? Are the explanatory factors for depression in the Portuguese population the ones we expected (in accordance to those observed in literature)? Which policies could be developed to improve the mental health status of the Portuguese population? Which vulnerable groups should be particularly supported? Which vulnerable groups and risk factors seem to demand for further research?

To answer these questions, we have selected a set of methods. First, we began by developing an explanatory model of the mental health state of an individual. This model contains a set of explanatory factors which include: presence of risk factors, belonging to vulnerable groups, daily habits and daily experiences, urban/planning and workplace conditions, education, social and health systems factors; finally, embraces symptoms, signs and behaviours typical of an individual with poor mental health. Some of these explanatory factors give indications of the quality public sector - such as education, workplace, urbanization, transport, health care services, social and housing support – which might affect the life quality and well being of individuals.

Second, we apply our model to the database of the Fourth National Health Survey 2005/06, which allowed us to:

- Carry out descriptive analysis on the incidence and prevalence of mental health on the Portuguese population, detecting vulnerable groups of depression and verifying their symptoms and behaviour characteristics;
- Propose a Bayesian network as a tool to support the diagnosis of depression in primary care services and to help planning the mental health services, with regard to the likelihood of an individual having or not having depression. For this network, it was used the prevalent population with depression as the reference population.
- Apply statistical and multivariate econometric analysis to explore which factors explain depression in the Portuguese population. We have decided to use Logistic regressions.

We expect that the application of these methods will help decision-makers to develop policies to decrease the burden of depression. Nevertheless, we acknowledge that given the extreme complexity of this disease, our aim is ambitious.

This chapter is structured in three main topics. In the first section we propose an explanatory model for mental health in which the explanatory factors are discussed. The model is represented by a

mindmap - a diagram used to represent ideas and other items linked and arranged around a central key word or idea. The software MINDMAP PRO was used for building them. The second section explains how the model was applied to the data of the 4th Portuguese National Health Survey and the conditions and limitations found when using this survey. The third and last sections describe the types of descriptive analysis performed and the selected multivariate statistical econometric regressions used to identify which factors contribute or not contribute for the prevalence and the incidence of depression in the Portuguese population.

3.1 Explanatory Model of Mental Health

In this section, we select determinants and indicators of mental health and their respective explanatory factors, building sub-models of the global explanatory model of mental health state of an individual. We describe the reasons to choose explanatory variables. For this, we used the evidence stated in the previous chapters and additional information that is described on this chapter. The partial elements and the global model were organised in structured maps for easy illustration and understanding of the issue, through the mindmap method.

The idea of using mindmaps appeared because it was necessary to organise a large amount of diversified information and literature review taken. And the mindmap method optimises thinking process unlocking of the dynamic of the brain, memorization, accelerating the understanding of complex issues (Colin and Brain, 1995). Mindmaps may use lines, symbols, words, colours and images, allowing a long list of monotonous information to be converted in a colourful, memorable and highly organized diagram (Colin and Brian, 1995). Mindmap is a type of problem stretching method and has a significative importance as a teaching method in social problems analysis (Pererson, 1998). Potentially, other problem stretching methods could be used.

Therefore, the following paragraphs describe and explain the reasons for the selection of explanatory factors included in our model; and figures 3.1 to 3.10 display mindmaps of sub-models of the global explanatory model of mental health state of an individual.

Figure 3.1 displays the selected risk factors representing the groups of individuals that we expect to be more vulnerable to mental disorders. Furthermore, most of individuals suffering from mental illness may display or possess more than one of these characteristics. Indeed some of the referred situations might be in some cases causes of mental disorders and/or consequences of it. All these risk factors contribute to worsen the state of mental health, or even to stimulate their development of mental disorders (WHO, 2001).



Figure 3.1: Possible risk factors of mental illness (Weel-Baumgarten et al., 2005; WHO, 2003b)

Taking the chronic physical illness factor as an example, evidence shows that it is regularly followed by depression and/or anxiety disorders. Besides that, the majority of individuals suffering from depression also suffer from anxiety (Cameron, 2007). Therefore, in order to identify possible persons with mental illness or in risk of catching it, we found it necessary to include in our model symptoms and signs. Through this option, we expect find yet unidentified depression.

The differences between sign vs. symptoms are explained as follows: a symptom is any subjective evidence of disease, it is experienced by an individual, whereas the sign is any objective evidence of disease that other person than the affected individual can detect¹³.



Figure 3.2: Suspicious Signs of Developing Mental Illness (Weel-Baumgarten et al., 2005; WHO, 2003b)

We then selected the following explanatory factors: signs of developing mental health disorder, depressive symptoms, behaviour symptoms and common cognitive and physical symptoms of the

¹³ http://www.medicinenet.com/symptoms_and_signs/article.htm

anxiety disorder. These factors are represented in figures 3.2, 3.3, 3.4, 3.5 and 3.6 respectively. However, it is difficult to establish which symptoms are specific for each disorder, due to comorbidities. Figure 3.3 displays the depressed symptoms found. The next two paragraphs explain that lack of interest and insomnia have an impact in the daily life of individuals, two of the symptoms of the figure 3.3.



Figure 3.3: Depressive Symptoms (Weel-Baumgarten et al., 2005; <http://www.nimh.nih.gov/health/>)

Often 30% of patients with insomnia have moderate depressive disorder. This is a severe symptom in depressive disorders (Weel-Baumgarten et al., 2005). These symptoms often lead to subsequent cognitive¹⁴ and behavioural symptoms, represented in figures 3.4 and 3.5 respectively.

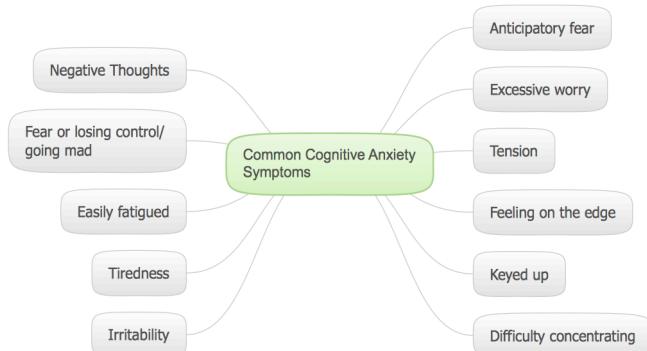


Figure 3.4: Cognitive Anxiety Symptoms (Weel-Baumgarten et al., 2005)

Also lack of interest results in uncareful food intake and lack of physical activity, which will likely generate stress and lead to an increase of alcohol consumption and smoking. (Weel-Baumgarten et al., 2005).

¹⁴ The cognitive symptoms are related to thought processes, such as learning, comprehension, memory, reasoning, and judging.

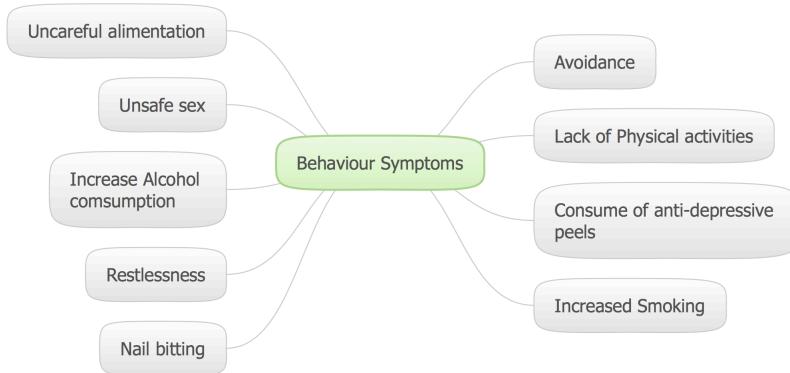


Figure 3.5: Behaviour Symptoms (Weel-Baumgarten et al., 2005; WHO, 2003b).

Careless behaviour might have an impact on a weakening of physical health, through obesity, cardiovascular and respiratory problems (Weel-Baumgarten et al., 2005). However, a physically active person can resist or even avoid mental disorders and cardiovascular problems (Zoeller, 2007). Figure 3.6 presents possible physical symptoms which an individual with a common mental health disorder might have. Figure 3.5 displays other behavioural symptoms common to individuals suffering from - or in risk of developing - mental illnesses. These symptoms are commonly followed by cognitive symptoms displayed in figure 3.4. As an example, some mental illnesses result in difficulties of concentration, sleeping and relaxing to which is often followed by excess of worry and inability to rest.

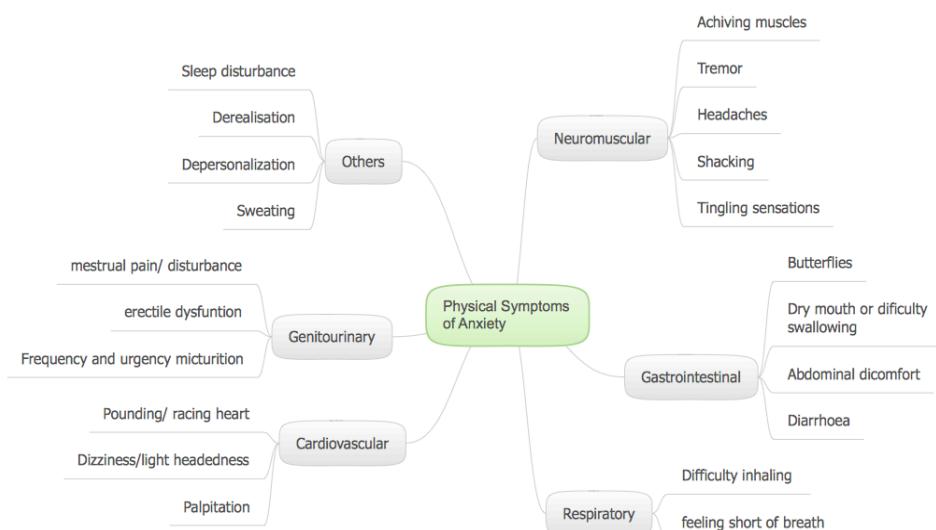


Figure 3.6: Common Physical Symptoms of Anxiety (Weel-Baumgarten et al., 2005; WHO, 2003b).

Depression is recognized as a multisystem disorder affecting brain and body (Insel and Charney, 2003). It has been associated with alterations in endocrine, cardiovascular, and immune systems, as well as changes in bone metabolism, resulting in important medical consequences (Insel and Charney, 2003).

These symptoms and signs were included in the model, because their application in the analysis would allow for: an identification of people whose mental illness not yet been diagnosed/identified and a characterization of the mental health state. Moreover, previous evidence indicates that mental illness does not affect society equally. There are groups more vulnerable than others, mostly those living in adverse circumstances and with the least resources (WHO, 2003a). Figure 3.7 displays these

expected vulnerable groups. Some are more likely to lose their job, facing discrimination, violations of human rights, and suffering from negative stereotyping. As a result, they might face significant barriers to employment opportunities and treatment (WHO, 2003b). In addition, it is also common for different groups shown in figure 3.7 to face the same kind of problems.



Figure 3.7: Vulnerable Groups (Weel-Baumgarten et al., 2005; WHO, 2003b; WHO, 2003a; WHO, 2001; Directorate-General for Health & Consumers, 2008).

For a better representation of the context of vulnerable groups, we present aspects regarding gender: it is commonly accepted that depression is more common among women than men. Males often show depression manifestation through fatigue, irritability, loss of interest in once-pleasurable activities, sleep disturbances, mainly alcohol and drugs disorders. In the developed countries males are committing suicide more often than females¹⁵.

However, to achieve a good explanatory model of the mental health state of an individual, we believe that we need to go beyond the risk factors, vulnerable groups, signals and symptoms of mental disorders and problems other factors are important. We should also include indicators of the functioning and structure of several public sector and services, since they might have an impact on the mental health state and well-being of individuals, mainly in conjunction with other problems and conflicts usual of life. Despite we believe that the educational, health, justice and security, planning and urbanization, social, housing and labour systems and structures should be included, in our model, we only include: education, health, education, social systems, and planning and urbanization structures. In the end, with them, we expect to represent the vast and complex public system of our

¹⁵ <http://www.nimh.nih.gov/health/publications/real-men-real-depression-easy-to-read/index.shtml>

society, and through the model measure their influence in the mental health state of an individual. Indicators of social and labour systems used in the model regards workplace and housing conditions. According to what was previously stated, mental health illness has a direct impact on the work dynamic at the workplace. A study carried out in Toronto presents associations between mental health disorders and temporary, part-time jobs, low salaries and without benefits (Marques I. 2008). Another result presented by WHO points out that in Spain the prevalence of poor mental health increases with the type of job contract – permanent, fixed-term temporary, non-fixed term temporary and no contract (The Economist, 28th August 2008). Figure 3.8 displays the selected workplace indicators divided into workload and environmental, health and social conditions.



Figure 3.8: Workplace Risk Factors (Jané-Llopis, et al. 2005; WHO, 2005).

Indicators of weak planning and urbanization can increase the risk of homeless, poverty and exposure to environmental adversities such as pollution and noise. Badly planned neighbourhoods lead to the inexistence of social structures, insecurity, reduction of leisure activities and social life, disorganized family daily life, resulting in a significant decreased individuals quality of life. Also, the existence of green areas promotes and allows individuals to have healthier behaviours, performing physical activity and spending more hours in daily light. Evidence shows that exposure to daylight as decreasing the probability of depression (Kripke, 1997).

Finally, a good planning and urbanization structure is likely to improve the health of people and express positive social impact in the community (Hoehner et al., 2003).

Figure 3.9 presents indicators of urbanization and planning.

The education sector is another important factor. In Portugal, family and school institutions provide the major education to population. Education promotes the access to social life, opportunities for getting better jobs, social and economic level. Therefore, school involvement is related to positive social and emotional development, by increasing employment and earnings, and consequently providing better access to health, social and community resources (Jané-Llopis and Anderson, 2005; Wendy, 2006). Schools are also able to detect earlier children with mental and behaviour problems (WHO, 2003a).



Figure 3.9: Urbanization Risk Factors (Jané-Llopis and Anderson, 2005).

Figure 3.10 displays education indicators that we expect to be relevant in explaining mental health state.

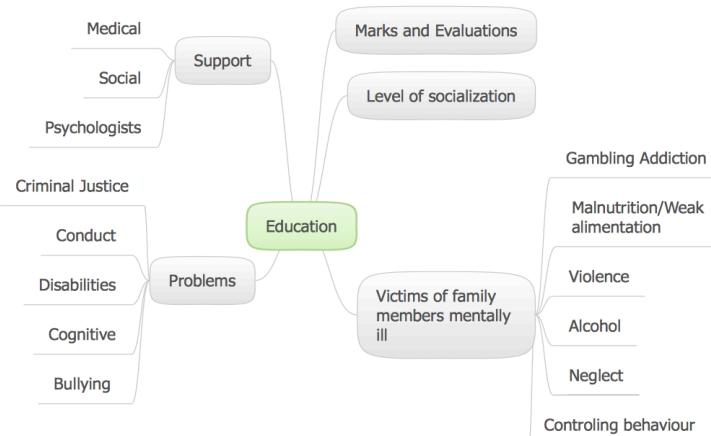


Figure 3.10 Educational Risk Factors (Jané-Llopis and Anderson, 2005; Directorate-General for health & Consumers, 2008)

The above explanatory factors were used as a base in structuring the overall model displayed in figure 3.11, using mindmap diagrams. The map should be read from the centre (where the individual's mental health state is displayed) to the surrounding areas. Its first level of lines describes relationships between mental health state and its determinants and indicators, and the second level of lines indicate relationships between these and their explanatory factors.

The map illustrates positive and negative signs, according to what we expect being the impact of explanatory factors in the mental health of an individual. The explanatory factors presented in red, represent the ones that were found in the 4th Portuguese National Health Survey. Additional information will be provided in the next subsection about this application

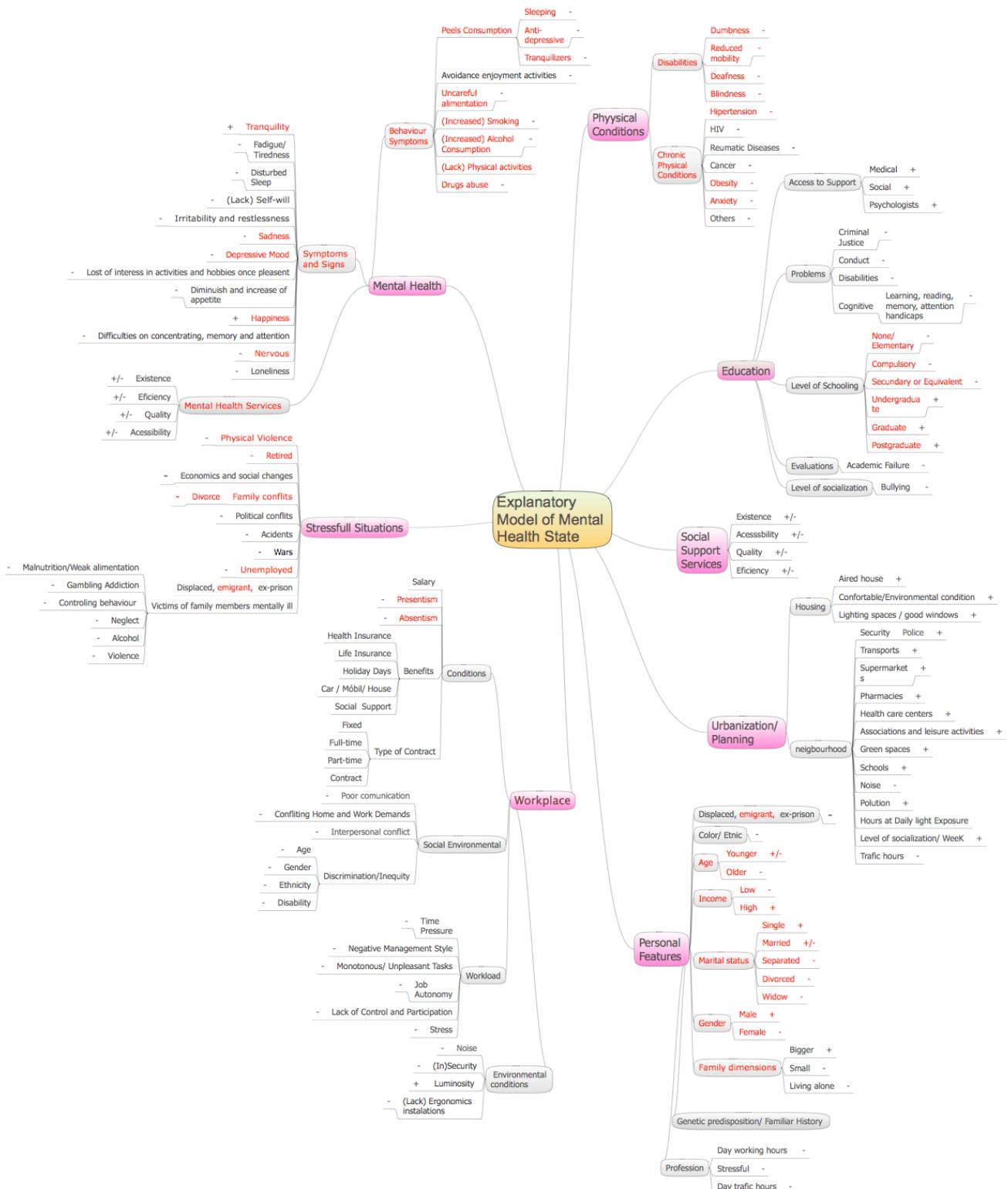


Table 3.1: Summary of importance, availability and features of factors included in the model of mental health state for an individual.

Explanatory factors		Importance (high, low, neutral)	Easily measurable (Yes or No)	Explanatory, Indicator
Education System	Level of education	High	Yes	Explanatory
	Evaluations	Neutral	Yes	Indicator/ Explanatory
	Problems	High	Yes	Explanatory
	Level of Socialization	High	No	Indicator/ Explanatory
Mental Health	Symptoms and Signs	High	Yes	Indicator
	Behaviour Symptoms	High	Yes	Indicator
	Mental Health Services	High	Yes	Explanatory
Workplace	Conditions	High	Yes	Explanatory
	Social Environment	High	No	Explanatory
	Environmental Conditions	Neutral	Yes	Explanatory
	Workload	High	Yes	Explanatory
Urbanization	Housing	Neutral	Yes	Explanatory
	Neighbourhood	Neutral	Yes	Explanatory
	Traffic Hours	High	Yes	Explanatory
	Private transport/ Public Transport	Neutral	Yes	Explanatory
	Light Exposure/week	Neutral	No	Explanatory
	Level of Socialization/Week	Neutral	No	Explanatory
Social Support and Services	Existence/Accessibility	High	No	Explanatory
	Quality/Efficiency	High	No	Explanatory
Personal Features	Profession	Neutral	Yes	Explanatory
	Age	Neutral	Yes	Explanatory
	Sex	Neutral	Yes	Explanatory
	Marital Status	Neutral	Yes	Explanatory
	Income	High	Yes	Explanatory
	Family dimensions	Neutral	Yes	Explanatory
Stressful situations	Victims of family members mentally ill	High	Yes	Explanatory
	Violence	High	Yes	Explanatory
	Wars, political conflicts, economic and social changes	High	Yes	Explanatory
	Unemployed, family conflicts, retired	High	Yes	Explanatory
	Displaced people	High	Yes	Explanatory
Physical Conditions	Disabilities	High	Yes	Explanatory
	Chronic Physical Conditions	High	Yes	Explanatory

Regarding the difference between “state” and “status” of mental health: “state” defines the mental health condition of an individual, whereas “status” is the same for a population or a group of individuals.

From all the explanatory indicators above, we believe that the inclusion of measures of its temporal action would offer the best way to understand their influence on the mental health state of an individual. In this way, it would be possible to evaluate if the influence was recent or old. Hence, we agree that our model would add more information if it presented factors throughout time.

Along with testing and analysing the explanatory factors for the Portuguese population, we aim at finding the causes of mental health state, particularly those that explain the prevalence and the incidence of depression in the Portuguese population.

Table 3.2 resumes which explanatory factors were considered in the model displayed in figure 3.11 and the main reasons for choosing those factors.

Table 3.2: Types of explanatory factors included in the explanatory model of mental health state and the reason why they were chosen.

Explanatory model of mental health state	
Which factors were considered?	With which aim?
Signals and Symptoms	Characterise the mental health status Verify whether or not exists an additional risk group outsider of our identified group with poor mental suffering of poor mental health
Personal Characteristics and Experiences	Find the causes of depression
Public Sector	Verify their impact in mental health state
Temporal	Allow to understand their influence on the mental health state of an individual

In order to test our model, we have collected available data to test the model for the Portuguese population.

3.2 The Fourth Portuguese National Health Survey

After developing the explanatory model globally represented in figure 3.11, we have chosen to test it using data from the 4th National Health Survey for Portugal, which was carried out in the 2005/2006 period. The sample was collected between February 2005 and January 2006 and based on a mother sample used in national surveys by the Portuguese National Institute of Statistics (INE -*Instituto Nacional de Estatística*). The survey included individuals living in Portugal in familiar housing units, therefore excluding those living in collective housing, e.g., individuals living in social care institutions, hotels and prisons. Inside each residence no selection of individuals was carried out, so a collection of information on all individuals living in the household was carried out. For those individuals that were not present in the time of interview, their information was collected by the remaining present individuals. The geographic areas were uniformly selected by trimester and week, in order to minimize the seasonal effects in the results¹⁶. With regard to, the dimension of the survey, the number of individuals was defined by INE, with the collaboration of *Instituto Nacional Saúde Dr Ricardo Jorge* (INSA) and both were defined in accordance to the following criteria:

- Inclusion of the households and population 2001 census, and the information of the Health National Survey taken in 1998.
- Ensuring a homogenous distribution of the sample in all seven regions established by the Nomenclature of Territorial Units for Statistics (NUTS II).
- Minimized seasonal effects, with selected areas being distributed more or less uniformly for each quarter and week.
- Use of representative samples for health regions.

Nevertheless, the use of this survey has imposed some limitations to our study, mainly due to sample limitations, and the fact that the survey was not built to specifically answer to mental health, because:

- Questions did not have the purpose of identifying individuals with mental health problems.
- Questions did not collect information for the majority of explanatory factors identified in our model and did not allow for analysing variables on other non-health sectors, reducing the possibility for testing some hypothesis.
- Within mental health, the survey only included questions about depression and about chronic

¹⁶ <https://woc.uc.pt/feuc>

anxiety disorders.

- The survey only included a section with some symptoms of depression, such as feeling relaxed, nervous, depressed, sad or happy.
- The survey did not include questions capturing dynamic explanatory factors, such as those regarding the duration of situations and conditions.

As a result, a lot of explanatory factors defined in the explanatory model could not be tested, due to: lack of observations available in the respective question; sample dimension variations; difficulties in adapting the questions to what was intended; lack of questions asking for many variables chosen in our model.

Consequently, we have selected a subset of questions of the survey that could be used to test our explanatory model of mental health state, developed in section 3.1. Table 3.3 contains the selected survey questions, the respective variables created and the limitations found in data collection in the survey. In bold letters, we have the variables *diagnosed depression* and *new depressed*, which were created for the identification of the prevalent individuals and incident individuals with depression, i.e. the individuals with a mental health state of depression in our model. We have also created some variables based on the answers to the survey, and we have used that database to perform statistical analysis and econometric regressions. We have transformed some categorical variables into dummy variables.¹⁷

Table 3.3: Selected Survey questions and respective variables and limitations

Name of survey Section	Survey	Created Variables		Limitations	
		Name	Type	Weeks	Age
Chronic Diseases (Mental Health)	Do you have or had Depression?	Depression	Dummy	ALL	ALL
	Has any doctor or nurse told you that you had Depression?	Diagnosed Depression	Dummy		
	Were you depressed for the first time during the past year?	New Depressed	Dummy		
Drugs Consumption	In the last two weeks:			ALL	ALL
	Did you take medication for Depression?	Depression Pills	Dummy		
	Did you take medication for Anxiety or Nervousness?	Anxiety Pills	Dummy		
	Did you take Sleeping Pills?	Sleeping Pills	Dummy		
Socio Demographic Characterization	What is your gender?	Gender	Dummy	ALL	ALL
	What is your Nationality?	Nationality	Qualitative		
	How old are you?	Age	Continue		
	What is your marital status?	Marital Status	Qualitative		
	What is your highest level of schooling?	Education Level	Qualitative		
	Which of the following categories describes your professional situation in the last two weeks?	Retired/ Unemployed	Qualitative		
	How many hours do you usually work in a week?	Working Hours per Week	Continue		
	What is your height? What is your weight?	*Used to create Obesity	Continue Continue		
General Health Information	During the last two weeks? How many days did you miss at work or school?	Absenteeism	Continue		Active persons and

¹⁷ A dummy variable considers two situations: the presence of a categorical situation or its absence, taking one or zero values, respectively.

	Have you been ill or felt ill in the last two weeks?	Presenteeism	Dummy	students	
Long Term Incapacities	Can you listen to TV or the radio?	Hearing Problem	Qualitative		
	Can you recognise a friend?	Vision Problem	Qualitative	ALL	>=1
	Do you have speech difficulties?	Speech Problem	Dummy		
	Are you always laid down; can't you get up of bed, even if someone helps?			1-13	>= 10
Physical Activity	Are you limited to your house?	Mobility Problem	Dummy	1-13	>= 10
	Are you always lying down or seated all day, and limited to your house?			14-26	>=15
Chronics Diseases	Do you currently suffer, or have you ever suffered from:				
	Asthma?	Asthma	Dummy		
	Anxiety?	Anxiety	Dummy		
	Diabetes?	Diabetes	Dummy		
	Hypertension?	Hypertension	Dummy		
	Constant Pain?	Constant Pain	Dummy	ALL	ALL
	AVC?	AVC	Dummy		
	Obesity?	Obesity	Dummy		
	Myocardial Infarction?	Myocardial Infarction	Dummy		
	Chronic Wound? (like ulcerate, scabs)	Chronic Wound	Dummy		
Socio-Economic Characterization	Now, I will ask to choose the letter that is closest to your total family income, of last month, including outcome, salary, pensions, allowance, subsidies of all members?	Family Income <i>*used to create the Income</i>	Quantitative and Discrete	ALL	ALL
	How many members does your family have?	Family Dimension/ <i>*used to create the Income</i>	Continue		
Tobacco Consumption	Do you smoke?	Smoking	Dummy	ALL	>=10
Physical Activity	During the last week how often did you practice physical exercise?	Physical Activity	Continue	14-26	>=15
Mental Health (MHI-5)	In the last 4 weeks, how many times have you felt:				
	Nervous?	Nervous Symptom	Qualitative	ALL	>15/ Own
	Depressed?	Depressed Symptom	Qualitative		
	Calmed and relaxed?	Relaxed Symptom	Qualitative		
	Sadness?	Sadness Symptom	Qualitative		

The obesity variable was calculated applying the body mass index (BMI) definition and using the answers to the weight and height questions. Obesity was defined through the establishment of the following categories: "obese" from overweight to the maximum and "non-obese" for the lower levels. Consequently, obesity is treated as a dummy variable.

The new depressed variable is dichotomous, and it was created for individuals that have had depression for the first time in the past year and as baseline the remaining depressed diagnosed. The aim was to isolate the new cases of depression (i.e. the incident individuals with depression).

Due to a limited number of recorded answers in specific questions, several explanatory variables could not be included in the statistical regressions, such as those regarding disabilities, physical activity and absenteeism.

In addition, the income variable was developed using questions about family dimension and family income to perform a normalized family income scale as defined by the OECD:

$$Income = \frac{Family_Income}{\sqrt{Family_Dimension}} \quad (1)$$

This variable aimed at measuring how much each family member had for a living, and considered four levels: low [0; 500]€, media-low]500; 1000]€, media-high]1000; 1500]€, and high]1500; 2000]€.

At last, we did not consider questions on alcohol consumption: first the data from the survey section about the alcohol consumption was not available, second due to difficulties in adapting the information available from the survey section about the food and drinks consumption to what was intended. And in the database, we also found difficulties in finding data that allowed measuring temporal action of explanatory factors.

3.3 Statistical Analysis

In this section, we describe the analysis and the estimations selected to explain the mental health status of the Portuguese population. As a result of applying the model to the selected survey, we decided to focus our study on the depression disorder.

To attain reliable results, we have decided to use as the definition of depressed individuals, only those that had been diagnosed. For that, it was created the diagnosed of depression variable, displayed in table 3.3. Despite we exclude possible cases of depression of individuals that have not yet been identified by a specialist, we remove people that could just have a perception of being depressed. Therefore, in our definition we have excluded people in psychological suffering, and might be underdiagnosing for depressed cases.

Next, we have two subsections describing the methods used in the descriptive analysis and in the application of statistical econometric methods to the prevalent and to the incident populations.

In the descriptive analysis we have studied: the prevalent cases with depression, - *defined as individuals with diagnosed depression* - and the incident cases of depression - *defined as individuals that have had a depression diagnosis for the first time in the past year*. After identifying the prevalent population, we could perform a bi-dimensional analysis using the prevalence rates of depression. Prevalence rates are *defined as the ratio between the total cases of individuals with depression and the sample dimension*. This indicator can be seen as a measure of risk. We have also proposed a tool, based on a Bayesian network that might inform diagnosis and planning of mental health services. This net uses representative groups of depressed individuals and defines an individual's probability of developing depression, given the set of characteristics of the individual.

The second subsection describes the econometric methods used in explaining the prevalence and incidence of depression. The target was to detect the risk factors that can be seen as an explanatory cause for depression, so as to test in our explanatory model and explain the statistically significant causes of depression for the Portuguese population.

The reason why we have decided to carry out multivariate regressions is that as previously explained, mental health state can be influenced by a combination of several factors, such as genetic, social, demographic, personal experiences, health and environmental (WHO, 2001). Thus, through the use of multivariate regression, we could verify their positive or negative contribution for the occurrence of a depression case. We selected the Logistic regression technique. We have also used Multivariate OLS regression, although given the dichotomous nature of our dependent variables, we exclude these

results. In the following subsections we describe each of the methods in use.

3.3.1 Descriptive study on the Prevalence of Depression

In this subsection, we explain how we have analysed the prevalence of depression in the Portuguese population. Analysis has been constrained on the variables available in the survey. In this analysis, we aimed at characterising and quantifying the burden of depression on several groups of the Portuguese population, and at explaining whether results were consistent to our explanatory model and with the expected hypothesis stated in tables 3.4 and 3.5.

Firstly, we have identified the vulnerable groups of depression in all the population and for each gender group. We have compared the risk of depression according to different groups, e.g. by comparing prevalence rates for different population groups. We could comparatively analyse which population groups might potentially need more support. Afterwards, we have performed analysis of available variables related with depression and behavioural symptoms.

Table 3.4 contains a list of vulnerable groups. Besides aiming to verify risk factors through bi-dimensional analysis, we expect to show statistically significant relationships in the assessment of the production functions of the state of mental health of the population through the use of statistical regressions.

Table 3.4: Expected vulnerable groups.

Divorced	Drug Abuse Disorder	Loneliness
Separated	Consumption of Anti-depressant Drugs	Living with a Companion
Widow	Lack of Physical Activity	Absenteeism
Middle-age	Pregnant or New Mothers	Presenteeism
Unemployed	Poor Eating Habits	Work less hours
Retired	Physical Chronics Diseases	Smoking habit
Alcoholism	Anxiety Disorder	Low Level of Schooling
Obese	Low Income	

Table 3.5 holds a list that compares the risk of depression for gender, according to different population characteristics. In order to achieve a better illustration of the results that we expected to find out, the following nomenclature is used in the table: if the signal is $>$, it indicates that one case is expected to have higher prevalence than the other, i.e. to show a higher risk of depression.

Table 3.5: Expected results according to groups and between genders

Female>Male	Single Male> Single Female
Male Reformed > Female Reformed	Female Separated > Male Separated
Male Unemployed>Female Unemployed	Female Obese > Male Obese
Lonely Male>Lonely Female	

Unfortunately, not all of the relationships stated in tables 3.4 and 3.5 could be tested, for two reasons: limitations of the sample dimensions and difficulties in adapting questions to our research questions. Thus, our analysis was centred on the following variables: marital status, family incomes, NUT II regions, levels of schooling, retired and unemployed people, family dimensions, smoking habits, chronic diseases, physical exercise habits, consumption of drugs and depressed symptoms.

This descriptive study was divided in several analyses, aiming to achieve the following goals: identifying the prevalent population with depression and their vulnerable groups; characterizing this population, performing analysis of symptoms of depression and consumption of antidepressant drugs;

and proposing a tool for supporting the diagnosis of depression in primary care services and the planning of the mental health services.

Concerning the analysis of symptoms of depression and of consumption of antidepressant drugs, comparative analysis was also performed between the groups identified with depression and those not identified with depression. With this comparative analysis, we aimed to observe patterns in these populations indicating the presence of an outsider group in psychological suffering.

For the analysis of symptoms of depression, we have used questions from the mental health section of the 4th National Health Survey, which are commonly named as five questions of the Mental Health Inventory - MHI-5. These questions intended to measure the likely existence of psychological suffering among the population (INE, 2007). However, we alert for the limitations of this data, due to the nature of its answers: the answers are a result of individual self-response relatively to self-perception.

3.3.2 A Tool to Help Planning Mental Health Services

This subsection proposes a tool that makes use of the descriptive information on prevalence and that can be helpful for diagnosing and planning of mental health services. A Bayesian Network consists on a graphical and probabilistic casual network composed by a set of nodes, representing variables, and by directed arcs, which establishes dependent cause-effect relationships between variables - parent and child nodes (Jansen, 1996). Furthermore, when applying this technique to medical situations, the top nodes might possibly be seen as predispositions or causes influencing the likelihood of the disease. They might have internal conditions, which in turn have links to nodes for observables. The number of layers of nodes varies according to the complexity of relationships of the disease. The strength of these networks is that they are very resistant to missing information, and make the best possible prediction with the available information¹⁸. So as to have a Bayesian Network reflecting casual relationships of our population, we have built one having as base the database of population under study. As a result, the proposed network organises information collected in the section of prevalence of depression. The proposed Bayesian Network is a tool and an example that might be developed to support depression diagnosis at a general health services or to plan mental health services of specific groups of the Portuguese population. The network seeks to measure the risk of a depressed patient according to his/her features and the population data available (Subramani, 2005). As an example of the potential of using a Bayesian Network, we have used a Netica software application - Windows Version 4.08¹⁸ – in the development of that network.

Within a Bayesian Network, the graphical structures are directed acyclic graphs, which might be used either in prediction or in diagnosis directions, providing a complete probabilistic description of a particular system (Jansen, 1996). The last child-node of the network establishes the conditional probabilities of patients being depressed or not, regarding its characteristics, i.e. according to its parent's nodes relationships (Costa, 2008). These conditional probabilities are defines by the expression (2).

$$P(X_1, X_2, \dots, X_n) = \prod_{i=1}^n P(P_i | P_{ai}) \quad (2)$$

¹⁸ <http://www.norsys.com/netica.html>

where P_{ai} stand for parents of X_i . In the network we consider vulnerable groups and risk factors of depression identified ahead in the results of the descriptive analysis on the prevalence of depression, and we have defined the nodes as close as possible to patient characteristics. Moreover, in order to exemplify how this application is likely to be a useful tool in a depression detection program, we use a limited number of variables that could be exploited by the clinician as a helpful tool when taking the diagnostic, or in health services planning. But we need to take into account the limitations of the database in use. As will be shown in the results section, it is expected that our data underestimates the probability of being depressed. In the results chapter, we provide two patient examples to show the risk probabilities provided by a Bayesian Network developed in this study.

3.3.3 Descriptive Study on the incidence of Depression

Besides analysing the prevalent population, we found it relevant to identify and analyse new cases of depression i.e. the incidence of depression. Thus, we have used the answers given in the survey to the question "Did you have depression for the first time during the last 12 months?" - displayed on table 3.2- and created the *new-depressed* variable. This variable allowed us to analyse the characteristics of the incident population, comparing them with the individuals who have been diagnosed with depression for the first time before those 12 months, and identify changes in the characteristics of the population with depression. We have also carried out bi-dimensional analysis for the incidence of depression across selected population groups.

3.3.4 Econometric Methods

The aim of this subsection is to present the methods used to identify the causes of depression in the Portuguese population. Therefore, we have chosen to estimate production functions for the mental health state by estimating econometric regressions. Whether for the prevalence or for incidence of depression, we expect to find the statistically significant factors that contribute and others that not contribute to depression.

In addition, we also explain here the work carried out to study the prevalent population through the use of *diagnosed depression* variable, and the incident population through the use of the *new-depressed* variable. In the study of prevalence, we carried out analysis for three groups of the Portuguese population: total population, male and female. According to each gender group, the estimations were performed so as to test whether different explanatory factors for the two groups exist¹⁹.

In order to achieve these objectives, we have estimated production functions using Logistic regressions, which we describe in this subsection. The production functions were built with information from 4th Portuguese National Health Survey, and thus the variables created and displayed in table 3.2²⁰. We may describe these production functions as simplifications of our explanatory model of figure 3.11.

We have run two different models:

- **Model One** presented in figure 3.12 considers simple variables.

¹⁹ For the incident population we did not carry out estimations for each gender type.

²⁰ For example, we have excluded explanatory variables related with disabilities, practice of physical exercise and absenteeism, because they reduce excessively the dimensions of sample in performing the estimations.

- **Model Two** displayed in figure 3.13 - besides considering the variables of model One, it also includes some of those variables crossed with the gender type.



Figure 3.12 Names of explanatory variables used for the evaluation of Model One.

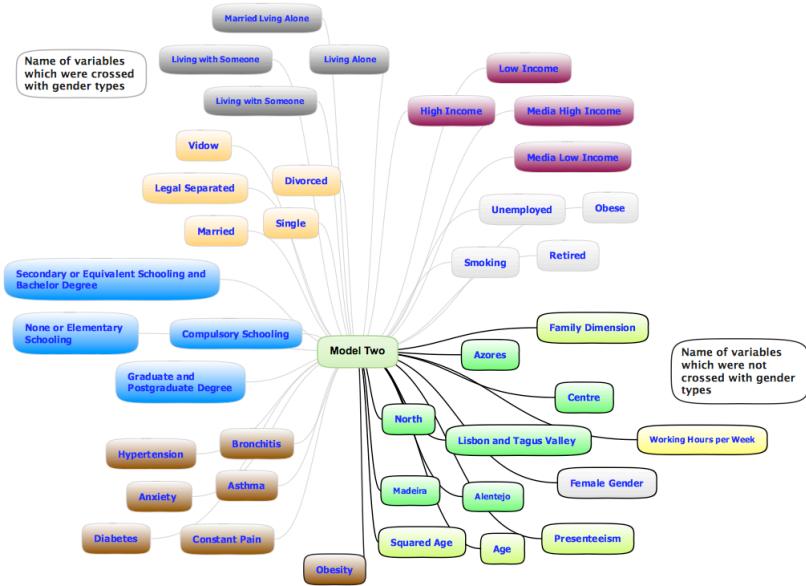


Figure 3.13 Name of explanatory variables used for the evaluation of Model Two

For this, we had to transform several categorical variables into dummy variables. Figures 3.12 and 3.13 illustrate the names of variables considered in models One and Two respectively; the yellow balloons represent continuous variables and the remaining balloons represent dichotomous variables. The diagram in figure 3.12 contains the names of variables used on the construction of model One, in which some were used as baseline variables, to compare results of remaining associated. The second diagram of figure 3.13 contains the names of variables used in the development of Model Two. These variable names are also divided in two groups, for variables that were or were not crossed with the

gender type.

Furthermore, when we made the selection of variables for the two models, we had to consider the need of avoiding multicollinearity problems on regressions, since they could bring unstable and skewed estimates. Since we expect the variables associated with consumption of antidepressant drugs and symptoms of depression to be indicators of poor mental health instead of causes of depression, we exclude them from the models. Otherwise they should be redundant with the remaining independent variables.

At last, when we ran the production function represented by model two, we observed severe multicollinearity problems, for which the logistic regression algorithms of Stata solved by excluding the variables that causes multicollinearity problems.

Once again, we used mindmap diagrams to represent models, which should be read from the centre to the surrounding areas, with lines representing the statistical significant relationships that we meant to test.

Model Two was developed with the purpose of attaining a better identification of the causes of depression, through the achievement of an increased level of explanatory power and with a higher number of statistically significant variables. After identifying the variables that contribute to depression disorder, we expect to obtain some information on the factors that explain depression in the Portuguese population. In the next subsections, we describe the fundamentals of each econometric methods in use, and how they were applied in this study.

3.3.4.1 Logistic Regression

Logistic regression is a technique used for predicting the probability of an event by fitting data to a logistic curve. Similarly to OLS regression, it uses several explanatory variables, which might be either numerical or categorical (Damodar, 1995). The logistic function is useful because it can take any value from negative infinity to positive infinity as an input, whereas the output is confined to values between 0 and 1. Considering the representation of the expected value of the dependent variable defined in expression (3) (please do not confuse these β_i parameters with the ones used in the OLS regression):

$$P_i = E(Y | X_i) = \frac{1}{1 + e^{-(\alpha + \beta_1 x_1 + \dots + \beta_k x_k)}} \quad (3)$$

and using a transformation of variables,

$$z_i = \alpha + \beta_1 x_1 + \dots + \beta_k x_k \quad (4)$$

the variable z is a measure of the total contribution for depression from all the independent variables, while $P(z_i)$ represents the probability of the depression given a set of variables.

$$P_i = E(Y | X_i) = \frac{1}{1 + e^{-z_i}} \quad (5)$$

where $z_i = \alpha + \beta_1 x_1 + \dots + \beta_k x_k$. Therefore the β_i s are the estimates of the coefficients and indicate the contribution of each explanatory variable to the probability of occurring depression. The distribution (5) is known as logistic distribution function. Satisfying these requirements, there is an estimation

problem because P_i is not linear in X_i nor in the parameters β_i . To solve this problem, the odds ratio²¹ defined as the ratio (6),

$$Odds_ratio = \frac{P_i}{1-P_i} = \frac{1+e^{z_i}}{1+e^{-z_i}} = e^{z_i} \quad (6)$$

and through its natural log we obtain the relation (7), which is linear in X_i and in β_i :

$$L = \ln\left(\frac{P_i}{1-P_i}\right) = z_i = \alpha + \beta_1 x_1 + \dots + \beta_k x_k \quad (7)$$

Although the probabilities lie between 0 and 1, this model has the following features: even though the logit is linear in X_i , the probabilities are not interpreted as in the OLS model; the β_i parameters measure the change in L for a unit change in the X_i ; and while the OLS model assumes that P_i is linear in X_i , the logit assumes that the log ratio is linearly related to X_i (Damodar, 1995).

To ensure that the estimators have appropriate properties, estimations have to satisfy the assumptions of the logistic regression. When the assumptions of logistic regression analysis are not met, problems will exist - biased coefficient estimates will be generated or very large standard errors for the logistic regression coefficients will be obtained. These problems may lead to invalid statistical inference. Therefore, it is necessary to check if the logistic regression technique fits the data, as well as checking for influential observations that might have high impact on the estimates of the coefficients²². Therefore, in order to verify the previous conditions, we have used the following commands of the Stata, to which we have run the following tests²²: *LSTAT* (which carries out confusion matrix analysis); *LFIT* (Hormer and Lemeshow' goodness of fit test, gives indication about the performance of fitting of the regressions); *LINKTEST* (it is a specificity test, which shows if the models were correctly specified).

To sum up, this chapter has explained the different steps taken for the selection and construction of variables to be tested in the model explaining the mental health state of an individual; the construction and reformulation of the model to be tested with data from the 4th National Health Survey for Portugal for the years 2005/06; which population groups were analysed; which studies were planned; and which statistical techniques were chosen. The next chapter presents results from the application of these methods to the Fourth National Health Survey for Portugal.

²¹ Odds ration is a ratio that compares the probability of having diagnosed depression with of not having diagnosed depression.

²² <http://www.ats.ucla.edu/stat/stata/webbooks/logistic/chapter3/statalog3.htm>

4 Results

This chapter presents the results of applying the methods described in chapter 3. The chapter is divided in two parts. The first part performs descriptive analysis using bi-dimensional analysis between prevalence and incidence rates with other variables. It includes a characterization of the prevalent and incident populations with depression. Furthermore, the first part proposes a method that uses prevalence data to inform health care decision-makers on the probability of a given individual or population group having depression (through the use of a Bayesian network). The second part involves the application of econometric methods to test which factors statistically explain depression, in both male and female populations. We aim at obtaining results that answer to the research questions presented in chapter 3 and the objectives stated in chapter 1 of this study. Moreover, we aim at providing information to help decision-makers to define policies that might promote, prevent and treat mental health disorders.

4.1 Descriptive Study on the Prevalence of Depression

For the prevalent population, we have used a variable based on individuals who were diagnosed with depression - see table 3.3. It is important to take into consideration that this variable – diagnosed depression – does not specify the type of depression because the survey considers the general concept of depression. This means that the variable might exclude people with psychological suffering that have not yet sought help or who may have gone to a general practitioner but without depression being diagnosed. The lack of knowledge and overall unawareness of mental disorders among individuals, as well as stigma, might contribute to underestimation of the number of individuals on the population suffering from depression. This section contains the results from a descriptive study of the prevalent population, with the aim of detecting characteristics associated with risk of depression. The global sample for mainland Portugal has a size of 41 191 individuals, being 48,29% male and 51,71% female. We found a prevalence rate of depression of 7,30% for individuals answering that they had depression, and 6,84% for those depressed individuals indicated that had been diagnosed with depression. This group was the one selected to perform several analysis.

4.1.1 Vulnerable groups

We present here results on the prevalence rate of the population with depression and identify the main vulnerable groups, either for the total population or for gender groups. We also carry out a second level of crossed analysis, aiming to achieve a better understanding of the risk subgroups inside the main risk group. Table 4.1 displays results on the prevalence of depression.

Table 4.1: Main results of the prevalent population with depression.

Diagnosed Depressed in 41 191 individuals			
Type of Population	Sample Dimension	Proportion	Prevalence Rate
Male	590	20,94%	2,97%
Female	2 228	79,06%	10,46%
Overall	2 818	100%	6,84%

Table 4.1 shows that females have a triple risk of having a depression disorder in comparison to males, i.e. the proportion of depressed females on the total female population is three times the same proportion for the male population. This result might be partly explained by the stigma for male to report that they are depressed (WHO, 2001).

Afterwards, we carried out an analysis of prevalence for several groups of the population. Table 8.1 (displayed in the annexes) shows the results of this analysis, and the proportion of individuals included in these subgroups. We consider as groups with higher prevalence of depression those for which the prevalence rate is higher than the prevalence rate for the overall, female and male populations (6,84%, 10,46 % and 2,97% for the overall, female and male populations, respectively).

Analysis at table 8.1 in annexes show the following groups reporting the highest risk of depression (according to class) and commonly identified on males and on females are the following groups: the unemployed, the retired, the divorced, those with high incomes, those with chronic anxiety or chronic obesity, the obese, the age group of 50-65 years, those who live in the Centre and Lisbon and Tagus Valley NUTs II regions, and those who are living alone or with someone.

There were differences between male and female populations. The factors that report a higher risk of depression are:

- On female: low level of schooling; age below 50 years, in comparison with the ones above 65 years; and the legally separated present a higher risk than the married and the widowed;
- On male: high levels of schooling; married group in comparison to the widowed; age above 65 years with a higher risk than the ones below 50; and individuals living alone.

Table 4.2: Vulnerable groups of depression for three types of populations.

	Overall population	Female Population	Male Population		
Marital Status	Married				
	Widow				
	Divorced				
Age groups (years)	36-49/50-65/66-80				
Family Income	Live with [0; 500[Euros				
	Live with [1000;1500[Euros				
Level of Schooling	None or Elementary		Graduate and Post Graduate Degrees		
			Compulsory		
Unemployed	Unemployed				
Retired	Retired				
Obesity	Obese				
Chronics diseases	Hypertension				
	Diabetes				
	Constant Pain				
	Asthma				
	Obesity				
Family Dimension	Anxiety				
	Live alone				
	Live with someone				
NUTs II Regions	North				
	Centre				
	Lisbon and Tagus Valley				
	Alentejo				

For identifying the vulnerable groups of depression present in the Portuguese population, we took into account the dimension of the subgroups as a proportion to the population under analysis. With it, we expect to indicate only those that might be considered a risk group with a substantial size. Table 4.2 displays the vulnerable groups encountered for each population group under analysis (overall, female and male Portuguese populations). Where verify that most of findings are expected, confirming the hypothesis presented in our explanatory model of the state of mental health for an individual. For the several types of populations analysed, the age group with higher prevalence of depression was the middle age group - between 50 and 65 years.

In addition, for the male group, we found that graduate and post-graduate degrees and media high income are their main vulnerable groups. Comparing these with our explanatory model of mental health, these are unexpected vulnerable groups. Otherwise, for females we identified widow, none and elementary schooling, individuals living alone, individuals suffering from anxiety, obesity, asthma, and at last for individuals living in *Alentejo* as the most vulnerable groups.

4.1.2 Other groups

For the three population groups, we found that individuals with high income show higher prevalence of depression. This is not an expected result according to our explanatory model and literature stated in chapter 2. This finding might be partly explained by being a group with facilitated access to mental health services (as opposed to low income groups).

Analyses on the relative risk of depression between subgroups were also performed (see table 8.4 in annexes). The main findings are as follows: males with anxiety have a double risk of being affected by depression relatively to females with anxiety; and the divorced male population has a higher risk of being depressed than divorced female group.

After these findings, we decided to study in more detail some of the identified vulnerable groups. The analysis considered higher levels of cross-information. The selection of groups displayed here account for three situations: the risk groups found on the previous analysis, the vulnerable groups with enough dimension in the sample that allowed for further analysis, and results that we considered to be interesting. Tables 8.2 to 8.3 displayed in annexes contain analysis of the married, unemployed, middle-age group and retired groups for each gender group.

4.2 Depressive Symptoms

This subsection analyses the perceptions of the population to their own depression symptoms. The depressive symptoms include depressive mood, nervousness and sad feelings, as opposed to a depressed state with relax/calm and happy feelings. The questions that were analysed can be consulted in table 3.3. Our aim was to capture the existence of psychological suffering among those individuals who were or were not identified with depression. These questions are self-answered and capture the self-perception of mental health by individuals.

For analysing these questions, the sample has 23 839 individuals who have answered to mental health questions reported in table 3.3. From those individuals, 2344 were diagnosed as depressed, corresponding to a prevalence rate of 9,83%. Results displayed in tables 4.8 and 4.9 present

proportions of the depressed and non-depressed population, respectively, for the several categorical frequency levels of each declared symptom.

Table 4.3: Proportions of the depressed population with specific symptoms.

Depressed Population	Nervous		Depressed		Sad		Relaxed		Happy	
Frequency	%	#	%	#	%	#	%	#	%	#
Always/Most of times	39,0	913	27,7	649	28,8	676	16,2	380	18,0	422
A lot of time/Sometimes	41,1	961	40,6	951	43,8	1027	38,0	890	42,6	999
Rarely/Never	20,1	470	31,7	744	27,4	641	45,8	1074	39,4	923
Total	100	2344	100	2344	100	2344	100	2344	100,0	2344

Table 4.4: Proportions of the non-depressed population with specific symptoms.

Non-Depressed Population	Nervous		Depressed		Sad		Relaxed		Happy	
Frequency	%	#	%	#	%	#	%	#	%	#
Always/Most of times	11,0	2357	5,4	1170	6,8	1451	43,1	9260	43,6	9361
A lot of time/Sometimes	34,4	7395	24,7	5313	29,4	6320	41,1	8842	41,6	8938
Rarely/Never	54,6	11743	69,8	15012	63,9	13724	15,8	3393	14,9	3196
Total	100	21495	100	21495	100	21495	100	21495	100,0	21495

Comparing tables 4.3 and 4.4, we identify in the non-depressed population a large group of individuals with high frequency levels of depressive symptoms. Most of these groups show larger dimensions than the population identified with depression – the prevalent population.

Therefore these results lead us to believe that the prevalence rate of depression might be underestimated. However these findings may have been affected also by the bias associated to self-perception of frequency levels, hence affecting our conclusions.

As a conclusion, we believe the levels of poor mental health in Portugal are higher than our achieved prevalence rate of depression, which leads us to conclude that the rate of underdiagnosed depression is likely high as well.

4.2.1 Behavioural symptoms

4.2.1.1 Consumption of Antidepressant Drugs

The consumption of drugs questions were related to individuals taking drugs for depression, for sleeping and for anxiety – table 3.3. As described before, these behaviours are typical of individuals developing a mental illness, or even is a common symptom of mental disorders. These questions were only considered for people who have taken those drugs in the last two weeks. This time limitation causes the reduction of the size of the analysed sample, leading to a sample with 21 374 individuals. Those individuals represent 48,1% of the survey sample, with 62,5% being females and 37,2% males.

Table 4.5 considers this sample - taking prescribed medication in the last two weeks - analysing a bi-dimensional comparison according to the type of consumed drugs and to the gender type of the population under study.

Table 4.5: Consumption of anti-depressant drugs for the population with and without diagnosed depression.

Anti-Depressant Drugs for	Population with Depression			Population without Depression		
	Total	Female	Male	Total	Female	Male
Sleeping	%	44,53%	45,73%	39,59%	12,14%	14,50%
	#	(1120)	(926)	(194)	(2290)	(1643)
Depression	%	66,76%	66,96%	65,92%	1,28%	1,62%
	#	(1679)	(1356)	(323)	(241)	(184)
Anxiety	%	40,99%	45,83%	45,92%	5,90%	10,35%
	#	(1153)	(928)	(225)	(1660)	(1161)
Sample Dimension	#	(2818)	(2025)	(490)	(38373)	(11332)
						(7526)

Analysis from the table 4.5 indicates that:

- An average of 67% of the depressed population is being treated with pills for depression, which means that 33% of them are not being treated with this medication. These results might be partly explained by those individuals having psychotherapy or other types of treatment, or otherwise might not be monitored by a specialist; or even they might be in a stable condition and therefore not needing treatment.
- 45% of the depressed group is being treated with pills for sleeping disturbances, and 41% for anxiety disturbances.
- Either on depressed or on non-depressed groups, the proportion of females taking prescribed sleeping pills is higher than for males.
- In the non-depressed population, the proportion of females consuming pills for anxiety is higher than on male group. About 12% of individuals in the non-depressed group use pills for sleeping disturbances and 6% consume pills for anxiety disturbances.

The groups taking prescribed pills for sleeping and anxiety disturbances involve a larger number of individuals in the non-depressed population than on the depressed population. Given that sleeping disorders is a severe symptom of depressive disorders and anxiety is simultaneously detected with depression. This phenomenon may show that there is a large group in the Portuguese population showing signs of potentially developing poor mental health disorders.

4.2.2 Main Results of the Descriptive Studies on the Prevalence of Depression

To sum up, the prevalence rate of depression found on the Portuguese population was 6,8%, although evidence points in that this value is underestimated. The risk of the female group is triple the risk for the male group (prevalence rate of 10,46% vs. 2,97%).

On one hand, the main vulnerable groups with depression diagnosed correspond to individuals with the following features: age between 36 and 80 years old (in which the higher prevalence is for the age group between 50 and 65), married, widow and divorced (the higher prevalence of depression is for divorced status), with none or elementary schooling, with low income (high income presents the higher prevalence within this class), living alone or with someone, retired, unemployed, obese, and also in individuals suffering of hypertension, diabetes, asthma or constant pain, and that live in the Centre, Lisbon and Tagus Valley, Alentejo or North NUTs II regions.

On the other hand, some unexpected findings were encountered. For male, the high prevalence was

detected in individuals with media high income and with graduate and postgraduate studies. We believe that these last groups might indicate which groups of the depressed population have easier access to mental health services, doctors and specialists, and might feel fewer stigma in accepting that they are depressed given their high educational level.

According to the frequency of symptoms, in depressed population, we detect that between 28% and 39% of individuals show severe symptoms of depression, 41% to 44% present medium symptoms and 20% to 32% show low symptoms of depression. But still there is a 5% to 15% of the non-depressed population with severe symptoms of depression.

Concerning the consumption of anti-depressant drugs we obtained the main following result. The size of the population taking prescribed sleeping pills and tranquilizers is larger in the non-depressed group than in the depressed group.

Given that sleeping disorders is a severe symptom of depressive disorders and anxiety is simultaneously detected with depression. We believe that the levels of poor mental health are higher than our prevalence rate of depression, which lead us to the finding that the levels of underdiagnosed depression are potentially high.

In the study of depressed symptoms, comparing both groups, we also verified that the number of individuals with a higher frequency level of depressed symptoms is higher in the non-depressed group than in the depressed group.

This finding also leads us to believe that there is a large group in the Portuguese population suffering from poor mental health and that might be underdiagnosed.

4.3 A Bayesian Network to Help the Diagnose Depression and Plan Mental Health Services

As explained earlier, a Bayesian Network might be used as a tool to measure the risk of depression and to plan services for different groups of individuals. Figure 4.1 presents an example of a Bayesian Network. We consider five variables that are expected to influence the prevalence of depression. We used the Netica 408 software application. The proposed Bayesian Network uses the descriptive information on prevalence rates described in the previous section and some more.

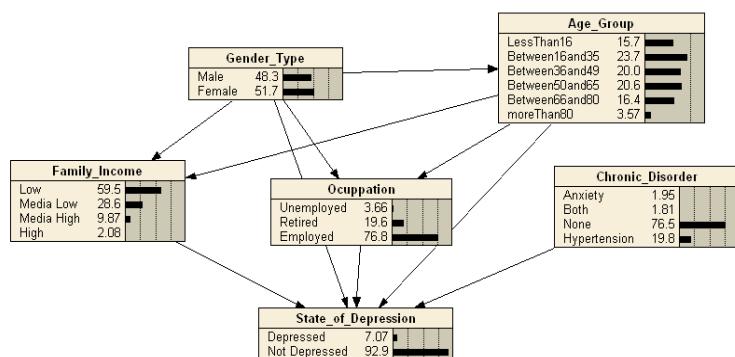


Figure 4.1 Bayesian Network for Depression

The variables and respective probabilities presented in figure 4.1 are dealt as independent. Figure 4.1 should be interpreted as follows: when a new Portuguese individual goes to the doctor's office, he/she has a probability of 6.86% of being depressed, a probability of 59.5% of having low income, a

probability 3,68% of being unemployed, 21,6% of having hypertension and a probability of 20% of presenting an age within 36 and 49 years old. Each node describes each group of our Portuguese database and the ending node represents the probability of having or not having depression. In the end, we seek to analyse the dependence of this dummy variable on the remaining and preceding categorical variables (the end node does not provide the same prevalence rate for the Portuguese population, as previously stated -6,8%-), because information used to build this network only included a subsample of 41167 individuals).

Afterwards, to exemplify the functioning and application of this Bayesian network, we present two examples. First example is about a patient showing the following characteristics: a male, with 52 years old, employed²³, and showing high level of income, suffering of anxiety. Figure 4.2 displays this network and determines, according to the patient characteristics, the dependent probability of depression.

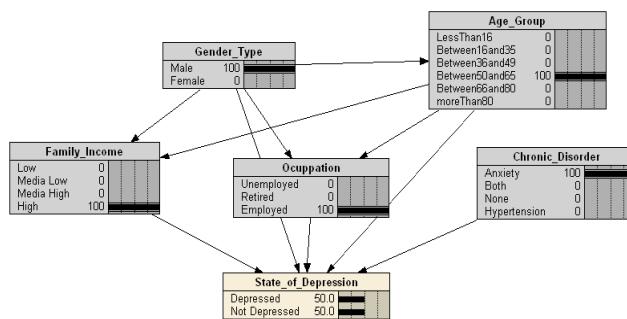


Figure 4.2 Information provided by a Bayesian Network for a male with 52 years, employed, suffering from anxiety, and presenting a high level of income.

As result, this patient has an expected probability of being depressed of 50,0%.

A second example is provided for a female, with 30 years old, employed, suffering of hypertension and presenting low level of income. From figure 4.3, we see the Bayesian network that describes this female patient with expected probability of being depressed of 28,6%.

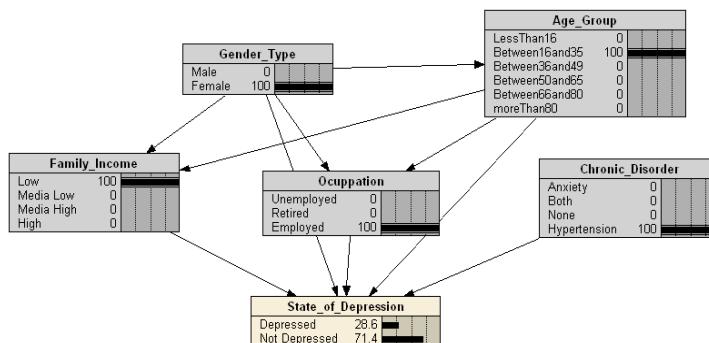


Figure 4.3 Information provided by a Bayesian Network for a female with 30 years, employed, suffering of hypertension and presenting a low level of income.

In order to evaluate the capacity of this tool to provide reliable information (i.e the capacity of the

²³ The employed category includes employed people and students

model to predict cases of depression), we have used the confusion matrix (also called matching matrix) (Hamilton, 2009). To build this matrix, we test it in a random sample with 5% of the total population. In addition, we calculated the results for the Bayesian network using the total population without the individuals included in this 5% random sample (to check the stability of results).

The confusion matrix provides the following indicators for model evaluation: prevalence rate, sensibility, specificity, positive and negative predictive values. To perform this assessment, we should consider the capacity of the model to predict cases of depression from the probabilities of depression above 50%. Table 4.6 provides indications about the Bayesian network quality to predict depression.

Table 4.6 Results of confusion matrix

Indicators	Results
Prevalence rate	6,9%
Sensitivity	20,4%
Specificity	94,4%
Positive Predictive Value	47,5%
Negative Predictive Value	98,3%
Number of Observations	1995

From table 4.6, we verify that the Bayesian network indicates that the positive identified cases have 50% probability of correctly identify depression. Moreover, the sensitivity value shows that the proportion of individuals with the disease correctly predicted is around 20% (when depression is classified for probabilities higher than 50%). This indicator estimates the power of the model to predict depression in the sample. Besides this indicator, there is also another indicator of the model performance, which is the ratio between the positive predictive value and the prevalence rate of the population from where this sample was extracted. It will tell us in what proportion our model is better in predicting depression with regard to the risk of the population having depression, which is 7 ($=47,5/6,8$). Also observing the negative predictive and specificity values, we confirm that the Bayesian network is good in excluding the non-depression cases. As a result, we verify that the Bayesian network is a good tool to predict depression, and its capacity to predict depression besides varies according to the selected conditional variables, also depends on the quality of the database used.

Given that we believe missing relevant information is missing in this Bayesian network, such as variables providing information of the level of schooling, consumption of sleeping pills and description of self perception of feelings, we would expect that a more complex Bayesian network would perform with a higher capacity to predict depression.

To sum up, results indicate that this tool might provide adequate information to help a positive or negative diagnosis of depression. In one hand, the Bayesian Network could be useful to add in medical practice in the diagnosis of depression in a detection program (after being validated). In the other hand, it could support the planning of mental health services, since it helps to predict the risk of groups that require special needs. Policy planners could use the information produced as guidance to focuses mental health strengths and resources on those groups of individuals.

Unfortunately the dimension of our prevalent population with depression and some survey limitations

reduced the number of variables to be included in the network.

At the end, we consider that this tool is simple, and can be powerful when used together with a database with large dimension and good quality data.

4.4 Descriptive Study on the Incidence of Depression

An incidence study was performed, aiming at identifying if the incident population has different risk groups relatively to the prevalent population. We consider relevant to analyse whether there has been an evolution on the Portuguese population with depression, verifying differences in the prevalent and in the incident population. Incident individuals are the ones that have been newly depressed in last year.

First, we have identified the diagnosed depression group that has been diagnosed for the first time in the last 12 months. For that we used the following survey question to get this information: "Have you had depression problems in the last 12 months?". 3004 individuals reported to this question - case 1 in table 4.7. Other complementary questions were required, to find whether individuals had had depression problems in the past but did not have in the last 12 months, - case 2 in table 4.7, - as well as those who already had it in the past and still had it - case 3 in table 4.7. As previously referred, the depression disorder can be episodic, periodic and recurrent or chronic. Potentially, case 1 might be an episodic case, case 2 might be a recurrent depression, but in that period of time was depression is absent , and case 3 might be a recurrent and with occurring symptoms.

Table 4.7: Results of the chosen question to identify the incident population

"Did you had depression problems in the last 12 months? "	%(#)
Yes, for the first time (case 1)	6,32 (178)
No (case 2) ²⁴	26,86 (757)
Yes, and I had it already (case 3)	66,82 (1883)

The results of table 4.7 allow us to identify that the number of new cases of depression for the year of 2005/6 were 178 individuals, which corresponded to 6,23% of the total prevalent population with depression, and to 0,43% as incidence rate of depression for the Portuguese people. Table 4.8 compares the characteristics of the incident and of the remaining individuals identified with depression. Analysing the differences between the two populations, we expect to report different characteristics in the new depressed population. When a percentage is higher in the incident population than on the prevalent population, it suggests that there might be changes in the patterns of depression.

And the results of table 4.8 suggest, that the following groups have an increased risk of depression in the incident population in comparison to the prevalent: males; single, divorced and legal separated groups; unemployed, those with secondary or equivalent studies and having bachelor, graduate and post-graduate degrees; high income; with ages between 16-35 and 36-49 years old (which correspond to a younger and active population); on families of 3 to 4 persons and with 5 or more persons; individuals with asthma as a chronic physical conditions and living in the Algarve, Madeira and Centre

²⁴ Had it the past, but now is absent of symptoms.

regions.

Table 4.8: Characteristics of the Incident and Prevalent population with depression.

	Incident Population with Depression (Case 1)	Periodic or Recurrent Depressed Population (Case 2 and 3)
Gender	77,5% Female	79,2% Female
Marital Status	59,6% Married 20,8% Single 10,7% Widow 7,3% Divorced 1,7 % Separated	65,9% Married 13,8% Single 12,3% Widow 6,9% Divorced 1,2% Separated
Family Income	60,1% live with [0; 500[Euros 27,5% with [500;1000[Euros 8,4% [1000; 1500[Euros 3,9% [1500; 2000[Euros	60,6% Live with [0; 500[Euros 27,2 % [500; 1000[Euros 9,3% [1000; 1500[Euros 2,9% [1500; 2000[Euros
Unemployment	7,9% Unemployed;	6,1% Unemployed
Level of Scholarship	62,9% None or elementary schooling 12,9% Basic schooling 16,3% High school or Equivalent and Bachelor 7,8 % Graduate and post-graduate	71,0% None or elementary schooling 12,1% Basic schooling 11,6% High school or Equivalent and Bachelor 5,4% Graduate and post-graduate
Obesity	47,8% Obese;	58,1% Obese
Reform	12,9% Retired;	26,6% Retired
Age (years)	32,6% 16-35 30,9% 36-49 23,6% 50-65 11,2% 66-80 0,56% more than 80	12,9% 16-35 26,7% 35-49 38,0% 50-65 19,9% 66-80 1,93% more than 80
Family Dimension	55,6% Live with 3 or 4 persons 20,8 % Live with a companion 15,2 % Live with 5 or more persons 8,4 % Live alone	45,1 % Live with 3 or 4 persons 34,5% Live with a companion 8,3 % Live with 5 or more persons 12,1% Live alone
Physical Chronic Conditions	31,5% Hypertension 14,0% Anxiety 6,2% Obesity 8,4% Diabetes 6,7% Bronchitis 9,0% Asthma 2,3% AVC 1,7% Myocardial infarction	39,8% Hypertension 29,2% Anxiety 8,6% Obesity 12,2% Diabetes 6,7% Bronchitis 8,1% Asthma 3,0% AVC 2,3% Myocardial infarction
NUTs II Regions	11,8% North 21,9% Centre 11,8% Lisbon and Tagus Valley 6,7% Alentejo 18,0% Algarve 9,6% Azores 20,2% Madeira	17,5% North 20,6% Centre 18,6% Lisbon and Tagus Valley 14,9% Alentejo 10,9% Algarve 10,3% Azores 7,3% Madeira

On the other hand, we observe that the following groups have a decreased risk of having depression in the incident population: the married and widowed groups; individuals with none, elementary and compulsory studies; obese group; retired; media-high family income; people within ages of 50 and 65 and 66 and 80 and more than 80 years; those living alone and with a companion.

Some of the reported risk groups were not expected. They show a slight increase of males with depression in the incident population. This finding can be a consequence of an increase of available

information, - such as in internet - which might result in a reduction of stigma among males towards recognising mental health problems; or health services might be more aware and are diagnosing better depression.

They also show an increased risk for legal separated and divorced groups. As explained in previous chapter, these are vulnerable groups of mental health disorders. They are often associated to situations of family conflicts, life transitions periods, or even be a consequence of mental health problems. The single status group is another unexpected vulnerable group, as well as high income groups and people with high level of studies are unlikely risk groups. As explained in chapter 2 and 3, mental health problems are often correlated to poverty and to the consequences of it. On the contrary, high-level studies are often strongly related with high income, and both to new and better opportunities and conditions of living (Knapp *et al.*, 2007). Besides that, we also found as vulnerable groups, the age group within 16 and 35 years and individuals fitted in families with more than three people. Hence the incidence of depression presents vulnerabilities on the younger set of the population, and is likely to appear in constituted families.

Consequently, we may infer that the depressed population in Portugal is changing and is affecting new branches of the population. These findings need special attention by policy makers, mainly the young group and individuals with high levels of qualification. These individuals should be active and productive resources for the society.

4.4.1 Main Results on the Descriptive Studies on the Incidence of Depression

The Portuguese depressed population is changing its characteristics. Depression is affecting new groups. Those groups are represented by the following features: male; single, divorced and legal separated groups and unemployed; individuals with secondary or equivalent studies, bachelor degree, graduate and post-graduate degrees and high income; age within 16 and 49 years old (corresponding to young active groups); individuals fitted in residences with 3 or more persons; individuals with asthma and living in Algarve, Madeira and Centre NUTs II regions.

Until here, we have provided descriptive summaries between explanatory variables and variables in study representing the individuals of the Portuguese population with diagnosed depression. Through regression analysis, we aim at providing statistical significant relationships between these variables and verify if the production functions of mental health state of an individual defined in this chapter whether or not might explain the prevalence and the incidence of depression in Portugal.

The next two sections contain the results from the regressions. Both sections attempt to explain the results obtained on the descriptive studies on prevalent and incident populations. The following subsection presents logistic regressions studies.

4.5 Explaining the Prevalence of Depression

In this subsection we present the results of using multi-dimensional statistical analysis: we have used logistic regressions, trying to statistically explain which factors contribute for depression. With it, we have tested how each explanatory variable contributes for the probability of occurrence of the depression disorder. We also examined whether the models could effectively estimate production

functions of the depression disorder in our prevalent population, being this represented by the diagnosed depression variable, the dependent variable used on estimations. This models were described in chapter 3: model One involves the variables developed using the questions of table 3.2, and model Two uses extended variables capturing crossed-information of some predictors.

In these estimations, we expect to detect the explanatory variables of depression and also to evaluate their positive or negative influence. To complement our prevalence study, we have also carried out separately analysis for female and male populations. The tables present significant explanatory variables with the following statistical levels of significance, 1%, 5% and 10%.

The software used for models evaluation was Stata version 9 in a Macintosh computer, with Mac OS X10.4.11 operating system and a processor of 2GHz and 1Gb of memory.

4.5.1 Logistic Regression

In this subsection, we applied logistic regression techniques to estimate production functions of mental health presented in figures 3.13 and 3.14, using models One and Two. Table 4.9 contains results of coefficients of statistically significant variables of the logistic regression. The coefficients should be interpreted as for each unit increase of the variable, the log odds of being diagnosed depressed (vs. not being diagnosed depressed) increases according to the coefficient value, or decreases if this coefficient is negative.

Moreover, analysing table 4.9, we perceive that the two models show robustness in results, due to: several significant variables of model One are confirmed by model Two; model Two contains new statistical significant variables – not significant or not included in model One. Hence improves the number of significant explanatory variables and allows the identification of additional explanatory factors that might explain depression in the Portuguese population. So, model Two complements and adds relevant information to the results of model One.

The following key findings describe the explanatory variables with positive statistical significant impact on the probability of being depressed:

Model Two indicates: retirement, unemployment, smoking, high income, female gender, divorced, hypertension, chronic pain, anxiety, presenteeism, Lisbon and Tagus Valley and Centre NUTs II regions, married female;

Model One adds: graduate and post-graduate, obesity, bronchitis, Azores region.

Examining the female prevalent population with depression, we established that the explanatory variables having a positive statistical influence on depression are:

Model Two indicates: hypertension, smoking, chronic pain, Anxiety, obesity, presenteeism, retired females;

Model One adds: retirement, divorced, bronchitis.

Exploring the male prevalent population with depression we concluded that the explanatory variables having a positive statistical influence on depression are:

Model Two indicates: unemployment, divorced, graduate and post-graduate, hypertension, chronic pain, Anxiety, diabetes, presenteeism, retired male.

Model One adds: retirement, high income and bronchitis

Table 4.9: Main results of the Logistic regression in the study of Prevalence of depression using models One and Two for the several populations under study and with levels of significance of 1%, 5 % and 10%.

Logistic Method			Model ONE			Model TWO		
Significant Variables			Population			Population		
Type	Name	Reference level	General	Female	Male	General	Female	Male
Continue	Age		0,1451*	0,1501*	0,1313*	0,1494*	0,1581*	0,1271*
	Squared Age		-0,0016*	-0,0016*	-0,0013*	-0,0016*	-0,0017*	-0,0014*
	Hours of Work per Week					-0,0055**		-0,0145**
	Family Size		-0,1042*	-0,1141*	-0,0803***	-0,1274*	-0,1335*	
Dummy	Retired		0,3415*	0,2926**	0,4575*	0,7753*		
	Unemployed		0,3360*		0,7624*	0,8133*		0,8237*
	Smoking		0,1352***	0,2376**		0,1765***	0,2554**	
	Female gender		1,2145*			1,1325*		
	Single	Divorced	-0,3951*	-0,5678*				
	Married	Divorced	-0,4172*	-0,4427*		-0,5564***		-0,5420***
	Separated	Divorced						-0,7812***
	Widow	Divorced	-0,4218*	-0,3728**				
	None or Elementary Schooling	Compulsory Schooling	-0,2084**		-0,0291**			
	Graduate and Post-graduate Degrees	Compulsory Schooling	0,5061*	-0,5441*			-0,5974*	0,7547**
	High Income	Media High Income	0,3429***		0,7045**	0,7471**		
	North	Centre	-.5061*	-0,5431*		-0,3941*	-0,5101*	
	Lisbon and Tagus Valley	Centre	-0,3956*	-0,5157*		-0,4439*	-0,5074*	
	Alentejo	Centre	-0,4100*	-0,4740*		-0,3179*	-0,3269**	
	Algarve	Centre	-0,6522*	-0,7372*	-0,4460**	-0,6550*	-0,6971*	-0,5059**
	Azores	Centre	-0,6820*	-0,7871*	-0,4034***	-0,6942*	-0,7059*	-0,6453**
	Madeira	Centre	-0,5142*	-0,5123*	-0,5241**	-0,4195*	-0,3861*	-0,5132***
	Hypertension		0,2513*	0,2161*	0,3105**	0,3115*	0,3155*	0,3938**
	Chronic Pain		0,3965*	0,4022*	0,3694*	0,4919*	0,5102*	0,5096*
	Chronic Anxiety		2,4857*	2,2828*	2,9693*	3,211*	2,2451*	3,2048*
	Chronic Obesity		0,2597**	0,3118**			0,3694**	
	Asthma							
	Chronic Bronchitis		0,4565*	0,3158**	0,7235*			0,4408***
	Diabetes							
	Presentism		0,5020*	0,4432*	0,6718*	0,5083*	0,4359*	0,7403*
Crossed Dummy	Separated Female					0,5341*		
	Married Female					-0,7240*		
	Married Male					-0,4837**	0,3222**	
	Unemployed Female							0,6919*
	Retired Female							
	Retired Male							
	Anxiety Female					-0,9755*		

Levels of significance of 1%(*), 5%() and 10%(***)**.

To sum up, these explanatory variables contribute to a higher prevalence of depression across individuals in the Portuguese population.

Furthermore, analysis of results of table 4.9 shows the following findings.

Presenteeism is an explanatory variable with a positive statistical significant impact on depression, verified in all types of population studied. We remind that this variable tries to represent individuals that go to work despite feeling sick or not well;

Concerning to the impact of age in explaining depression. The age variable with a positive statistically significant influence on depression and squared-age variable with a negative statistical significant influence on depression show that the influence of age in depression disorder behaves as an inverted parabola, describing higher risk of depression in middle-age individuals, and lower risk on below and

above ages.

The variable hours of work per week reveals a negative statistically significant influence in the probability of depression, and this confirms what we expected, the hours of work diminish with depression in all types of population analysed in this study of prevalence;

Family size has a negative statistical significant influence in all the populations. Therefore, we conclude that the larger is the family, the smaller is the probability of having depression in the prevalent population;

Chronic anxiety presents a higher (expected) coefficient. Individuals suffering from this condition show a higher risk of depression (as verified in results reported in the previous section).

Comparing results between gender groups, we can observe that for the female group the graduate and postgraduate studies and high income show a protective effect on depression, while for the male group contributes for depression.

Generally most of the detected risk factors were as expected – see table 4.11 – and in accordance with hypothesis of list 3.3, literature described in chapter 2 and with our explanatory model of mental health state displayed in figure 3.11. Few of the risk factors found were non-expected as causes of depression, although were consistent with the descriptive analysis previously performed. These results were regarding graduate and post-graduate studies and high income in the male group.

Table 4.10: Main results of the diagnostic tests carried out Logistic regression in the study of Prevalence of depression.

Models	Tests	Overall Population	Female Population	Male Population
One	Sensitivity ²⁵	17.99%	17.60%	8.41%
	Specificity ²⁶	99.22%	98.47%	99.73%
	Positive predictive value ²⁷	63.10%	63.30%	50.68%
	Negative predictive value	94.22%	63.30%	97.07%
	Pseudo R ²	0,19	0,13	0,16
	Homer and Lemeshow Test	0,97	0,98	0,82
	Specification Test	0,86	0,90	0,81
	Total of observations	25169	11355	13814
Two	Prevalence Rate	0,07	0,11	0,03
	Sensitivity	17.28%	18.40%	13.27%
	Specificity	99.29%	98.74%	99.67%
	Positive predictive value	63.12%	63.89%	55.71%
	Negative predictive value	94.48%	90.88%	97.34%
	Pseudo R ² ⁽²⁸⁾	0,20	0,15	0,19
	Homer and Lemeshow Test ²⁹	0,99	0,40	0,99
	Specification Test ³⁰	1,14	0,94	0,85
	Total of observations	17844	8080	9686
	Prevalence Rate	0,07	0,11	0,03

²⁵ Sensitivity is the measure of the percentage of individuals with the disease who were positively detected with the disease by the model.

²⁶ Specificity is the measure of the percentage of people without the disease who have not been identified by the model.

²⁷ Positive predictive value reflects the proportion of individuals correctly identified with the disease with regard to those correctly identified by the model.

²⁸ The pseudo R² indicator is a coefficient used to measure the improvement in the fit of the model that is due to independent variables. Therefore this coefficient shows us which of the two models is better in explaining the prevalence of depression in each type of population.

²⁹ Goodness-of-fit tests which provides indicators of model appropriateness

³⁰ Specification test verifies if the model is properly specified, one should not be able to find any additional predictors that are statistically significant except by chance.

4.5.1.1 Other Results

Table 4.10 shows the main results of the diagnostic tests carried out on both models. Results indicate (the confusion matrix used to achieve the first four indicators classifies depression for probabilities higher than 50%):

- Good values of specification;
- Good values of goodness of fit (except in one case);
- High values of specificity;
- Low values of sensitivity;
- Positive predictive value higher than 50%;
- Negative predictive value higher than 88%;

Comparing both models, pseudo-R² indicates that model Two presents a reduced increase in the level of explanation. Where female group has the lower level of explanation.

Since the positive predictive value evaluates whether or not the individuals positively identify with disease are effectively depressed. Their values show that models are able to identify correctly depression in 60% of cases identify with the disease. Besides this, for all the populations analysed they suggest that our models are good at explaining depression. Nevertheless, the pseudo-R² results show that relevant explanatory factors are still missing.

Table 4.11 displays the explanatory factors with positive statistical significant impact on the probability of depression, according to the type of prevalent population studied, and an "Yes" is an identification of a risk factor.

Table 4.11: Explanatory factors contributing to the Prevalence of depression in Portugal

Explanatory Factors	Logistic Regression		
	Total	Female	Male
Retirement	Yes	Yes	Yes
Unemployment	Yes		Yes
Smoking	Yes	Yes	
Divorced	Yes	Yes	Yes
High Income	Yes		Yes
Female gender	Yes		
Centre region NUT II region	Yes		
Hypertension	Yes	Yes	Yes
Pain	Yes	Yes	Yes
Anxiety	Yes	Yes	Yes
Obesity		Yes	
Bronchitis		Yes	Yes
Diabetes			Yes
Presenteeism	Yes	Yes	Yes
Graduate and Post-graduate Studies	Yes		Yes
Married Female	Yes		
Retired female		Yes	
Retired Male			Yes

4.6 Explaining the Incidence of Depression

In this section we present the results carried out using multi-dimensional analyses in the study of the incident population with depression. We have also used Logistic regressions, trying to explain statistically which factors contribute for the incidence of depression. We aim at testing how explanatory variables might statistically explain variations in the probability of occurrence of a depression disorder in the incident population. We have also examined whether the models could effectively estimate production functions of depression disorder of the incident population, represented by the variable new depressed, - see table 3.2 - as the dependent variable used on estimations. The models assessed here are also those evaluated in section 4.3.

In these estimations we expect to detect the explanatory variables of depression and also to evaluate their positive or negative influence, as well as quantitatively compare the explanatory factors. The next tables of results display significant explanatory variables with the following statistical levels of significance, 1%, 5% and 10%.

4.6.1 Logistic Regression

Observing data of table 4.12, we also conclude that model Two is better than model One. Model Two presents more significant explanatory variables, and higher levels of explanation - showing a higher pseudo R² value.

On the other hand, from table 4.12, we may say that both models present robust results, since part of the predictors are common and reveal similar level of significance, and approximate coefficients.

Table 4.12: Main results of Logistic Regression in study of Incidence of depression using the model One and Two an regarding 1%, 5 % or 10% as level of significance.

Logistic Regression			Model One	Model Two
Significant Variables			Population	
Type	Name	Reference level	Incident	
Continue	Age Squared Age		-0,0945**	-0,0991**
Dummy	Single	Divorced		14,5948*
	Widow	Divorced		17,0890*
	Secondary or equivalent Schooling and Bachelor Degree	Compulsory Schooling		
	North NUTs II region	Centre NUTs II region	-0,7582**	0,8449**
	Alentejo NUTs II region	Centre NUTs II region	-0,9719 **	-0,9288**
	Madeira NUTs II region	Centre NUTs II region	0,8980***	0,8620**
	Chronic Pain		-0,4897***	-0,7307**
	Chronic Bronchitis		0,8095***	
	Chronic Anxiety		-0,5854***	
Crossed Dummy	Married Female			14,4545*
	Married Male			15,7424*
	Divorced Female			14,8136*
	Divorced Male			15,5119*
	Separated Female			14,7987*
	Females with None or Elementary Schooling			1,612547**
	Females Living with someone			16,3904*
	Males Living with someone			18,4406*

Levels of significance of 1%(*), 5%() and 10%(***).**

According to model Two results - table 4.12 -, the explanatory variables having a positive statistical influence on depression are: single and widow status, North and Madeira regions, married female, married male, divorced male, divorced female, legal separated females, females with none, elementary studies, females living with someone and males living with someone.

The explanatory variables with negative statistical significant contribution on the probability of depression are: age, Alentejo NUTS II regions and chronic Pain.

Interpreting Alentejo NUTs region result as having a protective impact on diagnosed depression might have two possible explanations: the result might be in agreement with intrinsic protective characteristics of this region; or it might indicate reduced rates of diagnosed depression.

Concerning age, results indicate the higher is the age of individuals, the lower is the probability of having depression. Therefore it indicates the young set of Portuguese people as being the most at risk.

Finally, results show several marital status categories as risk factors for the incidence of depression. Therefore, we may say that this result does not lead us to any conclusions about the influence of the several marital status on state of depression in this population. Extra factors not included in the models might explain depression among these population subgroups.

Analysing table 4.13, we verify that specificity values are similar for both models. Goodness of fit test and positive predictive values show worst values for model One.

Table 4.13 Main results of the diagnostic tests carried out Logistic regression in the study of Incidence of depression.

Models	Tests	Incident
One	Sensitivity	0,98 %
	Specificity	99,94%
	Positive predictive value	50,00%
	Negative predictive value	94,57%
	Pseudo R ²	0,1227
	Homer and Lemeshow Test	0,12
	Specification Test	0,97;
	Total of observations	1863
Two	Sensitivity	4,9%
	Specificity	99,88%
	Positive predictive value	71,43%
	Negative predictive value	94,50%
	Pseudo R ²	0,1651
	Homer and Lemeshow Test	0,53
	Specification Test	0,96
	Total of observations	1772

Comparing model Two with model One, we verify that for model Two adds more information on explaining the incidence of depression (besides low); model Two also better predicts the correct cases of incidence of depression (about 11% better than model One), which might indicate that model Two is better at explaining the incidence of depression.

Nevertheless, given the low level of explanation achieved – we have low Pseudo R² coefficients for both models –, we can indicate that both models ignore explanatory variables relevant to the study of the incidence of depression. Also sensitivity values point out that the models potency to explain the incidence of depression in the Portuguese population is reduced. Comparing these results with those encountered for prevalence, we verify that what explains the incidence and the prevalence differs. As

a result, we might say that our model is better on explaining the prevalence than the incidence of depression.

In the last two sections - 4.3 and 4.4 – we verified model One and Two as presenting missing relevant variables to explain depression either on prevalence or on incidence. As a confirmation, the regressions analysis present lower pseudo- R^2 coefficients, as well as a reduced number of significant explanatory variables. Moreover, the goodness of fit test and sensitivity values indicate that both models are better explanations of the prevalence than of the incidence of depression.

The next chapter discusses the main findings and methods used throughout this work.

5 Discussion

In this chapter, we discuss the foremost results and the methods used, as well as we summarise information to answer to the research questions defined in chapter 3.

5.1 Discussion of results

5.1.1 Discussion of descriptive results

Concerning the burden of depression in Portugal, we found the following prevalence rates for the diagnosed depression: 6,84% for the overall population, 10,46% for the female group and 2,97% for the male group. These figures show that females are more vulnerable to depression than males. This finding on females is in conformity with several references stated in chapters 2 and 3, including results presented by the Eurobarometer study of 2003 (The European Opinion Research Group 2003). Given that this later study indicates for Portugal a prevalence rate for positive cases of depression of 29,8%, we suspect that our results underestimate the prevalence rate for depression. Also, according to reference (Mateos *et al.*, 2001), the prevalence for depressive disorders in the overall population of five European countries is 8,56%, with a rate of 10,05% for female and 6,61% for male. Our figures are much in agreement with the order of magnitude of the figures indicated in this study, although there is a gap for males. The lower prevalence for males might be due to stigma in accepting that they are depressed. We should although remark that our rates were computed for diagnosed depression, and that the definition of depression being captured in different studies is different.

For Portugal, the largest comparative prevalence rates of depression were found for the following population groups (operating as a risk factors): female, unemployed, divorced, retired, with high and low income, obese, with middle age, living in the Centre and in the Lisbon and Tagus Valley NUTs II regions, and living alone or with someone. Population with two chronic health conditions –anxiety and obesity- show a very high risk of depression, with the following prevalence rates: 51% and 20% respectively. These two values show that: 50% of individuals that suffer from anxiety also suffer from depression; 20% of individuals that suffer from obesity also suffer from depression. Several of the hypotheses displayed in table 3.4 were verified by the detection of some of groups.

However, not all of these groups were considered as vulnerable groups of depression, since some have shown to have a small size. Table 4.2 displays the vulnerable groups considered for overall, male and female populations.

On the burden of depression, further conclusions were found out.

Analyses of prevalence rates were carried out separately by gender group, different prevalent groups were identified. Population with none or an elementary level of schooling represents the key female risk group. Graduate and postgraduate degree and media high income groups represent key risk groups for males. Other results also show differences between gender types: males present a higher risk of depression than females in several population groups, for instance being divorced, retired, unemployed, and when suffering from anxiety are key risk factors for males, a higher risk of depression for females rather for males is being obese (see table 8.4 in annexes).

Examining the previous findings, we may say that some of these results were expected. Nevertheless, we found some evidence of higher prevalence rates for some unexpected groups. Despite the

population group with high income does not present a considerable size, it was detected as a group with higher prevalence in the three populations analysed. Besides that, in the male population, the media high income group was also identified as being a high risk group. We believe that both cases might be partly explained by being people who possess economic resources and access mental health services, thus having a higher probability of being diagnosed. This finding contradicts what is expected in mental health. Also, males with graduate and postgraduate degrees were found out as having a higher rate of prevalence, which may indicate that this group is more vulnerable or may be more aware about what is depression and the advantages of its treatments (in comparison to the remaining male groups). These reasons may explain a reduction on the impact of stigma. Stigma was also stated in chapter 2 as being affecting more males. Moreover, high levels of education are often related with high levels of income, therefore it might also indicate that individuals with higher economic background are seeking and better accessing mental health support. At last, these two aspects may constitute risks that have not been evaluated in this work.

Concerning the results obtained in the analysis of depressed symptoms and consumption of anti-depressant drugs, we have characterised the population with and without diagnosed depression. We have verified that a high number of individuals suffering from depressed symptoms and consuming sleeping pills and tranquilizers were not identified as being diagnosed with depression. As these are typical symptoms and behaviours of common mental disorders, (mainly insomnia is a severe symptom of depressive disorder) these findings may show that these individuals suffer from poor mental health. Consequently we may infer a higher burden of poor mental health in the Portuguese population. Moreover, these findings might also contribute for our conclusion that prevalence and incidence results are likely to be underestimated. The factors that might contribute for this conclusion might be stigma and low recognition of mental health disorders. Stigma is related with culture and with attitudes in the provision of mental health services and may induce people not to seek medical help. The second factor might be associated with people that fulfil the criteria for a psychiatric disorder, but might not experience the level of disability required to seek medical assistance from mental health services (e.g., not being detected in consultations in general primary care sector). Finally, this conclusion also contributes for the finding of our results being underestimated.

With regard to the population being diagnosed with depression in the last year, that population was identified as being 6,23% of the total prevalent population with depression, which is 0,43% of the overall Portuguese population. While characterising this population and comparing it with the group of individuals that have had depression for a longer period, we detected that the new population groups which have an increased risk of depression are (in comparison to the prevalent population diagnosed with depression): male; single; divorced and legal separated status; unemployed; and with age between 16 and 49 years old. And an increased risk of depression was also verified among individuals with secondary or equivalent studies, bachelor degree, graduate and postgraduate degrees, owning high income, living in families/residences with more than 3 persons, suffering of asthma, and living in the Algarve and Centre NUTs II regions. According to these findings, we might indicate as likely causes for an increased risk of newly diagnosed depression, family stress factors, the fact that males might be possibly overcoming stigma and seeking for medical care support, or healthcare providers

might have increased their awareness on detecting depression. For the fact that the risk of depression has increased among the youngest age groups, it is in agreement with studies of the WHO described in chapter 2. It is important to take into account that this group should be the most productive group of the population, therefore is essential to develop health policies in order to prevent these cases of depression.

5.1.2 Discussion of econometric results

In the second part of this study, econometric analyses were performed. These analyses aimed at accomplishing statistically significant relationships between the explanatory factors and the prevalence and the incidence of diagnosed depression.

The results achieved for prevalence indicate that the explanatory factors presenting a positive statistical significant impact are: retirement; unemployment; smoking; divorced; high income; female gender; graduate and post graduate degrees; living in the Centre NUTs II regions; having hypertension, chronic pain, anxiety, obesity and bronchitis; presenteeism (situation where the employee goes to work, despite being ill or unable to work, instead of taking a leave); married female and age. The explanatory factors with negative statistically significant impact are: squared age, hours of work per week and family size.

From these findings, it might be interpreted that the following risk factors apply: middle-aged people, working less hours - likely to be associated with loss of productivity. The positive impact of high-income is a robust result from the application of econometric techniques and descriptive analysis. According to references stated in chapter 2 and 3, poverty, is a determinant of mental health. Therefore that risk factor was not expected. However it may partly reflect the fact that individuals with high income might have better access to mental health service than people with a lower income, and thus being diagnosed with a higher probability.

The marital status has been shown that divorced individuals are the ones at an higher impact on the prevalent diagnosed population, which shows how family circumstances might impact on mental health. Concerning the area of residence, the most robust result was the higher risk of depression for individuals living in the Centre region. According to data presented by Comissão Nacional de Reestruturação de Serviços de Saúde Mental (Comissão Nacional para a Restruturação dos Serviços de Saúde Mental, 2007), the rate of psychiatric doctors per 25000 habitants is higher in the Centre region and in the Lisbon and Tagus Valley regions, in comparison to the remaining regions. Also as stated in chapter 2, the number of specialised mental health doctors in the region might help to explain the higher rates of individuals identified with depression. Thus, our findings might reflect that a higher number of psychiatrists is contributing for a higher diagnosis of depression in those regions. The retirement explanatory factor might be associated with loss of health, functional and cognitive abilities, diminished social contacts resulting in loneliness and lack of social activities, which also contribute for depression. The unemployment explanatory factor might be associated with economic difficulties and might contribute for entering into the poverty cycle.

Moreover, for both gender groups, the encountered common explanatory factors contributing for depression were: retirement, divorced, hypertension, chronic pain, anxiety, bronchitis and presenteeism. Concerning to the mental health determinant age, the explanatory variables related with

it show that both genders have a higher risk of depression with middle age. An additional finding of this analysis, was allow for verifying that the divorced group has always a higher risk of depression in relation to the remaining marital groups. Most of these results were robusts with results of descriptive analysis.

Concerning the differences verified between gender groups, the female group has as explanatory factors contributing for the prevalence of depression: smoking and obesity. Those encountered not contributing for the prevalence of depression were family size, graduate and postgraduate degrees and high income. These findings show that the level of education influences the risk of depression in female group, in the manner that for high levels of education reflect a protective effect on the occurrence of depression (also the descriptive result associates female group with low income level as a vulnerable group of depression). Therefore the influence of level of education in the female Portuguese population is according with what is expect in mental health. (High levels of education tend to offer more professional and life opportunities, contributing for improvement of quality of life and well-being.) For the smoking factor we verified a positive relation with diagnosed depression, which is in agreement with what was stated in chapter 2 and 3 (smoking behaviour is characteristic of individuals with weak mental health). In the male set, the exclusive explanatory factors contributing for depression were unemployment, high income, diabetes and graduate and postgraduate degrees. In opposition, the explanatory factor regarding the number of hours of work per week diminish with the cases of diagnosed depression. This may reflect two consequences of depression; depressed individuals are less productive or may reflect the days of absenteeism (unscheduled employee absences from the workplace). This variable is not verified as significant for the female group.

Furthermore, according to references stated in chapter 3, obesity and diabetes findings, verified on female and male groups respectively, might be related with behaviours of poor mental health, such as poor habits of food intake and lack of practice of physical activity or even with eating disorder.

With regard to robust results of descriptive and econometric analysis, the male set presents robust results for the following explanatory factors: unemployment and graduate and postgraduate degrees. The female group shows robust results for the level of schooling.

Furthermore, through econometric results, we found that the explanatory factors contributing for incidence of depression are divorce, single and legal separated individuals and also are young individuals. These findings are robust with descriptive results for the incidence. Moreover, despite the following results have not been robust with descriptive analysis, the remaining explanatory factors found as contributing for the incidence of depression are; individuals living someone and females with none or elementary schooling. Once more we detected low level of education as an explanation for depression in the female group.

Concerning NUTs II regions results on the incidence of depression, we verified that Madeira shows a positive significant statistical relationship with depression, otherwise Alentejo NUTs II region shows negative significant statistical relationship with depression. However, a source has reported a very high suicide rate for that region (Diário de Notícias, March 13th, 2005). And according to a reference described in chapter 2, a possible explanation for this value can be untreated and underdiagnosed depression. We may, on the other hand, indicate as consequences for these explanations two

situations: stigma and low access to mental health services and treatments. In the end, the main finding on the incidence of depression was in fact that the young age group has increased its risk of depression. This group might include students or people starting up their professional life.

At last, most of hypothesis displayed in tables 3.4 and 3.5 were observed, although we did not test the effect of several explanatory factors (such as alcohol abuse, drug abuse disorder, pregnancy, poor food intake habits and incapacities/disabilities) due to survey limitations. Many of the hypothesis and relations displayed in our mental health explanatory model were also not assessed in our study.

5.2 Discussion of methods

Concerning methods and decisions taken throughout this study, we found several limitations and problems in the application to the Portuguese population. The 4th National Portuguese Health Survey limited the evaluation of our explanatory model in several points, such as the available issues and the dimension of recorded answers limited the quantity and the types of analysis performed. As a result, several hypothesis of our explanatory model of mental health state expected to be evaluated, could not be tested. Not all selected survey questions could be used in the econometric regressions and encapsulated in model One and Two due to variations in the number of records. Also, some questions were not carried out in the survey in a form that could be suitable to be included in our study. The survey did not allow for identifying and characterizing people with poor mental health beyond those having depression and anxiety disorders. In fact, the 4th Portuguese National Health Survey was not designed specially to answer the relevant questions for carrying out analysis on the mental health status of the Portuguese population.

Throughout this work we have used several methods, which have inherently some limitations.

With regard to the analysis of the vulnerable groups of depression in the Portuguese population, we considered that a group should have a minimal size to be considered as a risk group. This condition has the goal to show the groups with considerable dimension to be specially considered by health policy makers. That option might have either influenced the number of vulnerable groups identified and also limited which ones to be considered as vulnerable groups.

The variables developed to identify the prevalence and incidence of depression are dichotomous, which has meant limiting the information provided about the type, severity and duration of depression. At last, it lead us to exclude the results from Multivariate OLS regression. Moreover, we have only accounted for depression of individuals that have been diagnosed by a professional, which might limit our inference on the mental health state of the Portuguese population.

As key disadvantages of the selected methods, the descriptive bi-dimensional analysis does not show relations of causality, only providing simple summaries about the sample. In our case we used crosstabs, and they only express relationships between two selected variables, but in some cases it might induce to uncertain conclusions. With regard to econometric techniques, the logistic regression tests for the influence of explanatory factors on the binary response of the dependent variable. In addition, the coefficients should be interpreted as factors that contribute to higher or lower probability of being depressed, in comparison to an average individual.

The logistic regression was found to be an adequate technique to estimate the risk of being depressed. We also verified that model Two provided better information than model One with regard

to the relevant relations between predictors and dependent variables. Also, both models, One and Two, were more properly in explaining the prevalence than the incidence of depression, have been verified less quality of data studying this population. Besides that, results confirmed that relevant factors were missing in models One and Two.

Furthermore, we should consider the possibility of our regression results are affected by moderate collinearity problems since only the severe collinearity are corrected by the Stata algorithm commands. Moderate multicollinearity is fairly common, and is difficult to overcome. It emerges when predictors share redundancy information or are correlated. Since symptoms of depression and the consumption of antidepressant drugs can be seen as indicators of poor mental health. The inclusion of the consumption of antidepressant drugs in the model would bring redundant information with the independent variables, and thus would not provide additional information.

About the proposed Bayesian network tool, despite not being commonly used together with survey data, it was shown that Bayesian networks might be provide good results in predicting the cases of depression.

On the one hand, it could be used in general health services to complement the diagnosis of depression and help to predict individuals at high risk of being depressed. On the other hand, clinicians and planners of mental health policies to predict needs in the health services for specific populations could use the information produced. We have exemplified how this tool might facilitate the diagnosis of this disorder, where medical devices and other methodologies to predict risk tend to be rare. Nevertheless, the choice of variables to include in a Bayesian network depends on the number of individuals that answers to the specific questions of the survey (i.e. it depends on data) that lead to the creation of those variables. Given that, not all the individuals have answered to all relevant questions, and we found out that probabilities on the network might vary with the configuration of the network. Consequently, a different choice of variables might lead to the use of different sub-sets of the survey, and to some differences in probabilities (nevertheless, generally these do not vary too much, with the exception of cases where the number of respondents to the survey highly decreases, which implies higher variation in the probability estimates, and less precise results). Thus, the use of a Bayesian network should be informed by the quality of data used to estimate it. And further analyses could be applied for verification of its capacity to correctly predict depression.

Moreover, data from the prevalent population was preferred to data from the incident population, because of the larger size of the prevalent population under study. For this reason, we used data from the prevalent instead from the incident population (the incident population would be better since it describes the most recent evolution of depression in Portugal). There is space for develop risk prediction tools based on Bayesian nets.

Moreover, this tool is not often used but was shown to be useful for GPs diagnosing depressed individuals, and might be tested with other databases. Nevertheless, we may say that this study was a first approach for planning mental health services and policies.

5.3 Policy improvements

Concerning to the measures that might improve the mental health status of the Portuguese population, we suggest the following policy implications that follow from our findings.

For the retired, single, divorced and living alone individuals, we suggest that it should be developed social programs and activities in order to increase social cohesion, interpersonal relationships and reduce the impact of loneliness in daily-life. (Structured neighbourhoods stimulate social cohesion.)

For the younger and the retired groups, findings are likely to be related to extra difficulties in reintegration in the labour market, due to permanent or temporary disabilities or incapacities (see table 8.2 in annexes). Therefore, for these individuals it should be developed programs to promote their integration in the labour market. There are some policy measures attempting to promote this – for example, cost reductions to the employers that employ these groups - but more policies might be reinforced. For the unemployed population, it should be provided expanded access to education, in order to increase intellectual competences and job prospects. Also policies and programs should avoid that these individuals enter into the poverty cycle. Again, some policies already exist in Portugal, through unemployment allowances, the “New Opportunities” program and other professional courses. In the workplace, programs could be developed for early diagnosis of depression, in order for people to benefit from earlier treatment, and so that costs due to productivity losses and to healthcare services usage can be reduced.

With regard to chronic health conditions, such obesity, anxiety, hypertension and diabetes, these are likely to be associated with poor food intake and lack of physical activity and with mental health problems and low quality of life. Promotion of healthy behaviours, good public transport systems (weak public transport system can induce to a sedentary life to its users), and educating for stress management techniques could help to improve the mental health status of these groups.

Developing public policies to improve housing and healthy urban planning could also potentially have a direct impact in mental health, because this type of policies potentially help reducing stress and noise levels, generate perceptions of safety, increase social and community participation, and green areas promote physical activity.

Results in that estimates of prevalence and incidence rates are underestimated, and that high-income and postgraduate degrees are explanatory factors contributing to depression leads us to three questions. Whether the causes for the number of people diagnosed with depression being: economic difficulties to access to mental care support (the Portuguese population verifies difficulties in accessing mental health services); people more enlightened about mental health problems might overcome stigma and consequently seek for medical support; or due to other factors not evaluated here. Thus, stigma problems and low recognition of mental health problems should be tackled.

Some measures could be developed. First, there could be anti-stigma and education campaigns. The information provided could be spread through TV, radio and websites (like in European Alliance Against Depression website) and the following issues should be available: mental illness as a disease like any other; in what mental illnesses consist, which are their typical symptoms, signs and behaviours; how a person can help another with a mental illness; the advantages and where to seek mental health support and treatments.

Second, increasing access to mental health services - this includes access not constrained by economic background. This is particularly important, since it is a factor already stated in international literature on health inequity in Portugal (see chapter 2), and was also confirmed in this work. Also, it

might require re-allocating mental health specialists according to geographic needs, increasing the number of professionals and providing information to health professionals for better detection of depression.

At last, we suggest special attention to the younger population that has increased their risk of depression. (Early depression might lead to individuals giving up from studies earlier, present extra cost to health system, might have extra difficulties in getting a job). This set should be the most productive group of the population and present low health needs and cost. So it is essential to develop health policies in order to prevent these cases of depression, for that further studies should be performed in order to understand the causes of depression of this set.

Finally, it should be pointed out that we were expecting to have the opportunity to assess more hypotheses of our explanatory model, mainly regarding factors associated to other public sector infrastructures and support. Beyond the hypotheses displayed in our model, also temporal explanatory variables were not analysed. Therefore, a lot more can and should be done to understand the social and environmental factors influencing depression. The major weakness in evaluating this model was imposed by the characteristics of the 4th Health Portuguese National Survey. It limited the quantity of issues available and the types of analysis performed. As a result, a less complete multisystem was assessed in this work.

6 Conclusions and future research

Along with the latest research studies that attempted to understand the interconnections between the determinants of mental health disorders and behaviour, this work has studied the determinants of mental health status in the Portuguese population.

We began by collecting literature on explanatory factors/determinants of mental health for the development of an explanatory model of mental health state of an individual. The selected factors involve several subjects – vulnerable groups and risk factors of poor mental health, symptoms and signs of common mental disorders, indicators of health, education, urban/planning services and workplace.

We attempted to test our model on data from the 4th Portuguese National Health Survey, which resulted in detailed studies on the prevalence and incidence of depression. Characteristics of the survey limited our study, in terms of the type of analysis performed and of the hypothesis that could be tested in an explanatory model. Afterwards, descriptive and econometric analyses were performed on the prevalence and on the incidence of depression in the Portuguese population. Using these methods, we have found out evidence on which are the key vulnerable groups of depression and which explanatory factors contribute most for the prevalence and incidence of depression. Some of these analyses were applied for different gender types.

For the Portuguese population, using the 4th National Health Survey we estimated a prevalence rate for diagnosed depression of 6,84%, and an incidence rate for diagnosed depression of 0,42%.

The following groups were found to be at a higher risk of depression (using descriptive statistics): female, divorced, retired, unemployed and middle-age. High risk of depression was also detected in individuals that live alone, live with one person, own a high income, present a low level of education, and suffer from anxiety and obesity. Nevertheless, a more reduced number of groups was considered as vulnerable groups of depression. Econometric results have shown the explanatory factors as having a positive statistical significant impact on the risk of depression are: female, unemployment, retirement, divorce, hypertension, chronic pain, anxiety, obesity, bronchitis, age and the "presenteeism" phenomenon. In contrast, the explanatory factors found to have a negative statistically significant relationship on the risk of depression were: family size, and hours of work per week.

The findings on the variables presenteeism and hours of work per week may suggest loss of productivity in the prevalent population with depression. High income and graduate and postgraduate results suggest that: the first finding indicates that this economic group of the Portuguese population might have better access to mental health services, and the second explains which group of individuals might better recognise depression or better overcome stigma.

With regard to incidence, the following groups were found to have a higher level of incidence: males, single, divorced, legal separated status, unemployed, age groups within 16 and 49 years old. It was also verified in individuals with secondary or equivalent studies, bachelor degree and graduate and postgraduate degrees. Finally, it was verified that individuals owning high income and living in residences with more than 3 people have higher incidence as well. With regard to chronic conditions, it was detected an increased risk of newly diagnosed depression in individuals with asthma. The econometric analysis has shown fewer explanatory factors with a statistical significant relationship with

depression (in comparison to the econometric studies using prevalence data). The main findings have shown robust results in that, for divorced, single and legal separated status displaying a positive statistical significant relationship on newly diagnosed depression; age presents a negative statistical significant relationship with depression.

Beyond these findings, we have also found in the prevalence study, differences between gender groups. In descriptive analysis, we found that female with none or elementary level of schooling have a higher prevalence rate of depression, in opposition to the males, which show an higher risk of depression with graduate and postgraduate degrees. Through econometric analysis, we found out that for the females, the smoking factor presents a positive statistically significant relationship on the risk of depression. In opposition, the explanatory factors encountered with negative statistical significant relationship on the prevalence of depression of this group are: family size, graduate and postgraduate degrees and high income. These last three factors may show that they have a protective impact in the prevalence of depression of the female group. Furthermore, for the male group, the explanatory factors with positive statistical significant relationship on the risk of depression are individuals: unemployed, owning high income, with graduate and postgraduate degrees or suffering from diabetes. Contrary, hours of work per week present a negative statistical influence on the risk of depression.

These explanatory factors suggest that males are comparatively more affected by stigma in comparison to females. Finally, the robust result about divorce (verified in the three populations analysed) might indicate that family conflicts contribute for the prevalence of depression.

Data on depressed symptoms and on consumption of antidepressant drugs has shown that there might be individuals not being diagnosed with depression but having signs of poor mental health.

Concerning the estimates of prevalence and incidence rates, we found out that these can be underestimating the true rate of incidence and prevalence. Therefore this finding should be taken into consideration when analysing results, since they might describe a group with identified and diagnosed depression, which can be different from the overall Portuguese group with depression.

Finally, this work proposes a Bayesian Network tool to help planning mental health services. The net determines the probability of an individual having and not having depression regarding the conditional characteristics, which consist in the characteristics of the individual or of the population group under analysis. The defined network included specific determinants: age, gender type, level of income, anxiety, hypertension and occupation (employed - employed people and students; unemployed; and retired). This proposed tool could also support the diagnosis and the detection of depression in general healthcare services and guide the planning of mental health policies.

Given the complexity of the topics researched in this thesis and despite the limitations brought by the application to the 4th National Health Survey, and by the methods used to test the proposed hypothesis, we found out useful information with regard to factors that explain depression in the Portuguese population. Hereupon, we discuss the importance of continuing to carry out studies on mental health in Portugal. There is lack of information on the burden of mental health in the Portuguese population and on the explanatory factors that influence mental health indicators.

Furthermore due to reduced range of findings to explain the incidence of depression, we consider the possibility of our production functions of mental health state show higher evidence on the determinants

of mental health for the prevalence of depression than on the new cases of depression. In this case, we suggest the assessment of the remaining hypothesis not evaluated in this work although purposed in the explanatory model of mental health state.

Therefore, we suggest the following future research topics: besides the evaluation of the remaining hypothesis that were not assessed in this work; and since the methodologies to carry out diagnosis of depression, as well as of others mental health disorders are scarce, applying and adapting the proposed model to study the different explanatory factors for the several types of mental health disorders might be useful. In addition, it might be useful to add to the proposed explanatory model other indicators such as concentrations of biologic chemicals (neurotransmitters) often verified in pathological circumstances.

Policy research should be held in order to: identify which are the best ways to capture population attention in promoting mental health and explaining mental health disorders; evaluating the effectiveness of health interventions that might influence the detection of depression – such as the provision of different types of mental health related services, endorsing a better knowledge of health professionals on mental health disorders, promoting the use of risk assessment tools, and an improved planning of mental health services.

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8 Annexes

In the selection of the vulnerable groups, 2,5% and 5% were the minimum relative sizes considered for the overall population, female and male groups, respectively.

Table 8.1: Prevalence analysis developed regarding the several subgroups of the Portuguese Population.

	Subgroups of the Portuguese Population	Overall Population		Female Population		Male Population	
		Subgroups Dimension (%)	Prevalence Rate (%)	Subgroups Dimension (%)	Prevalence Rate(%)	Subgroups Dimension (%)	Prevalence Rate(%)
Marital Status	Single	36,7	2,7	32,9	3,7	40,7	1,75
	Married	51,5	8,7	49,9	13,7	53,1	3,73
	Separated	0,8	10,4	0,9	15,9	0,7	2,76
	Divorced	3,0	15,6	3,6	21,2	2,4	6,36
	Widow	8,0	10,2	12,7	12,0	3,1	3,28
Family Income	Live with [0; 500[Euros	59,4	7,0	61,0	10,5	57,8	3,02
	Live with [500;1000[Euros	28,6	6,5	27,4	10,4	29,8	2,68
	Live with [1000; 1500[Euros	9,9	6,4	9,5	9,9	10,3	2,98
	Live with [1500; 2000[Euros	2,2	9,7	2,1	13,5	2,1	5,56
Unemployment	Unemployed;	3,7	11,5	3,6	16,2	3,7	6,74
Level of Scholarship	None or Elementary schooling	66,7	7,2	67,1	11,2	66,3	2,94
	Basic schooling	13,4	6,2	12,1	9,6	14,8	3,19
	High school or Equivalent and Bachelor	13,1	6,2	13,3	9,5	12,9	2,62
	Graduate and post-graduate	6,9	5,6	7,6	7,1	6,1	3,49
Obesity	Obese;	49,6	8,0	47,6	12,5	5,4	3,42
Reform	Retired;	19,5	8,9	19,1	12,6	20,1	4,76
Age (years)	0-15	15,7	0,2	14,6	0,3	16,9	0,24
	16-35	23,7	4,1	22,2	6,3	25,4	1,98
	36-49	19,9	9,3	20,1	14,3	19,9	3,77
	50-65	20,5	12,3	21,1	18,7	20,0	5,13
	66-80	16,4	8,1	17,8	11,2	14,9	4,02
	More than 80	3,8	3,5	4,2	4,7	3,0	1,70
Family Dimension	Live alone	7,1	11,4	9,6	13,9	4,5	5,67
	Live with a companion	24,4	9,4	24,9	14,1	23,9	4,15
	Live with 3 or 4 persons	51,5	6,1	49,3	9,5	54,0	2,7
	Live with 5 or more persons	17,0	3,6	16,3	5,6	17,6	1,48
Chronic Conditions	Hypertension	21,6	12,4	25,5	16,5	17,4	6,06
	Anxiety	3,8	51,4	5,5	54,7	1,9	41,41
	Obesity	2,9	20,0	3,5	27,1	2,2	7,85
	Diabetes	7,3	11,3	8,0	15,0	6,4	6,29
	Bronchitis	3,2	14,2	3,3	20,3	3,2	7,51
	Constant Pain	14,4	16,1	17,4	21,1	11,1	7,38
	Asthma	5,2	10,8	5,4	16,1	4,9	3,70
	AVC	1,9	10,7	1,7	17,0	2,1	5,11
	Ulceration	0,9	12,9	1,0	20,4	0,9	3,98
NUTs II Regions	Myocardial infarction	1,4	10,7	0,9	17,4	2,0	7,20
	North	14,8	8,0	14,9	11,8	14,7	3,77
	Centre	14,4	9,8	14,6	15,5	14,2	3,58
	Lisbon and Tagus Valley	14,6	8,5	14,7	12,4	14,3	4,29
	Alentejo	14,0	7,0	13,9	10,9	14,1	2,92
	Algarve	15,0	5,2	14,7	8,1	15,2	2,19
	Azores	14,4	4,3	14,1	7,4	14,8	2,2
	Madeira	12,9	4,9	13,1	6,6	12,8	1,73

Legend

	Reasonable dimension for subgroups be considered as vulnerable groups
	Considered vulnerable groups
XX	Subgroups with risk of depression 2 times higher than the risk for the population group in analyse

Table 8.2: Prevalence analysis carried out for the subgroups studies in more detail

	Married				Unemployed				Retired				50-65 years				
	Women		Men		Women		Men		Women		Men		Women		Men		
	Prevalence Rates (%)	Sample proportion (%)	Prevalence Rates (%)	Sample proportion (%)	Prevalence Rates (%)	Sample proportion (%)	Prevalence Rates (%)	Sample proportion (%)	Prevalence Rates (%)	Sample proportion (%)	Prevalence Rates (%)	Sample proportion (%)	Prevalence Rates (%)	Sample proportion (%)	Prevalence Rates (%)	Sample proportion (%)	
Marital Status	Single	-	-	-	8,7	14.	4,91	32.	14,29	9.	9,14	9.	15,92	5.	6,33	7.	
	Married	-	-	-	16,67	60.	7,95	56.	14,65	55.	4,72	79.	17,96	72.	4,96	84.	
	Separated	-	-	-	28,57	3.	0	0	11,43	1.	0	0	26	2.	2,63	0.	
	Divorced	-	-	-	27,14	15.	10,87	10.	21,49	5.	8,54	4.	21,72	6.	6,59	5.	
	Widow	-	-	-	27,27	7.	16,67	2.	10,03	0.	2,91	0.	22,7	14.	6,67	3.	
Age Groups (years)	0-15	-	-	-	-	0.	-	0.	0.	0.	0.	0.	-	-	-	-	
	16-35	8,74	10.	1,41	4.	9,12	23.	6,23	38.	66,67	0.	0.	0.	-	-	-	
	36-49	13,59	32.	3,22	25.	21,19	40.	4,74	18.	37,35	4.	16,13	5.	-	-	-	
	50-65	17,96	43.	4,96	43.	20,93	36.	8,91	44.	24,35	38.	7,19	38.	-	-	-	
	66-80	11,46	16.	4,07	25.	20,00	1.	6,23	38.	11,03	53.	4,14	52.	-	-	-	
	81-++	4,85	1.	1,85	2.	0	0.	0.	4,47	5.	1,68	5.	-	-	-	-	
Level of Scholarship	None and Elementary	14,61	77.	3,67	71.	17,65	65.	6,24	62.	12,19	84.	4,28	76.	18,76	81.	4,79	72.
	Obligatory and Basic	14,35	12.	4,27	13.	16,3	18.	9,66	28.	18,71	5.	7,5	11.	21,04	8.	7,94	15.
	High School - Bachelor	10,61	9.	3,53	10.	15,62	16.	6,67	10.	19,71	8.	6,48	7.	20,36	8.	3,86	6.
	Graduates Pósgraduates	8,17	4.	3,77	6.	3,92	2.	0	0.	19,1	3.	9,52	5.	11,06	3.	6,85	7.
Retirement	Reformed	14,65	20.	7,95	7.	-	-	-	-	-	-	-	-	24,35	24.	7,19	35.
	No-reformed	13,44	81.	3,58	93.	-	-	-	-	-	-	-	-	17,43	76.	4,43	65.
Unemployment	Unemployed	16,67	5.	5,06	34.	-	-	-	-	-	-	-	-	20,93	5.	8,91	11.
	Employed	13,53	97.	5,27	18.	-	-	-	-	-	-	-	-	18,57	95.	4,88	89.
Obesity	Obese	14,54	61.	4,72	38.	18,49	57.	8,56	17.	14,33	67.	4,87	63.	19,05	67.	5,06	66.
	No obese	12,56	41.	3,3	62.	13,85	43.	4,89	10.	10,84	33.	4,57	37.	17,97	33.	5,27	34.
Families	Lonely	34,88	1.	7,25	1.	23,08	7.	17,07	22.	12,62	28.	5,84	13.	25,74	13.	9,64	9.
	2 persons	14,35	39.	4,14	40.	21,89	30.	7,33	29.	13,58	49.	4,36	54.	19,59	46.	5,23	38.
	3 to 4 persons	13,67	52.	3,68	51.	13,49	46.	5,84	34.	13,74	20.	5,55	29.	17,4	36.	5,1	47.
	More than 5 persons	10,91	10.	2,56	8.	15,44	17.	5,73	15.	6,7	3.	3,24	4.	12,16	5.	2,69	5.
Family Income	Low	13,85	60.	3,8	59.	16,07	72.	6,76	12.	11,92	67.	4,31	61.	19,2	59.	5,25	53.
	Media Baixa	13,86	30.	3,29	26.	14,12	20.	6,71	11.	14,67	20.	5,49	25.	18,97	27.	4,62	28.
	Media Alta	12,17	10.	4,2	13.	25	4.	6,25	14.	18,63	11.	4,79	10.	16,55	11.	5,2	14.
	Alta	13,92	2.	5,56	3.	29,41	4.	6,67	13.	14,85	3.	12,68	5.	15,08	2.	8,49	4.
Chronics Diseases	Hypertension	16,23	60.	5,82	42.	26,57	30.	13,82	17.	13,76	59.	5,1	45.	21,32	50.	7,64	48.
	Asthma	16,13	13.	6,07	7.	31,91	12.	18,52	10.	15,66	10.	5,32	8.	24,83	8.	7,1	5.
	Constante Chronic Pain	21,05	53.	7,17	32.	26,09	29.	14,14	28.	17,99	45.	8,17	38.	28,08	41.	9,18	33.
	Chronic Anxiety	54,37	42.	40,71	29.	60,61	32.	48	37.	53,39	36.	44,06	33.	58,33	32.	42,57	31.
	Ulceration of the leg	20,29	3.	3,17	1.	25,00	1.	0	28.	16,82	3.	0	0.	30,36	2.	10	2.
	AVC	16,15	4.	5,443	5.	80,00	3.	22,22	96.	14,85	6.	4,8	7.	27,91	3.	12,04	6.
	Obesity	26,94	13.	8,28	7.	30,23	10.	9,09	0.	26,64	11.	8,53	6.	30,42	10.	9,8	7.
	Myocardial Infarction	17,5	2.	6,81	6.	0	0.	0	44.	16,28	4.	6,33	8.	35,9	2.	9,3	6.
	Chronic bronchitis	24,29	6.	9,87	10.	43,48	8.	11,11	18.	20,45	10.	9,43	16.	31,76	6.	13,48	9.
	Diabetes	14,48	17.	5,98	16.	32,65	13.	14,29	0.	12,2	17.	5,92	21.	22,26	15.	8,46	21.
Regions	North	15,76	18.	5,11	21.	15,06	20.	8,97	26.	13,45	16.	5,68	17.	21,42	17.	7,56	22.
	Center	19,99	24.	4,46	19.	31,33	21.	7,14	10.	19,14	20.	5,34	15.	23,96	22.	5,93	19.
	Lisbon and Tejo Valey	15,6	17.	5,61	22.	17,91	19.	8,46	22.	17,41	21.	7,34	24.	20,95	17.	7,62	23.
	Alentejo	13,28	14.	3,07	12.	12,97	15.	5,3	14.	10,92	20.	4,45	18.	19,61	14.	5,11	15.
	Algarve	9,63	10.	2,24	9.	11,03	13.	6,31	14.	9,5	13.	2,95	11.	13,39	10.	2,73	8.
	Madeira	9,63	8.	2,04	6.	15,79	7.	3,75	6.	7,89	6.	2,53	5.	14,7	10.	2,17	4.
	Azores	9,84	10.	3,02	11.	11,32	5.	5,41	8.	13,74	5.	4,33	10.	14,13	9.	3,73	9.

Table 8.2 contains the analysis of prevalence and the proportion of each subgroup according to the population under analysis. For the selection of their vulnerable subgroups we consider higher prevalence rates (superior to the risk of depression found for the group in question) and dimensions superior to a fifth (20%) of the population under analysis (in order to provide information of groups with considerable dimensions). Table 8.3 shows the vulnerable subgroups of the married, unemployed, middle age and retired groups; and also points out similarities and differences of between gender groups.

Table 8.3: The selected risk subgroups for married, unemployed, retired populations and its similarities and differences between gender groups.

	Married group		Retired group		Unemployed group		Middle-age group	
Subrgoups Types	Female	Male	Female	Male	Female	Male	Female	Male
Marital Status			Married		Married			
Age groups (years)	50-65 years		50-65 years		36-49 years			
		66-80 years			50-65 years	50-65 years		
Level of Schooling	None or Elementary				None or Elementary	Compulsory	None or Elementary	
Regions	Centre	North	Lisbon and Tagus Valley		Centre	North	Centre	North
		Lisbon and Tagus Valey				Lisbon and Tagus Valley		Lisbon and Tagus Valley
Retired/uneemployment	Retired	Unemployed					Retired	
Obesity	Obese		Obese		Obese		Obese	Non-Obese
Chronics diseases	Hypertension		Hypertension		Hypertension		Hypertension	
	Constant Pain		Constant Pain		Constant Pain		Constant Pain	
	Anxiety		Anxiety		Anxiety		Anxiety	
				Diabetes		AVC		Diabetes
Family Dimension	Living with someone		Living with someone			Live alone	Living with someone	
	Living with 3 or 4 persons		Living with with 3 or 4 persons		Living with someone			
Family Income	Low		Media low	Media low			Low	
	Media Low						Media low	

Married Group

We verify the following similarities between gender groups. The common vulnerable subgroups are: middle-age group, obese individuals, and persons suffering from hypertension, constant pain or anxiety. All of them are expected risk groups.

With regard to the differences between gender groups, results show that the male group has a higher prevalence of depression for older individuals. It presents a higher risk for the unemployed and for individuals living in the North and Lisbon and Tagus Valley regions. On the other hand, the female group shows a higher prevalence of depression for individuals with none or elementary level of schooling, living in the Centre region and in residences with 3 or 4 persons. At last, the female group presents a higher risk of depression when earning media low income as well. Most of these groups

are expected as increasing the vulnerability of having depression, and verify hypothesis of table 3.2 (except living in a residences with 3 to 4 persons).

Concerning to the results to which the dimension requisite was not verified, we believe they describe important aspects of the prevalent population with depression. For the male group we found relevant the high prevalence of depression in individuals with graduate and post-graduate degrees and with high family income. For both genders, we also verify highest risk of depression for the divorced marital status. Once more we alert that graduate and post-graduate degrees and high income are non-expected vulnerable groups of depression. Literature mentions that individuals with low level of schooling and low income have a higher tendency for a poor mental health state.

Unemployed Group

Results of table 8.3 indicate that there is a comparatively higher prevalence of depression in several vulnerable subgroups of the unemployed population. For both genders groups, we detected the higher risk of depression on individuals of the following groups: living someone; married; age between 50 and 66; suffering of constant pain and anxiety.

We found different risk subgroups across gender groups. For females, the highest risk of depression were found for: age between 36 and 49 years old; none and elementary level of schooling; and living in the Centre NUTs II region. For males, the highest risk was also found for individuals of the following groups: living alone and in North and Lisbon and Tagus Valley regions. And also in male individuals who have suffered of AVC (stroke).

Without considering the dimension requisite, we found the risk of depression in the female group embraces a wider range of ages than in the male group. Furthermore, we find that the low level of schooling is a risk factor that might be related with added difficulties on getting a job. In addition to the stigma and discrimination problems due to the depression disorder, there might exist extra additional difficulties on getting a job. Comparing with the other three populations analysed, this group presents a high risk of depression for females with high and media high income, in opposition to males with the same characteristics.

Retired group

These results allow for the identification of vulnerable subgroups inside the retired population. For both gender groups, we observe the following subgroups with a higher risk of depression: age between 50-65 years; being obese; suffering of hypertension, constant pain or anxiety; living in Lisbon and Tagus Valley and in residences with more 3 or 4 persons.

Differences of vulnerable groups were also found among the two gender groups. For retired females, the higher risk is associated with married status and living with someone. For the retired male group, a higher risk is verified for those who suffer of diabetes and show a media low family income.

For the results to which the dimension requisite was not contemplated two interesting findings were encountered (see table 8.2). First, the young female group shows high risk of depression, which might be related to an earlier retirement. This finding suggests a lost of productivity and additional costs to the Portuguese state through social support. This vulnerable group might be composed of people with poor level of health state; or who were victims of traffic or work accidents, reducing their probability of participating in the labour market. Second, the subgroups presenting highest risk of depression are the

individuals with high and media high level of schooling, with high and media high incomes. According to our explanatory model of mental health state, displayed in figure 3.11, these features are unusual risk groups of depression.

Middle-age group

For both genders, table 8.3 shows that the individuals presenting the highest prevalence of depression are: retired, suffer of hypertension, constant pain or anxiety and live with someone or present low family income.

Finally, we observe that for married, unemployed and middle-age groups, females present a highest risk in the Centre region, whereas males present highest risk in the North and Lisbon and Tagus Valley. The retired group shows highest risk in the Lisbon and Tagus Valley region, which might be caused by the sense of isolation and loneliness that people might feel in urban region.

Table 8.4: Results of the analysis of relative risk of depression between subgroups.

		Married		Unemployed		Retired		50-65 years		Obese		Elementar or None Scholarship		Married and employed		Low Family Income	
Explanatory Variables		Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
Marital Status	Single			0,52	0,62	0,98	1,94	0,89	1,28	0,31	0,56	0,20	0,45			0,27	0,49
	Married			1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00			1,00	1,00
	Separated			1,71	0,00	0,78	0,00	1,45	0,53	1,21	0,30	1,08	0,24			1,23	0,91
	Divorced			1,63	1,37	1,47	1,81	1,21	1,33	1,70	1,35	1,44	1,45			1,59	1,31
	Widow			1,64	2,10	0,68	0,62	1,26	1,34	0,89	0,89	0,76	0,75			0,80	0,84
Age Groups (years)	0-15									0,02	0,04	0,01	0,06			0,02	0,06
	16-35	0,64	0,38	0,55	0,78	4,55	0,00			0,57	0,63	0,58	0,58	0,63	0,29	0,50	0,54
	36-49	0,99	0,86	1,27	0,60	2,55	3,42			1,03	0,93	1,07	0,58	0,98	0,89	1,14	1,18
	50-65	1,31	1,33	1,26	1,12	1,66	1,52			1,31	1,30	1,26	1,31	1,32	1,31	1,39	1,38
	66-80	0,84	1,09	1,20	0,78	0,75	0,88			0,80	1,09	0,71	0,95	0,85	1,14	0,76	0,94
	81-++	0,36	0,50	0,00	0,00	0,31	0,36			0,33	0,42	0,31	0,36	0,36	0,52	0,31	0,46
Regions	North	1,15	1,37	0,90	1,13	0,92	1,20	1,19	1,52	0,90	1,04	0,84	1,05	1,16	1,35	0,84	0,98
	Center	1,46	1,20	1,88	0,90	1,31	1,13	1,33	1,20	1,33	1,18	1,13	1,09	1,45	1,23	1,12	0,93
	Lisbon and Tejo Valey	1,14	1,50	1,07	1,06	1,19	1,56	1,17	1,54	1,01	1,27	0,86	1,10	1,15	1,51	0,95	1,21
	Alentejo	0,97	0,82	0,78	0,67	0,75	0,94	1,09	1,03	0,91	0,71	0,74	0,82	0,99	0,81	0,75	0,81
	Algarve	0,70	0,60	0,66	0,79	0,65	0,63	0,75	0,55	0,65	0,66	0,61	0,51	0,71	0,59	0,65	0,69
	Madeira	0,70	0,55	0,95	0,47	0,54	0,54	0,82	0,44	0,51	0,54	0,50	0,44	0,69	0,54	0,45	0,43
	Azores	0,72	0,81	0,68	0,68	0,94	0,92	0,79	0,75	0,07	0,64	0,55	0,62	0,72	0,86	0,54	0,57
Level of Schooling	None and Elementary	1,07	0,98	1,06	0,78	0,83	0,91	1,04	0,97	0,84	0,85			1,07	0,98	0,80	0,80
	Compulsory	1,05	1,14	0,98	1,22	1,28	1,59	1,17	1,60	1,03	1,11			1,04	1,12	0,59	0,78
	High School or Equivalent	0,78	0,95	0,94	0,84	1,35	1,37	1,13	0,78	0,90	0,85			0,79	0,98	0,63	0,67
	Bachelor Degree	0,60	1,01	0,24	0,00	1,30	2,02	0,62	1,38	0,88	0,73			0,62	1,06	0,31	1,28
Retirement	Reformed	1,07	2,13					1,36	1,45	0,99	0,76	0,82	1,17	1,08	1,32	0,86	1,13
	No-reformed	0,98	0,96	0,97	0,85			0,97	0,89	0,82	1,25	0,73	0,67	0,98	0,86	0,73	0,69
Unemployment	Unemployed	1,22	1,36					1,17	1,80	1,27	2,19	1,18	1,70	0,00	0,00	1,16	1,78
	Employed	0,99	1,41			0,89	1,01	1,03	0,98	0,85	0,83	0,74	0,77	0,00	0,00	0,74	0,74
Obesity	Obese	1,06	1,27	1,11	1,08	0,98	1,03	1,06	1,02	0,00	0,00	0,82	0,91	1,06	1,04	0,89	0,95
	No obese	0,92	0,88	0,83	0,62	0,74	0,97	1,00	1,06	0,00	0,00	0,66	0,66	0,92	0,93	0,62	0,63
Chronics Diseases	Hypertension	1,19	1,56	1,59	1,74	0,94	1,08	1,19	1,54	1,14	1,47	1,06	1,47	1,27	1,54	1,14	1,54
	Asthma	1,18	1,63	1,91	2,33	1,07	1,13	1,38	1,43	1,27	1,32	1,15	1,00	1,55	1,56	1,21	0,82
	Chronic Pain	1,54	1,92	1,57	1,78	1,23	1,73	1,56	1,85	1,44	1,80	1,38	1,84	1,65	1,92	1,46	1,74
	Anxiety	3,98	10,91	3,64	6,04	3,64	9,33	3,25	8,58	3,91	11,50	3,68	11,41	4,11	11,24	3,82	11,77
	Ulceration of the leg	1,49	0,85	1,50	0,00	1,15	0,00	1,69	2,02	1,36	1,20	1,30	1,26	1,77	0,89	1,25	1,22
	AVC	1,18	1,46	4,80	2,79	1,01	1,02	1,55	2,43	1,31	1,45	1,03	1,35	1,42	1,39	1,30	1,16
	Obesity	1,97	2,22	1,81	1,14	1,82	1,81	1,69	1,98	1,84	2,11	1,74	2,47	2,08	2,37	1,83	2,24
	Myocardial Infarction	1,28	1,83	0,00	0,00	1,11	1,34	2,00	1,88	1,36	1,80	1,20	2,10	1,10	1,96	1,43	1,79
	Bronchitis	1,78	2,65	2,61	1,40	1,40	2,00	1,77	2,72	1,59	2,12	1,42	1,85	1,76	2,68	1,44	1,56
	Diabetes	1,06	1,60	1,96	1,80	0,83	1,25	1,24	1,71	1,07	1,43	0,95	1,66	1,25	1,60	1,01	1,73
Families	Lonely	2,55	1,94	1,38	2,15	0,86	1,24	1,43	1,94	1,08	1,52	0,86	1,39	2,59	1,67	0,93	1,53
	2 persons	1,05	1,11	1,31	0,92	0,93	0,92	1,09	1,05	1,02	1,13	0,94	1,03	1,05	1,11	0,97	1,08
	3 to 4 persons	1,00	0,99	0,81	0,73	0,94	1,18	0,97	1,03	0,82	0,78	0,72	0,73	1,01	1,00	0,71	0,72
	More than 5 persons	0,80	0,69	0,93	0,72	0,46	0,69	0,68	0,54	0,50	0,53	0,42	0,49	0,77	0,64	0,38	0,39
Family Income	Low	1,01	1,02	0,96	0,85	0,81	0,91	1,07	1,06	0,85	0,93	0,75	0,83	1,01	1,01		
	Media Low	1,01	0,88	0,85	0,84	1,00	1,16	1,06	0,93	0,86	0,75	0,77	0,76	1,03	0,89		
	Media High	0,89	1,13	1,50	0,79	1,27	1,01	0,92	1,05	0,98	0,88	0,66	0,49	0,89	1,18		
	High	1,02	1,49	1,76	0,84	1,01	2,69	0,84	1,71	0,87	1,44	0,84	1,15	0,99	1,46		