

## Preface

When I first started working on this thesis I was based in Norway. But after a while I recognised that this kind of work sometimes requires the skill of *hanging on in quiet desperation*<sup>1</sup>, so therefore it was more natural to continue the work overseas – it is after all *the English way*<sup>2</sup>.

After a lot of rewriting, recoding and redoing I have finally reached my goal. However sometimes the journey towards the goal is more important and I feel I have learned a lot about geography, health research, statistics, GIS and most of all myself during this last year. And for that I need to thank my supervisors Stig Jørgensen and Andy Jones for professional support and feedback.

I also need to thank Caroline Mevik and Andreea Cetateanu for controlled procrastinating between the sessions of perspiration.

“Every now and then go away, have a little relaxation, for when you come back to your work your judgment will be surer. Go some distance away because then the work appears smaller and more of it can be taken in at a glance and a lack of harmony and proportion is more readily seen” - Leonardo Da Vinci.

And thanks to my brother for statistical aid and my father for re-drawing a bad scan of Meade and Earicksons “Trinangle of Ecology”.

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1 “Time” - Pink Floyd

2 “Time” - Pink Floyd

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## Abstract

There are lots of different ways of understanding health and disease. In this dissertation I have tried to explain different environmental and behaviour factors associated with self-rated depression based on the theoretical framework of “Triangle of human ecology”. This explains state of health based on behaviour, environment and population factors.

The study aims to identify possible geographic patterns of depression and the distribution of other area variables like temperature, education level, urbanity etc. since these factors may have an indirect effect on depression. I also look at individual-based associations between the outcome variable, depression (HADS-D score, based on the Hospital Anxiety and Depression Scale), and associative variables (smoking, alcohol intake, physical activity etc.) by using logistic regression analysis. It is not possible to say anything about causal relationships since this requires information about the temporal ordering between the variables.

The empirical data is obtained from HUNT 3 (Health study in Nord-Trøndelag) from 2006-2008, Meteorologisk institutt and various statistics from SSB (Norwegian Statistics).

The analysis show a positive association between HADS-D above 8 and being male, high age, CAGE-score above 2, neurotic personality, difficulties in childhood and self-reported imminent mortal danger the last 12 months. There is however a negative association between HADS-D above 8 and alcohol consumption, having a job, participation in music/theatre and outdoor activity, social support both on personal and neighbourhood level, exercise, extroversion, high temperature and life satisfaction. For people having a job being male, having high age, having high demands at work and short education seems to be positively associated with HADS-D score above 8, while high social support and high control seems to be negatively associated with HADS-D above 8.

## 1.0 Introduction

### 1.1 Choice of topic and importance of the study

It's expected that half of the population will have a mental illness during their lifetime and 20-25% of the population have a mental illness at any given time (Nes & Clench-Aas 2011). Unipolar depression was ranked third in the WHO's list of burden of disease globally and in first place in the middle- and high-income countries in 2004. By 2030 it is expected that unipolar depression will be the leading burden of disease worldwide (WHO 2008). In Norway anxiety, depression and substance abuse-related disorders are the top three common forms of mental disorders. When it comes to depression, about one in five people suffers from this during their lifetime, and one out of ten in a given year (Mykletun et. al. 2009). Based on these prevalence proportions, we understand that depression is a phenomenon most of us are affected by either because it affects one's own life or that someone we know is affected. The fact that depression is a growing health problem makes it a very important topic to gain knowledge about. Timeliness about depression is one of the reasons I have chosen to focus on this in my thesis.

The many consequences of depression are also making the topic relevant. Psychological problems are causing emotional distress among individuals who are affected, but also problems related to stigmatizing, discrimination, impaired quality of life, decreased physical health and premature mortality. Psychological problems also create stress for the patients' families, both financially and socially (Nes & Clench-Aas 2011). Mentally ill people often require continuous treatment and this can lead to frequent sick leave, unemployment and reduced working abilities. Indeed, mental disorders are the most frequent cause of disability among workers aged under 45 years (Olsen 2005), and in Nes and Clench-Aas' (2011) survey of mental health in Norway, 10.1% aged 25-64 said they had reduced working abilities due to mental disorders. Depression is thus not only a burden to individuals and families, but also for society as a whole due to heavy losses in manpower and production. To reduce the economic burden for society, it is thus important to identify risk factors associated with depression so one can take effective action.

Risk factors that affect mental health problems are linked to genetics, behavior and

environmental factors. The biological aspects related to depression cannot be changed easily, but environmental and behavioral factors can be influenced by political and social measures. As environmental factors is often a precipitating factor for mental health problems, it is very important to identify them in order to operate an effective prevention (Meade & Earicksson 2000, Mykletun et. al. 2009). This is also the reason why I have chosen to mainly focus on behavioral and environmental factors associated with depression. In addition, the biological causes of depression (with the exception of gender and age) largely fall outside my expertise.

The second reason for choosing this theme is that depression and mental health is still a taboo in spite of the high prevalence rates, which makes openness on the subject essential. Mental health problems are often more difficult to talk about than physical illness. Just think of how friends, family and colleagues can talk openly about high blood pressure, back pain and other physical diseases. Compare this with the number of times you have heard them talk about mental problems. One reason that mental health is still taboo may be that it takes time to change perceptions in society. Throughout history, people with mental problems have been isolated from the rest of society. In the 1300s people with mental disorders were placed on the so-called 'ship of fools'. During the Enlightenment people with mental problems was incarcerated with criminals. After 150 years psychiatric hospitals started taking care of the patients, but they received various treatments - ranging from force to care. The mentally ill were not given a voice until Freud's psychoanalysis. In Western Europe there was a deinstitutionalization and return of mentally ill into society in the 70s, but the stigma of the past still remains (Ingstad 2007).

In addition, a number of myths are associated with mental health and depression. Depression is often seen as a sign of weakness and that one can get out of the depression by 'straightening up'. Even the depressed themselves often experience depression as a weakness. Feeling ashamed and inferior is often linked to depression and even feelings of not being worthy of health care funds are thoughts that can affect depressed (Eknes 2006). If you look at the proportion of the health budget which is earmarked for mental health this also sends out a signal that mental health is not as "important" as a physical illness. Only five countries (including Norway) in Europe used 10% or more of the health budget on mental health (Nes & Clench-Aas 2011). Writing a dissertation on depression will hopefully be a contribution to highlight the importance of mental health to a greater extent.

The last and perhaps most important reason for the choice of topic are of personal nature, as I have suffered from depression myself. I was not sure if I would write this as a justification for the choice of topic when I on one side did not want to be so personal, but at the same time I felt it was somewhat ambiguous to talk about the importance of removing the taboo surrounding the topic, if I was to be "caught" under taboo myself. In addition, it is important to state this as it may have affected my role as researcher, as choice of risk factors, source selection or discussions about the theme subconsciously or consciously may be colored by personal experience.

## **1.2 About the data material**

The study area of this thesis is North-Trøndelag county, and the data are taken from the public health survey HUNT III (2006-2008). This data is collected using questionnaires, interviews and clinical trials. In this dissertation only data from the surveys and the interviews are used. The HUNT study includes all residents of Nord-Trøndelag over 13 years, and it is one of the largest health studies internationally (NTNU 2010). As Young-HUNT is separated from the rest of the HUNT study, HUNT-III includes only people aged 20 years upwards.

When talking about depression in everyday language we often talk about a feeling of sadness, whereas when using depression as a diagnosis it is related to a person's whole mental state (Nielsen 1996). In this thesis depression will be measured using the Hospital Anxiety and Depression Scale (HADS), and thus it is self-reported depression symptoms rather than depression as a clinical diagnosis that will be investigated.

## **1.3 Research questions**

The problems in the thesis will be the following:

- Identify the geographic distribution of depression measured by HADS in Nord-Trøndelag
- Investigate whether there is a possible link between depression and area factors like:
  - urbanity
  - climatic factors
  - moving rates



- hospital area of residence (functional regions)
- And further control for possible confounding factors for depression:
- By examining relationships with various behavioural and environmental factors (tobacco, physical activity, alcohol consumption, personality, work environment, social networks) related to depression

## 1.4 Organization of the thesis

Chapter 2 contains the theoretical foundation of this study. First I give a general introduction to different kinds of health beliefs and understandings, before I focus more specifically on mental health and depression. Then I introduce Triangle of Human Ecology, which is the theoretical framework of the thesis. Last I discuss health and the importance of location.

In chapter 3 I give a further description of the different data material I have used. Then I go through all variables used in this study, before I go through some methodology and issues related to the study.

Chapter 4 is an introduction to the study area. Here I have mapped the geographical distribution of depression and also different area factors like precipitation, settlement, education etc. These factors can contribute to an understanding of difference in depression proportions.

The main analysis is found in chapter 5. First I give the descriptive statistics split by gender and urbanity/rurality. Then I present the table of unadjusted associations. Last I give the main logistic analysis and the separate model of work environment.

In chapter 6 I discuss the findings of the analysis and compare them to former theory.

Chapter 7 is the conclusion with some final comments about what could be done further, limitations and strengths of the study and theoretical implications.

## 2.0. Theory

In this chapter I will examine the theoretical basis of this study. First, I will review the concept of health and disease and link this to mental health in section 2.1., before I focus more specifically on mental health and depression in section 2.2. In section 2.3. I will describe the "Triangle of human ecology" which is the theoretical background framework I have used in the study. I will also link this to the variables of investigation. Finally, I am going to review health in relation to place in section 2.4, and how health disparities can be explained on the basis of composition and context.

### 2.1 Health and disease

The concept of health has been the subject of many discussions, between professions, politicians and other groups. According to Jensen (1994), the ontological discussion about health concepts, i.e. the study of what exists and what we therefore can gain knowledge about (Hubbard et. al. 2005), has a practical interest. Indeed, the definition of the concept of health is crucial to how health care will take place (Jensen 1994). Among other things, it affects issues such as who are entitled to public benefits. Fibromyalgia and chronic fatigue syndrome (CFS), which has some overlap of symptoms of depression and that some regard as a physical manifestation of depression and dysthymia (Eknes 2006) are two examples of conditions where the debate about public acceptance has been heated (Ingstad 2007).

Mæland (2009) distinguishes between three different health beliefs:

- health as being healthy (state)
- health as well-being (experience)
- health as ability (property)

#### 2.1.1 Health as being healthy

Health as being healthy is often referred to as the negative health definition, where health is seen as the opposite to disease. Health defined as the absence of disease leads us to another concept, namely the concept of disease. We talk about the terms "illness", "disease" and

"sickness." Illness is the subjective experience of disease, while disease is the doctor's diagnosis (Gatrell & Elliott 2009, Ingstad 2007). There is however disagreement about the term sickness. Kleinmann (1988, cited in Ingstad 2007) uses the concept of how illnesses are perceived by the community and how they relate to different states, while Frankenberg (1986, cited in Ingstad 2007) talks about a cultural performance that includes the symbolic and instrumental aspects of illness. Mæland (2009) draws together these three concepts with three disease understandings:

- the objective or the biomedical model of disease
- the subjective or psychological model of disease
- the social or societal model of disease

#### *2.1.1.1 The biological model of disease*

The biomedical model of disease is built on the belief that the body has a natural condition, where the imbalance from normal condition leads to disease. If you use the term 'normal' based on what ought to be, you take the basis of an 'ideal' person, which according to supporters of the model, can be found by means of research (Mæland 2009). As this has not yet been possible, one can use a different method, which is based on 'the average'.

Biological phenomena often relate to a normal distribution, and often one adopts the normal state if it is within two standard deviations from the average. An example would be measurement of over- and under-weight. However, deviations from the mean are not always the same as disease. The average results are therefore not always useful to help understand how things should be (Mæland 2009). One should be aware of this, especially in quantitative research and particular in mental health research, where it is almost impossible to determine whether or not a person is within two standard deviations of the mean due to the highly subjective diagnostic and measurement methods. In addition, there are big cultural differences between what is considered 'normal' and not. Gananath Obeyesekere (1985) raises questions such as how to deal with entire groups of people who experience symptoms of depression, even when they themselves look at the reactions as a natural part of life. When the characteristics of a good Buddhist are the same characteristics described for the western depression diagnosis, who is right? (Obeyesekere 1985). It is therefore very important to consider the context when talking about what is normal or abnormal, and that a definition of normal as outside or within two standard deviations is useless in many situations.

The biomedical disease model can also be viewed in light of positivism. Positivism is characterized by data collected through observation and measurement of what we know exists and what we directly experience. Generalization and laws can only be produced from the testing of hypotheses, which can be "converted" to the theories and laws about the world. Theories can never fully be validated, but approved until the contrary is proved (Hubbard et. al. 2005). Within health geography, i.e. the study of health and disease in relation to place, the positivists are interested in what is observable and measurable and spatial distribution and mapping of disease and other health statements is a key task. The goal is to find patterns for areas, where people are reduced to numbers. Essentially positivists are interested in describing and explaining the spatial distribution and patterns of disease and health (Gatrell & Elliott 2009). Within the biomedical model, there is a clear boundary between being sick and being healthy, and all diseases are considered to be a universal biological phenomenon (Mæland 2009). All diseases can be explained in terms of specific causes, where the disease is a deviation from the normal biological function. One of the main contributors in this mindset is the naturalist Christopher Boorse.

According to Boorse (1977) health is the same as a normal function, where normality is determined statistically and function is biologically determined. Health and disease concepts are independent of values, and disease can be determined based on scientific studies (Nordenfelt 2007). This way of thinking is based on Rene Descartes distinction between the 'soul world' and the physical or material world. In this way, the body can be studied objectively. When it comes to mental and physical health, there is no distinction according to Boorse, as mental health is also identified by the presence of mental functions. This has of course been criticized since needs, emotions, attitudes, etc. vary between cultures, times and places. Although there are documented neurochemical changes in the brain during depression, one cannot reduce depression to simply a physical illness. And it is worth noting that drug therapy, psychotherapy, placebo therapy and cognitive therapy all affect severe depression. This suggests that one must have a more holistic view of how human psychology and biology are linked together (Eknes 2006). The biomedical model has also been criticized for not being independent of value. For example, Mæland (2009) mentions that Boorse's choices of physiology as a platform is a value option itself.

#### ***2.1.1.2 The subjective model of disease***

In the subjective model of disease, disease is subjectively defined, meaning that the patient is

sick if he or she feels sick, even if they based on biological factors do not have any disease. In other words we are talking about the illness concept mentioned above. The experience of disease is affected by the culture and the individual's own experiences and knowledge (Mæland 2009). As an example, there is a large difference between individuals as to what one interprets as disease. For some a common cold is enough to feel ill, while others are not ill before they are bedridden.

In the case of mental health, the subjective model of disease is very relevant, since the diagnosis is not based on objectively measurable data such as blood tests, etc. For example, in questionnaires such as the Hospital Anxiety and Depression Scale (HADS), subjective statements such as *"I feel cheerful"* are the main basis for measuring of depression. HADS scores will be used as a measure of depression in this dissertation. The problem with these questionnaires and health indicators is that different people have different definitions of both answers and questions. This means that if one could objectively measure the opinions of the participants, it could be that person A answered *"strongly disagree"* while person B said, *"somewhat disagree"*, despite that they had exactly the same feeling of being or not being in a good mood. This is because people have different thresholds to express depression, depending on personality type, social support, employment, etc. In addition to the subjective diagnosing methods there is also a problems connected to where the boundary lies between what is a depression and what is a natural reaction. If you have experienced a death of a close family member, how long can one be sad until the "natural reaction" goes into a diagnosis?

### **2.1.1.3 The social model of disease**

Disease in the social disease model is defined by Talcott Parsons. He talks about disease related to the concept of role, where according to Parsons (1951) there are four characteristics of the sick:

1. The sick are exempt from normal responsibilities
2. The sick cannot be cured through will since the disease is not self-inflicted - the disease is dependent on help from others
3. The patient must have a desire to be healthy
4. The patient must seek competent assistance

The Parsons model has been criticized with regard to fitness for mental health. Physical illness is a physical "wrong" with bodily function and the patient will consult a doctor as soon

as possible (Segall 1976). When it comes to mental health, seeking help is more complicated, since the social norms associated with the sick role are uncertain. On one hand, one is expected to seek help, while on the other, there is the risk of stigmatization (Segall 1976). In addition, there is a tendency among the depressed to think that they are not worth the health service resources and that they feel ashamed (Eknes 2006). This may partly explain why only 1/3 of individuals with significant mental health problems sought help for health problems in Norway in 2008 (Nes & Clench-Aas 2011). The point of exemption from duties is also criticized as it turns out that helplessness and passivity reduces the chance for recovery (Segall 1976). And as I will elaborate later, participation in work and physical activity help to prevent mental illness.

Within the social model of disease Sarah Holloway (2005) looks at how disabilities can be seen either as a personal tragedy that requires sympathy from society, or as a product of social structures in which the social and physical environment, creates or affects the disabilities (Holloway 2005). Health and disease are thus socially defined depending on time and place, and where different cultures and different individuals have different understandings of the concepts. Illness is defined through social processes, and various diseases can have different status. Mental disorders are particularly placed among the diseases that are often perceived as self-inflicted, and thus have a lower status than, for example cancer (Segall 1976, Mæland 2009). Society may not accept depression as a disorder and instead ask the patient to "pull themselves together". This can make the patient reluctant to seek help or to talk about their problems.

This disease model is close to the thoughts of structuralism and structuration theory, where disease is explained on the basis of overall social structures. With this way of thinking it is not depression itself that is interesting, but the politics around it. According to Marxists the individual's health is controlled by structures, and people are passive "puppets" (Hubbard et al 2005). Low activity levels can thus be explained by lack of access to the training arenas, rather than personality factors and behavior. Anthony Giddens (1984) on the other hand believed that social structure and individual action should be seen as a duality rather than looking at the individual as a victim of the overall structures. The structure of society is in this way conditioned for human action, but also a result of the same actions (Gatrell & Elliott 2009). In other words, activity will be dependent on a suitable venue, but behavior can also

affect the environment where increased physical activity creates demands for a training ground.

### **2.1.2 Health as wellbeing**

Health as well-being is a positive concept of health. Well-being can be interpreted as experienced well-being (subjective) or actual well-being (objective). WHO's definition from 1957: *"Health is a state of complete physical, mental and social well-being"* (World Health Organization, 1957) is an example of this. This definition has been criticized in several areas. Firstly, such a state is not possible to achieve, and secondly, it may be that social factors are also linked into the health concept, since life in general is being medicalized (Mæland 2009). Requirements and expectations will therefore exceed what the healthcare system should be responsible for (Helse- og omsorgsdepartementet 1999). However, what is positive with this definition is that it also emphasizes the subjective, psychological and social sides of disease, and that health is something more than absence of disease (Ingstad 2007, Mæland 2009).

Under this definition of health, the concept of quality of life becomes relevant, especially under the Næss (2001) definition where quality of life is treated as mental wellbeing. Mental well-being in this context refers to the feeling of joy. The term is thus broader than the mental health concept which mostly emphasizes negative experiences. Positive and negative experiences can be considered as independent components of mental well-being, one does not exclude the other (Næss 2001). According to Bradburn & Caplovitz (1965) positive feelings (positive affect) and negative feelings (negative affect) are not correlated with each other, though both were individually correlated with happiness measurements. In other words, it is possible to have high quality of life while you are mentally ill. Also Jørgensen (2009) highlights how people with good health do not necessarily experience the highest quality of life.

### **2.1.3 Health as ability**

Health as an ability, where health is perceived as a trait of character is the last health interpretation Mæland uses. Health is here regarded as a resource for achieving goals in life. A variant within this understanding is looking at health as a stable intrinsic feature in the individual, in which health can be broken down or built up through life. Another variant sees health as the ability to adapt and cope with life. This is a more dynamic understanding where you don't play a passive role in the environment (Mæland 2009). Peter Hjort's definition

«Helse er et overskudd i forhold til hverdagens krav» ["Health is a surplus in relation to the demands of everyday life"] (Hjort 1987, p. 9) is such a type of definition. Lennart Nordenfelt is also an important contributor to this health interpretation, in which he links the individual's ability to achieve its goals with the surroundings. *"A is completely healthy if, and only if, A has the ability, given standard circumstances, to reach all his or her vital goals."* (Nordenfelt 2007, p. 7). Nordenfelts holistic understanding of diseases is different from the biological model of disease in three ways. First, health is not a function of inner processes, but rather a function of the person's ability to perform actions and reach their goals. Second, the biological model of disease defines health on the basis of statistical and biological terms, while the holistic understanding of diseases is linked to concepts such as culture and society. External factors can affect the human capacity to act in both positive and negative direction. The health concept is in this way tied to culture, place and time, and normality must be seen in connection to context. The third and final distinction is between defining health as the absence of disease versus the view that health may coexist with disease. In addition, the biological disease model targets are only linked to survival, while the holistic understanding of diseases also deals with other dimensions (Nordenfelt 2007). Within mental health, one can draw connections between Nordenfelt and Desjarlais health definitions. Desjarlais defines mental health as well-being which enables us to contribute to society (Ingstad 2007). Like Nordenfelt definition, it emphasizes environmental and cultural aspects. Mental health is not something that takes place inside the minds of people, but the interaction between man and environment (Ingstad 2007). In this way the environment is also of importance to define what is normal or abnormal, not only biological aspects.

## 2.2 Mental health and depression

All of the above ways of looking at health is naturally also provided for mental health. But I will now narrow the focus even more for mental health, especially depression. Mathiesen et. al. (2007) divides mental health in mental well-being, psychological distress and mental diseases or disorders. Mental wellness concerns issues like feeling satisfied with life, the meaning of life and happiness. The absence of psychological distress is not sufficient for good mental health. Here we can draw parallels to the WHO's health definition and Næss's definition of quality of life. Psychological distress refers to symptoms such as sadness, concentration issues and sleep problems, but the symptoms are not serious enough to be diagnosed as a disease. Psychological distress is measured by questionnaires (Mathiesen et. al.



2007). Mental illness or disorders refers to a situation where symptoms are so severe that it affects the function of the patient and one can make a diagnosis (Mathiesen et al 2007). In the western world there are two different systems for the diagnosis of depression, the American DSM-IV (Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition) and the European ICD-10 (Classification of mental and behavioural disorders, Clinical and diagnostic guidelines), developed by WHO. Although these may appear as objective diagnostic tools, it is important to remember that different people interpret the same questions in different ways. In addition, there will be differences between therapists in the way they make the diagnosis. In a study of British psychiatrist's ways of diagnosing, there were significant differences between the diagnoses of the same patient. Psychiatrists' attitudes towards illness and health, what was considered normal or not, were largely dependent on age and education (Copeland et. al. 1971). In this thesis the focus will be on psychological distress, specifically depression symptom measured by the HADS, and not on clinical cases of depression. It is therefore important to note that when I later talk about depression in the analysis I refer to self-reported depression symptoms and not depression as a diagnosis.

As I have previously talked about the importance of the cultural aspects of mental health, and since this study deals with depression in a Norwegian context, it is natural to use a western model when talking about depression. In everyday language we talk about a feeling of sadness, whereas when using depression as a diagnosis it is related to a person's whole mental state - that is, depression as a disease with cognitive, behavioural and physical symptoms (Nielsen 1995). The distinction between "normal" and pathological is very difficult and vague, but usually the difference is that clinical depression requires treatment. This definition gives however few indications of where to draw the line, and various researchers and practitioners can draw the line in different places. Therefore, it is better to think of depression as a continuous phenomenon from the normal at one end, to the sick at the other (Nielsen 1995). Although depression is the term for a variety of disorders with different causes, there are still core symptoms that are found in most patients (Eknes 2006). Depression is characterised by sadness, loss of interest and decreased energy levels. Also, loss of self-esteem, guilt, suicidal thoughts, impaired concentration, and problems related to sleep and appetite are all symptoms of depression. Such feelings are a natural part of life, but if the symptoms persist for at least two weeks, one can speak of a clinical depression, according to western criteria. Depression is often graded in severity from mild to severe (WHO 2001),

yet it is integral to remember that not even mild depressions are easy to live with (Eknes 2006).

Depression often occurs several times during a lifetime, with each episode lasting from months to years, with normal periods in between. There is also a chronic form of depression with somewhat milder symptoms - dysthymia. While unipolar depression is characterized by only depressive symptoms, bipolar depression is a condition with alternating depressive and manic episodes (WHO 2001). It has been shown that there are different genetic factors underlying these two types of depression, in which genetics has a significantly greater role in bipolar depression. In this task, it is not possible to distinguish unipolar from bipolar depression types, but as the bipolar group is as small with between 1/10 and 1/20 of all diagnosed patients (Nielsen 1995) I assume that this will not affect my results in either direction. Previously people distinguished between reactive versus endogenous depression. The reactive depression was caused by reaction to life's difficulties, while endogenous was depression originating from within. The term reactive depression was usually used for the mild depressions, while severe depression often was categorized as endogenous. The problem with this division is that research has not shown any actual biological differences between the two groups. Most people today agree that depression is a combination of biological and psychological factors, and that only the bipolar depressions are largely genetically determined (Nielsen 1995).

### **2.3 Triangle of Human Ecology**

Meade & Earicsons "Triangle of human ecology" (fig. 1) sheds light on risk factors for disease based on multiple explanations and therefore it contains important elements from several of the disease understandings above. In this dissertation it will be used as a framework to elucidate risk factors associated with depression. The model is intended to illuminate the human condition based on three components: population, environment and behaviour (Meade & Earickson 2000, Meade & Emch 2010). It is important to note that the three components interact and work together. For example, environmental factors have different effects on health in different gender and age groups. And even if the behaviour is often seen as the individual's own choice, the environment is shaping the choices you make, as detailed below.

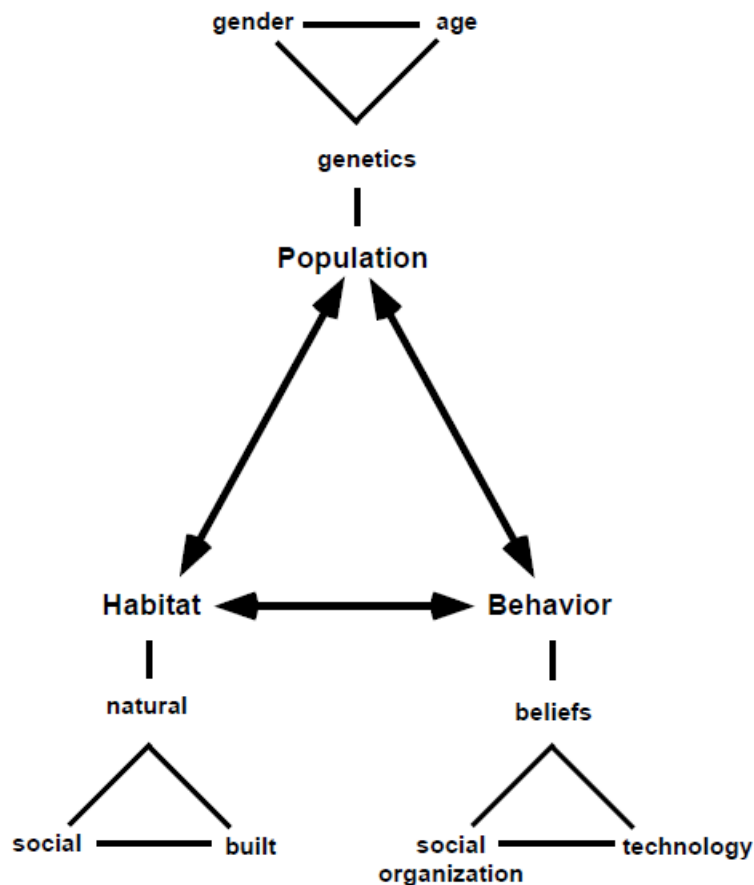


Figure 2.1 Triangle of human ecology made by Meade and Earicson 2000, show “state of health” based on behaviour, habitat and population factors

### 2.3.1 Population Factors

The population aspect represents the biological aspect of the disease, where genes, age and gender play a role as risk factors (Meade and Earickson 2000). This part of the triangle can be said to have a positivistic focus, as it is mainly concerned about measurable and observable parameters, where the explanation behind the disease has many similarities with the biomedical model of disease. Examples in mental health may be that women have more mental health problems than men and that mental health issues are related to different stages of life. In the report, "Psykisk helse i Norge" [Mental health in Norway] from 2011, lifetime prevalence of major depression is estimated to be 19.7% for women versus 11.0% for men. It has also been shown that women are more prone to anxiety and depression when it comes to the influence of negative life events and environmental stress (Sandanger et. al. 2004). When it comes to age, it is especially young women who report frequently report mental distress symptoms. Alcohol consumption is also greater at a young age, particularly for men (Nes &

Clench-Aas 2011). The genetic aspect concerns the fact that some mental disorders such as manic depressive disorder may have a hereditary aspect (Bellivier et. al. 1998).

One important thing to note is that it is gender, the socio-cultural phenomenon and not sex, as a biological phenomenon that is used in the model. This could be criticized since this part of the model represents humans as a biological organism. To improve the model one should rather refer to sex and put gender as a socio-cultural phenomenon under habitat or behaviour as this is dependent on culture, expectations, gender roles etc.

The difference between unipolar depression proportions between men and women can be explained in several ways. The first is of a biological nature. Some types of depression are associated exclusively to women: premenstrual dysphonic disorder, depression during pregnancy and depression at menopause (Eknes 2006). But even if these do not affect men, it is not necessarily purely biological as it can also be linked to psychosocial stress during these periods of life (Nielsen 1995). It is also conceivable that the current diagnostic criteria fail to capture the men's way of expressing depression (Eknes 2006). Some argue that a proportion of men missing from depression statistics appear in the alcohol statistics (Nielsen 1995). In addition, it is possible that men express depression through irritation rather than having presence of a depressed feeling (Eknes 2006). There are also theories that women are more likely to "complain about their distress". But studies have shown that this can only explain a small part of the difference (Nielsen 1995). The last explanation is related to who men and woman are raised differently and have different living conditions in adulthood (Nielsen 1995). Among other things, women more often take on more responsibilities and have less control over work tasks at work (Sandanger et. al. 2004). In addition, the modern woman often carries the major responsibility in the home while still working full time.

### **2.3.2 Environmental Factors**

The habitat section of the triangle is also divided into three areas: the social habitat, the built habitat and the natural habitat. Built habitat means those parts of the environment are man-made, e.g. buildings and transport. The natural habitat is nature-made environmental attributes such as climate, air and landscape forms, while the social habitat is the way the society is organized and relations between people, groups or entire communities. An example would be that socioeconomic status may affect health (Meade and Earickson 2000). This part of the

triangle is close to structuralism and structuring theories, especially the social and built habitat, as these are concerned about how the underlying factors in society affect health.

### ***2.3.2.1 Noise***

The connection between noise and mental health is a good example of the built habitats effect on health. Studies conducted by Tarnopolsky et. al. in 1980 about noise from airplanes showed that symptoms such as depression, irritability and sleep problems were higher near Heathrow airport in London (Curtis 2004). But causality may be reverse; the result could also be due to the fact that people with lower social status are tending to live in areas with lower house prices. Although the relationship between noise and mental health is still somewhat unclear, there are studies that indicate that people with mental disorders are influenced more by sounds and noises (Curtis 2004). Built habitat can also influence level of physical activity, which I shall discuss in detail later.

### ***2.3.2.2 Life Events***

Within the social habitat difficult life events such as divorce, loss of job, loss of close friends or family members may increase depression (Eknes 2006), and especially within 3-12 months after the event (Paykel & Cooper 1992, in Eknes 2006). Initial depression is particularly affected by environmental impacts, which also indirectly increase the likelihood of later depression as it may increase neurological vulnerability (Eknes 2006).

### ***2.3.2.3 Social networks and loneliness***

It may also be appropriate to examine whether depression is related to loneliness, defined as lack of social support (Nielsen 1995). According to Nes and Clench-Aas (2011) the risk of mental health problems multiplies for people who have low social support. There is also a correlation between depression and anxiety and the degree of social support in a survey conducted in EU countries (Dalgard and Sørensen 2009). The quality of social support systems has the greatest impact on women's quality of life (Antonucci & Akiyama 1987). According to Paykel and Cooper (1992 in Eknes 2006) loneliness is measured in the literature in four ways: 1) the degree of intimacy related to relationship, 2) the size of social networks - both objectively and subjectively, 3) participation in community activities and 4) the help of good friends - both emotional and practical. Social networks can be divided into structural and

functional support. Structural support is the size of, and the frequency with which you have contact with the network, while functional support is whether the network has a specific function, such as emotional or tangible. Functional support is further divided into "received functional support" (actually received support) and "perceived functional support" (support available if needed) (Grav et. al. 2011). It has been shown that "perceived functional support" is more robust for the prediction of depression than network size (Lett et. al. 2005, 2009). According to the Grav et. al. (2011) survey based on HUNT 3 there is a higher degree of depression among women with low emotional support than among men. When it comes to "tangible support" the results are opposite; the depression prevalence was highest in those who lacked both types of support and in older men without "tangible support".

A study by Dalgard et. al. (1995) found that social support protects against the development of mental health problems only when individuals are exposed to negative life events and environmental stress. Social support acts as a buffer (indirect effects), and not as a direct influence on mental health - hence people with high social support have better mental health. In addition, the buffering effect is only significant for people with a lack of control over their lives. People who had high control had low depression scores, even when low social support was combined with negative life events (Dalgard et. al. 1995).

Depression has also been linked to social support at the neighbourhood level, particularly for women. Social cohesion, reciprocal exchange, residential stability, high prevalence of married people was all negatively associated with depression scores even after controlling for individual factors. In men, only the family structure was significantly associated with depression after controlling for individual factors. Social ties were not associated with depression in some of the models (Mair et al 2010). Sund et. al. (2007) have also found that level of trust associated with social capital have significant impact on depression.

In relation to family structure, the single have a lower quality of life and poorer mental health than married or cohabitants (Nes & Clench-Aas 2011). On the one hand, it may be that people with mental health problems are less likely to establish cohabitation, and that they are more likely to get divorced. However, family structure has a protective effect in several areas, particularly among men. This is related to both improved economy and social support (Nes & Clench-Aas 2011). Divorce has naturally a contrary effect. In "Levekårsundersøkelsen" [Level of Living Survey], those who lived without a partner and the divorced (together with

the poor and those without work / school) had twice the rate of mental health problems compared to the rest of the population (Myklestad et. al. 2008). In addition, living without a partner (along with lack of work / school) is the least favourable for high life satisfaction (Myklestad et. al. 2008).

It is important to consider if social support affects mental health or whether it is mental health that affects the size of social networks. There are studies that confirm the first statement, including that by Brown and Harris in 1978 in London about the intimacy with the opposite sex and the chance of developing depression (Dalgard & Sørensen 2009). Nevertheless, it is conceivable that depressed and people with social anxiety choose to isolate themselves from other people, which also is mentioned by Dalgard and Sørensen (2009). It is also possible that some people pull away from those with mental problems, both because there are some taboos surrounding mental illness in Western society, and because they may feel they do not know how to deal with mentally ill, both due to negative stigma against such groups and a substantial lack of knowledge about the topic. This can be linked to social psychological theories of prior judgments and stereotyping, where the causes can be both social and cognitive. The social causes, which are clearly most relevant to geography, are partly due to the fact that differences in social status lead to a desire to maintain this status. It may also be that some people have been brought up with negative attitudes and that social institutions such as the media and politicians may support social prejudging (Myers 2008).

When it comes to social networks, an area of interest is whether animals can have any impact on the mental health, especially if there are weak human social networks. There have been varying results in previous studies, and there are three different hypotheses about the relationship between pet ownership and health. The first is that there is no association, but rather that personality traits, age, economic status and health affects likelihood of owning pets, and that therefore there is a false relationship between the two factors. The second hypothesis is that owning animals lead to increased social interaction with other people and thus indirectly affects health. It is also conceivable that pet ownership has a direct effect on health by reducing the experience of stressful environmental factors and protecting against anxiety and depression (McNicholas et. al. 2005). Although animals cannot be seen as a replacement of social support from people, it is shown that the support of animals in some degree reflects human support (McNicholas et al 2005). In a study by Siegel (1990) about the protective role of pets during negative life events among the elderly, it turned out that owning

a pet led to fewer doctor visits in response to negative life events and reduced stress. In particular, owning a dog was positively related to stress reduction. Relationships between humans and dogs were very different than between humans and other animals, in that the owner was talking more with the animal, and spent more time outdoors. Although increased physical activity could conceivably explain the stress reduction, time spent with the animal is probably more important, when greater connection with the pet has been shown to be associated with better mental health. Dog owners spend considerably more time with their pet than any other animal owners (Siegel 1990).

#### ***2.3.2.4 Childhood***

Not only current social relations and environmental conditions can affect depression. Events in childhood have particularly been shown to influence depression in adulthood. Child neglect, trauma, and abuse increase the risk of developing depression. This is because one often develops feelings of guilt, low self-esteem and learned helplessness in with such issues (Eknes 2006). But conditions like a strict and cold upbringing or if the child did not feel loved, can also affect the risk of later depression. Relationship to the nearest caregivers in childhood can also affect vulnerability to rejection and dependence, which is associated with increased risk of depression from stressful life events (Eknes 2006).

Early loss of caregivers has also been linked to the development of depression in adulthood, although research in this area is conflicting. According to Brown and Harris (1978, cited in Eknes 2006) there is an increased risk of developing depression if you lose a parent in childhood, although Lewinsohn (1994) found no correlations.

#### ***2.3.2.5 Socio-economic status***

Education, income and occupation are the three most important measurements of socioeconomic status (FHI 2005), which is closely related to people's health (Gatrell & Elliott 2009). Occupational status measured by educational qualifications show that people in the lower status groups have a higher prevalence of health problems (Krokstad & Westin 2002). Within the social environmental, working conditions and the working environment may therefore also be of importance when it comes to mental health. Working conditions can be both a protective factor and a risk factor. According to Mykletun et. al. (2009) people who feel they cannot cope with the demands at work are more often affected by mental illness. This applies particularly to women; who often have less control at work while at the same



time take on more responsibility. Shift workers are also at risk of developing depression, partly because of hormonal changes and partly due to less participation in society (Eknes 2006). But most often work acts as a protective factor for mental health as it gives self-esteem, connection to social networks and better economy. In “Levekårsundersøkelsen” from 2008, it turns out that having been out of work increases the risk for major depression (Nes & Clench-Aas 2011). Results from the “Levekårsundersøkelsen 2005”, which focuses on vulnerable groups, shows that social security recipients had about four times higher rate of psychological distress compared with the rest of the population (Myklestad et. al. 2008). In most cases being on welfare is often seen as a consequence rather than a risk factor for psychological distress, but psychological distress may be enhanced by being in that situation (Myklestad et. al. 2008).

Education is also used to measure socio economic status. Education affects health in different ways. First of all it is a way into the working life, and therefore indirectly gives people more resources and a secure economic future. Secondly increased knowledge together with a good economy makes it easier to make good lifestyle choices. According to “Levekårsundersøkelsen 2005” there is an association between low education and the risk of developing mental problems. This could be due to lower feeling of achievement, a poorer economic situation and social isolation (Myklestad et. al. 2008). In this thesis education is used as an aggregated factor. Therefore it will probably affect health in a different way than if it was an individual based factor. Using education as an aggregated factor with individuals as unit of analysis (chapter 5) you could get a position effect – where people feel bad or good about their position in the social hierarchy. A more educational egalitarian society may also lead to “blame the victim” or self-blaming mentality (introvert blaming). In ‘educational poor’ areas it is possible to blame external factors like poor educational facilities etc., while in highly educated areas it may be more stressful to be the non-educated. When using education as an aggregated factor with area as the unit of analysis (chapter 4), there is a chance for a higher prevalence of depression in ‘education rich’ areas if this leads to a larger gap in income between the high and low educated people – i. e. the Wilkinson hypothesis (Wilkinson 1996). It is however also possible that a high proportion of educated people will give the society as whole more resources which again indirectly might lead to better facilities, less crime, etc., and that this again will lead to less depression amongst individuals in these areas.

#### *2.3.2.6 Climatic conditions*

Some studies have shown an association between climate and disease, both physical and mental (Fretland 1998, Cunningham 1979), and when it comes to natural habitats darkness and depression are an interesting example. Seasonal Affective Disorder (SAD) has been much debated. Hansen et. al. (2002) has in several studies found no correlation between light, climate and prevalence of depression, and in the Finnmark III study the prevalence rate of depression is highest during the spring not the winter (Hansen et. al. 2002). Knudsen and Mc Mahon (2010), however, have found a relationship between genes and SAD, where people with short alleles (particular version of the DNA sequence) were clearly influenced by seasonality.

Furthermore, the weather can affect depression. The barometric pressure, humidity, winds and amount of sunlight has been shown to affect the mental health and behaviour (Cunningham 1979). Among other things, there is a correlation between low humidity, barometric pressure and an increased amount of sunshine and "atmospheric pleasantness" (Winslow & Herington 1936). Climate variables, especially seasonally, are probably also a contributing causal factor for suicide (Dixon & Kalkstein 2009, Cunningham 1979). Lester (1970) found a relationship between months of snow in the winter and suicide frequency.

#### *2.3.2.7 Urbanity - rurality*

Most European studies show a tendency towards a higher incidence of depression in urban rather than rural areas, although research findings are not entirely clear (Lehtinen 2002). Urban and rural areas can be divided by observable variables such as land use, employment, population size and density where the reasons for differences between depression proportions may be due to noise, access to recreation areas, pollution, etc. But they cannot solely be explained by such functional and geographical measurements. The concepts of urban and rural can also be seen as socio-cultural terms - which assumes that population size affects the socio-cultural conditions in the region - that is that high dense populations provide an urban society characterized by anonymity, dynamics and inequality, while rural areas are characterized by stability and social care (Berg & Dale 2004). For example, it is possible that higher levels of depression in urban areas are due to weaker social networks which in turn are due to the high density of people and a greater degree of anonymity. A final understanding of urbanity and rurality is based on constructed categories. The image of the "modern and

diverse city" is often set against the "boring, traditional village." The second mindset looks at the countryside as an idealized place with high degree of social welfare, peace and health, while the city is seen as dirty, noisy and unhealthy (Berg & Dale 2004). With this view, one can perhaps explain depression based on the fact that place perceptions affect health since they influence our actions, and influence on who lives where. Research from England has shown that the well-educated, affluent middle class people move to the countryside to "live the good life" (Fylkesplan 2000). Then depression prevalence in rural areas may be explained by individual factors in those who take up residence in the countryside, rather than physical attributes of the landscape.

Even though I in this study make a division between rural and urban areas, it is important to note that urbanity-rurality should be seen as a continuum. Some urban municipalities have more rural areas, so called "over bound cities", where the urban centre is less than the administrative city limits. Also some rural municipalities have areas where people are living in more urban environment. At the ward level the difference between urban and rural is more distinct.

### **2.3.3 Behavioural Factors**

The last dimension in the model is behavioural factors. This covers faith, social organization and technology. Behaviour is defined as what can be observed in the culture, behaviour towards each other, nature, technology, belief systems and social norms (Meade & Earickson 2000). When linking behaviour with mental health, it is natural to include factors such as personality characteristics, physical activity, and alcohol and tobacco habits.

#### **2.3.3.1 Personality**

Personality factors can influence mental health. For people who are very shy and reserved it can be difficult to establish and maintain social relationships, which contribute directly to depression (Eknes 2006). People who have a high degree of nervousness have more depression than others. Nervousness can also be part of an anxiety disorder, which has high comorbidity with depression (Eknes 2006). Personality characteristics are measured in HUNT 3 with a range of questions from Eyesenck Personality Questionnaire (EPQ). The original EPQ measures the dimensions E (extroversion), N (neuroticism), P (psycoticism) and L (lie scale) (Cheng & Furnham, 2003), but HUNT 3 measures only the dimensions of E and N.

Cheng and Furnham (2003) found a correlation between the extrovert personality traits and self-reported happiness, depression, negative affect and positive affect. Neurotic traits also proved to correlate with the same factors. But this does not mean that depression and feelings of joy are opposites since extroversion directly influenced joy, but not depression (Chung & Furnham 2003). This also supports the views of Næss (2001) and Jørgensen (2009) about life quality.

### *2.3.3.2 Physical Activity*

Physical activity improves mental health, and has particular impact on depression. In the “Levekårsundersøkelsen 2008”, physical inactivity was shown to be a greater risk for depression than low social support (Nes & Clench-Aas 2011). The reason is complex. Martinsen (2000) cites four different hypotheses. The biological hypothesis states that the increase in serotonin and endorphin levels in the brain contributes to a feeling of excitement. Anthropological hypotheses highlight how we are designed to be hunters and gatherers, and that physical inactivity is unnatural and therefore will lead to health problems. Psychologically, training can provide a sense of empowerment or distraction, which is identified by WHO as one of the goals of mental health (Nes & Clench-Aas 2011). In addition, there is a hypothesis that the transient increase in body temperature has a beneficial effect on mental health (Martinsen 2000). Yet it is also possible that the causal relationship also goes the other way, i.e. that mentally healthy people are more often physically active due to more energy for training in the first place.

Physical activity is not exclusively related to behaviour, due to the fact that built environment may influence physical activity, especially for women (Krenichyn 2006). Nature landscapes, hills and the presence of other athletes increases the likelihood that women participate in physical activity. Also feeling of security is an important criterion for women to use outdoor areas for exercise. In a survey done in Prospect Park in New York, it turned out that the park served as a physical fitness arena, but also as a mental "escape" from the city life and social meeting venue. The park was an important feature especially for the poor since other activities were not available (Krenichyn 2006). In other words, outdoor areas are affecting mental health in several areas, and we may here speak of "therapeutic landscape". Whether it is exercise alone or whether it is the natural environment on site, or a combination that improves the mental health is not studied much, but a survey has shown psychological benefits of

natural environments versus city scenery (Krenichyn 2006). This is also supported by a Norwegian study of Vogt (1987) where it appears that people who live in communities affected by pollution and noise are less physically active. However this could also be due to selective migration.

#### ***2.3.3.3 Drinking habits***

Alcohol consumption is also linked to mental health. Although causality is difficult to find, there is reason to believe that alcohol plays a significant role in depression (WHO 2004). This is because among the general population, a higher consumption is associated with greater symptoms of depression. Even among patients in treatment for alcohol dependence the prevalence of depression is higher than in the general population (WHO 2004). The direction of causality is somewhat uncertain, but abstinence removes depressive symptoms in alcohol abusers within a short time, suggesting that alcohol plays a significant role in depressive disorders (WHO 2004). Alcohol consumption has varied considerably over time. In Norway the use of alcohol is relatively low compared to international figures. Comparing the levels from 1998, 2002 and 2005 (“Levekårsundersøkelsen”), alcohol consumption in Norway is relatively stable, but the proportion that drink more than 3 times per week has increased (Nes & Clench-Aas 2011). If you look at total consumption for all groups from 1996 to 2007 there has been an increase of 31% (Mykletun et al 2009). How many people will suffer from alcohol abuse or alcohol dependence during their lifetime varies in the literature from a quarter (Mykletun et. al. 2009) to a tenth (Myklestad et. al. 2008). “Levekårsundersøkelsen” in 2005 showed that among lifestyle factors, alcohol dependence was the strongest predictor of psychological distress (Myklestad et. al. 2008). Although alcoholism has a high degree of heritability alcohol consumption is heavily influenced by environmental factors. The number of people with alcohol-related problems is related to the average consumption in the population. Although alcohol is often seen as an individual factor, there is need for intervention at the community level to reduce alcohol-related problems, since behaviour is socially determined (Wilkinson 1996, Mykletun et. al. 2009).

#### ***2.3.3.4 Tobacco habits***

Tobacco habits have a major impact on mental health. Most studies focus on smoking, but in this dissertation snuff will also be considered due to increasing consumption in Norway (FHI 2011). According to Mykletun et. al. (2009) there is an association between smoking and

depression. “Levekårsundersøkelsen” from 2005, shows the strongest correlation between psychological distress and daily smoking (together with alcohol addiction and mental health problems). The association between daily smoking and psychological distress was also significant by logistic regression analysis (Mykletun et. al. 2009). Again, it is difficult to comment on the cause of order. Previously it was thought that depressed people smoke more (WHO 2001). Lately, however, several studies have concluded that smoking increases the risk of depression, and there is observed a fourfold higher risk of depression for heavy smokers versus non-smokers (Klungsoyr et. al. 2006). Among teenagers who are depressed, there is also a higher prevalence of smoking before symptoms of depression (WHO 2001). The reason why there is such a strong association between depression and tobacco use are not clearly known, but one explanation may be that nicotine activates reward centres in the brain and increases dopamine levels in the part of the brain related to mental disorders (WHO 2001).

## 2.4. Health and the importance of location

### 2.4.1. Place

It is common to regard the concept of place as having mainly three different meanings in geography, defined by John Agnew (Castree 2009):

- place as *location*
- place as *sense of place*
- place as *locale*

Place as “location” is the oldest meaning of the term, and can be seen as a background frame. It is the external natural, physical and material that are of importance. This way of viewing place has an objective basis and quantifiable and visible aspects of place are the main focus (Berg & Dale 2009). To simplify, one can say that place as location is a specific point on Earth's surface, a container where individuals and physical and social environment are composed (Jørgensen 2004, Castree. 2009). Place as “sense of place” adds emphasis on the inner, subjective and experience-related attributes about place. Having a subjective basis means that individual's experience is linked to the place, and the place gives people identity (Berg & Dale 2009). Place is seen as a thought structure. The last approach is place as locale, based on the theories of Anthony Giddens, which try to bridge the gap between the subjective

and objective interpretation of place. Place is seen here as a social context, or a meeting place between individuals and structures. Giddens argues that structures both sets limits for individual actions, as well as being a result of the same actions. In this way structures are created and recreated in a social process (Berg & Dale 2009). Traditionally, place as location has been the basis for health geographers. And also in this thesis place will to a large extent be seen as a background frame, since I will identify mental health in relation to residence. The discussion will however be affected by the locale approach to place.

#### **2.4.2. Context or Composition?**

When trying to explain health disparities between places one can talk of either composition or context. Compositional explanations emphasize that differences are due to the composition of individuals and their characteristics. Areas with high health risks are the result of a high number of individuals with high health risks. Population health is thus an aggregate of differences at the individual level. Contextual explanations on the other hand are based on the place itself as an explanation to the health risks among individuals. Social and physical environmental factors will thus have an impact on population health (Curtis 2004, Shaw et. al. 2002, Macintyre & Ellaway 2003). To exemplify this, one can imagine that if the composition explanations correspond with reality, death rates among "similar" people should be independent of place of residence. If contextual explanations are applicable, death rates among "similar" people should depend on the residence (Macintyre & Ellaway 2003). This is a very relevant discussion within geography as a focus on the place itself as a health risk is highlighted.

Factors considered to be compositional include age, gender, individual health behaviours, social class and income. Contextual factors are associated with access to health care, climate conditions, percentage of unemployment in an area, settlement type, rurality / urbanity, social network and proximity to attractive buildings, environmentally green areas, open space and walking areas. It is not always easy to draw a clear distinction between context and composition. High unemployment among individuals may be a result of the labour market situation in a place (Shaw et. al., 2002). In addition, it has been shown that individual factors such as smoking depend on gender, class and the number of smokers in the local area (Duncan et. al. 1996, 1999, cited in Shaw et. al. 2002). The distinction between composition and context is therefore not straightforward. Curtis (2004) believes that composition and

context should be seen as inter-related rather than independent. Ethnic composition of a population is a result of the ethnic identities of individuals. However, the concentration of a particular ethnic group influences the ethnic identity of a whole society. This can manifest itself in through physical attributes such as ethnic shops, community centres etc. In this way, the ethnic profile of a community is more than just the sum of individuals in the area, as the site itself will contribute to the sense of identity among the inhabitants. According to Curtis (2004), composition and context mutually influence each other. This way of thinking is a parallel to Giddens's theory of locale as a meeting place between individuals and texture. Also the writings of Macintyre and Ellaway (2003) are critical to the very marked distinction between compositional and contextual explanations. People create places, but places also create people. Which job you have will depend on individual choices but site factors such as local labour market, educational level, access to transportation and housing market will also be highly important. Related to unemployment and depression it would be possible that unemployed people feel differently about their situation in different places. It would be more “accepted” to be unemployed in a society with high unemployment, which could lead to a reduced risk of depression compared to unemployed people in an area with very high employment rates. This is also based on Wilkinson’s theories (Wilkinson 1996).

As to the question of how context affects the health, one often distinguishes between physical environment and social context. Physical environment include elements as pollution, climate and geological factors (Shaw et. al. 2002, Macintyre & Ellaway 2003). The Chernobyl accident is a good example of how the physical environment can affect health. In addition to the purely physical effects of radiation, the mental strain of living in such an area probably has even greater effect on health (Shaw et. al. 2002). Another example would be how climate can affect mental health. In the northern hemisphere, the days get shorter in the winter, and as stated above access to natural light can affect the mental health (NHI 2011). We see here that physical factors can affect health at different geographic levels.

Social context covers a variety of physical and material factors (type of housing, access to facilities, food services), access to health services, equality within the community and social networks. Access to various grocery stores and food selection (price and quality), may influence the health behaviour of residents, especially individuals with low mobility who will be affected if options are reduced. Similarly, the proportion taking part in physical activity may be influenced by access to facilities that promote activity (Shaw et. al. 2002). To separate



the physical and social environment, like the distinction between composition and context, is not unproblematic. The physical geography of a place determines which type of industry will be located in the area which in turn affects population, land use and type of built environment. Physical facilities are often located in specific places because of the social context. Prisons, landfills and mental hospitals are often located in areas where the population does not have the resources to "resist" them. In addition, facilities such as schools, shops, and clean streets affect the "feel-good" sensation about the place, whilst crime and vandalism can have the opposite affect and lead to closure of such facilities (Macintyre & Ellaway 2003).

A problem related to the study of area effects is how to draw boundaries. Classifications of neighbourhoods may not match the residents' perception of boundaries. The same problem can apply to the classification of different groups. The context can also affect the inhabitants in two different ways, either by the same people residing in the same places, or that the context itself creates individual characteristics (Shaw et. al. 2002). The "Breeder and drift" hypothesis may be an illustrative example in relation to mental health. The breeder hypothesis states that environmental attributes, such as socio-economic deprivation or geographic concentration of vulnerable groups, increases the risk for mental health problems in some areas. Less attractive residential areas, run-down neighbourhoods and lack of recreational areas, combined with noise and air pollution may lead to mental health issues. The drifting hypothesis however, emphasizes that people with poor mental health and vulnerable personality move to more anonymous and cheaper parts of town, so called selective migration (Curtis 2004). This phenomenon will be a function of cities of different sizes. For example, it is assumed to manifest stronger in Oslo than Trondheim and stronger in London than in Oslo, both due to size and due to various social welfare systems. A study by Dalgard and Tambs (1997) on urban areas and mental health found that in parallel with the improvement of the social environment in an area of Oslo, there was also increased positive mental health of the residents. This supports the breeder hypothesis, i.e. that the environment is important for mental health (Dalgard & Tambs, 1997).

The "Breeder and drift" hypothesis is initially most relevant to the major cities in England and America. In relation to North-Trøndelag, Leighton theory (cited in Sørensen et. al. 2002) on socio-cultural disintegration will be of greater relevance. A disintegrated society is a society where social communication and social structures are degraded. There are no clear leading figures and economic activity may be impaired. People have poor communication with each

other and social networks are weak or absent. The local community is no longer a place for growth, fulfilment and recreation. In summary, the disintegrated society is a society without the ability to secure social support among members (Sørensen et. al. 1996). Leighton placed various communities along a disintegration-integration dimension, and correlated this to mental health. One of the communities were transformed from disintegrated to integrated, with consequent reduction in mental health problems, suggesting that environmental factors are important for mental health (Sørensen et. al. 2002). The study from Nova Scotia in Canada also provides a good illustration of social disintegration and mental health. Local communities with different religious and cultural traditions, lack of leadership, depopulation, weakened social networks and failing businesses had more mental disorders (Dalgard et. al., 2002). In rural municipalities in Norway there have been similar correlations, with higher proportions of psychological distress associated with a weak labour market. This is found in both elderly men in industrial towns where there has been a downsizing of the cornerstone company, as well as in older women in municipalities with reduced fishing industry (Dalgard et. al. 2002). Sørensen (1979, cited in Dalgard et. al. 2002) also found higher proportions of psychological distress in the commuter municipalities versus agricultural municipalities in eastern Norway.

In the Norwegian context, Ødegaard and Dalgard (Sørensen 2002) examined mental health conditions and migration. Dalgards explanations are aimed at the social context (similar to the breeder hypothesis), while Ødegaard has emphasized the vulnerability of individuals (corresponding to the drift hypothesis). Of the recent research in the field, Sørensen et. al. (2002) found that integration of the community is strongly correlated with good mental health for the population in some communities in Lofoten. They found that personal social networks and community networks have separate and overlapping explanations in relation to mental health. This is explained by the fact that in small places, most of the culture, social life and work take place within the same geographic area, and thus you will have overlap in different functions and roles. Yet the community is acting as an independent effect on mental health as well (Sørensen et. al. 2002), which again points to the breeder-hypothesis, and thus once again emphasizes the importance of place in relation to health. It is also possible that individuals' mental health can affect the local community, particularly if leading figures or other strategic parts of the network are affected (Sørensen et. al. 1996).

## 3.0 Method

In this chapter I will in 3.1 first introduce what will be done in this study, and then I will further introduce the data material and issues connected to using secondary data. Thereafter I will in chapter 3.2 say something about validity, reliability and representativeness of the study before I in 3.3 will do an operationalization of all the variables. In 3.4 and 3.5 I will go through the statistical- and GIS methods used in the study before I finish of in chapter 3.6 dealing with some methodological issues.

### 3.1 About the study

The first part of the study aims to identify possible geographic patterns of depression. I will also make maps of the distribution of other area variables like rainfall, population distribution, urbanity etc. since these factors will have an indirect effect on health.

In the second part of the study I will examine individual-based associations between the outcome variable, depression (HAD score, based on the Hospital Anxiety and Depression Scale), and associative variables (smoking, alcohol intake, physical activity etc.) using logistic regression analysis.

This study is mainly of *descriptive* nature, that is, that I will make description of the units (Hellevik 2003). This requires a high representation in the selection of items in which I will return to later. It is not possible to say anything about causal relationships, i.e. *the explanatory approach*, since this requires information about the temporal ordering between variables which is not available in a cross-sectional survey.

#### 3.1.1 Individual data from HUNT 3

The data of this thesis is based on the Health Survey of Nord-Trøndelag (HUNT). HUNT is one of the largest health surveys in the world, in which all citizens of the county over the age of 13 are included. Several different sampling methods have been used: clinical examination, interview, blood and urine samples and self-reporting by questionnaire. My thesis concerns mainly the variables collected through questionnaires. There are also some variables, relating mainly to work, that are collected through interviews and then quantified.

The data from the HUNT study was collected in three different periods, and in addition, it is conducted a separate survey for youth. HUNT 1, which is the first health survey was conducted from 1984-1986, HUNT 2 is from 1995-1997, while the latest survey, HUNT 3, from 2006-2008. UngHUNT, which is the name of the youth survey, was collected in the periods 1995-1997, 1999-2000 and 2006-2008.

Noteworthy for these data are the number of participants:

- HUNT 1: 75 000 participants (88 % show percentage)
- HUNT 2: 74 000 participants (70 % show percentage)
- HUNT 3: 58 000 participants (56 % show percentage)

As some people participated in several of the studies, there is health information about 126,000 different people in the database (HUNT 2009).

The size of the HUNT database is one of the major strengths of the data, as there is a clear positive relationship between sample size and statistical power as well as population representativeness. Random errors, i.e. differences between sample and population due to collection procedures, can also be corrected by increasing the sample size (Bryman & Cramer 2009). This means that the benefits of the size of HUNT 3 greatly outweigh the weaknesses in the collection procedure.

The age range in the data is wide; as mentioned all aged 13 and older are represented. Since I will only use adult-HUNT, the age ranges from 20 years upwards. I could also have chosen to only use the population between age 30 and 70 to make the life situation of the people in the sample more similar and also avoid psycho geriatrics. But the reason I have chosen not to do this is because former theories have connected different aspects of mental health to the youngest and oldest part of the population, and I would therefore potentially lose important sample heterogeneity.

When it comes to migration, Nord-Trøndelag county has had relatively little in-and out-migration throughout the period of investigation (HUNT 2009).

A weakness of the data is that in some characteristics the sample is relatively homogeneous, with less than 3% non-Caucasians, and the county lacks highly urbanized or segregated areas (HUNT 2009). This can make it more difficult to study site effects related to ethnic segregation and urban phenomena such as gentrification and high concentrations of certain properties in some parts of the municipality (e.g. social service rental housing). In addition, the results cannot be generalized to big cities or areas with high non-Caucasian immigration, such as Oslo. However, public health in North-Trøndelag follows general trends in Norway closely and although average values may differ from the national, the health trend goes in the same direction (Krokstad & Sandstad 2011).

The number of participants answering at least one of the questionnaires are 50 644 people. This is slightly different from Thoen and Krogstads (2011) calculations of 50 839, and could be due to technical selection routines of data and missing variables for a smaller number of cases. However the difference is so small it will not affect any results. There is a higher response rate among women in HUNT 3, 27 694 (58, 4 %) versus 22 972 (49, 3 %). As we can read of the table women have a higher response rate in all age groups except in the groups above 80 years. The lowest participation is in the oldest and youngest groups. The highest participation was in the age group 60-69 years, with scores of 74, 5 % for woman and 67, 5 % for men.

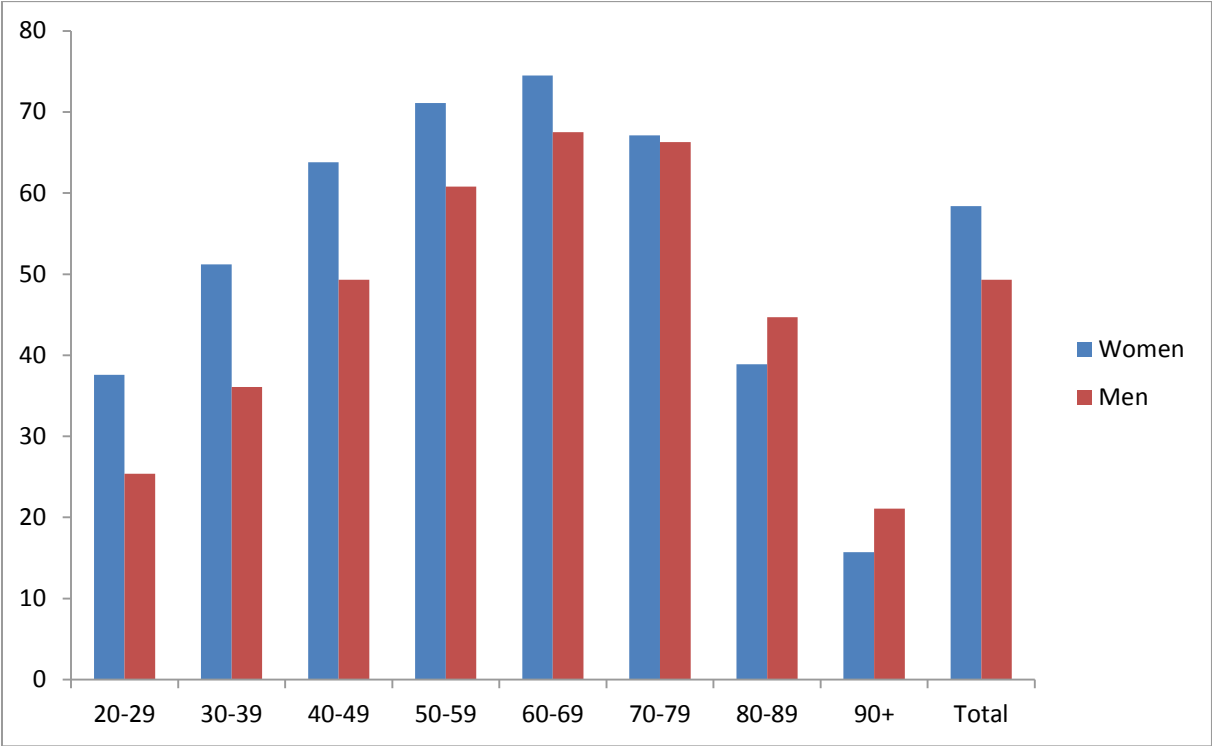


Figure 3.1 Participation percentages by gender and age

### 3.1.2 Area based data from Statistics Norway (SSB)

I have also used some area based data from SSB on variables like moving rates, education level and population density.

The data of education level is based on individual data and then aggregated to municipality level. It is based on people living in Norway at 1. October XXXX in the age group 16 and above in the end of the reporting year. Some 15 year old children finished primary school are also included. The data is originally based on Population and Housing Census of 1970, and thereafter updated each year. The Health Personnel Register (HPR) and National Certificate Database (NVB) have been used as additional data sources since 2003, and the Norwegian computer system for cases involving foreign nationals and refugees (DUF) since 2008. The survey *Education Completed Abroad* from 1990 and 1999 has also been used to update the database, but measurement errors are still mainly connected to people doing their education abroad (SSB 2012).

Data on internal migration concerns all moving between municipalities in Norway and between Norwegian municipalities and abroad. It is based on population register data, and since 1946 each municipality has had a local population registry that registers all residents in the municipality, pursuant to the Population Registration Act and its regulations. The population registries receive reports of births, deaths, marriages, divorces, migration etc. from various sources (SSB 2012).

The term urban settlement (tettsted) has been used by SSB since the Population Census of 1960. From 1960 to 1990 they produced statistics for urban settlements in relation to the population censuses every 10 years. Since 1990 the statistics have been updated every 1. January.

### 3.1.3 Climatic data from Meteorologisk Institutt

The data about rainfall and temperature is collected from eKlima. This is data about the weather normals – i.e. the average weather in a 30 year period. The present-day normal is from the period 1961-1990. There are some municipalities with several measuring stations,

which mean it would be possible that the choice of station may affect the outcome. But since the differences between the stations were quite small I don't think this will be an issue. There might also be a problem connected to the fact that there is over 15 year time difference between the dataset of climate and the depression data. But since the next normal period is not finished until 2020 it was not possible to get other climate data.

#### **3.1.4 Using Secondary Data**

In this dissertation, the use of secondary data is justified because it would be impossible to collect data of this sample size on my own. Yet there are some disadvantages of using data collected by others, because the data collected can be influenced by their cultural vision (Kitchin & Tate 2000). I will not necessarily have access to the questions that best measure what I'm looking to find answers to, which I will return to in the validation section below. When it comes to data quality and documentation of the collection procedures, HUNT data is known to be high quality as this is a study used as the basis of 150 scientific documents, 15 Ph.D. thesis and many regional and state reports (Holmen et. al. 2003). This secondary data is also collected earlier than the present, but since HUNT-3 is from 2008, I expect that there have not been very big changes in the population's mental health. This would be a bigger problem if I had used the HUNT 1 data or if there had been major social upheavals that could affect the mental health of some of the municipalities during this time period.

### **3.2 Validity, reliability and representativeness**

#### **3.2.1 Validity**

Validity indicates if measurements reflect the concept one is trying to gain knowledge about (Bryman & Cramer 2009). Since this is data collected by others I don't necessarily have access to the questions that best measure what I want to investigate. If one wants to look at the relationship between social networks and depression, does the statement "*I feel a strong sense of community with the people who live here*", reflect a social network? It could be that people who answer "no" have a social network other places than the immediate neighbourhood. With a geographical basis, migration and high activity patterns outside the residence area are often a problem when it comes to localizing the data.

### 3.2.2 Reliability

Reliability refers to the accuracy of the measurements (Ringdal 2007). HUNT is a recognized study, yet when it comes to reliability of answers; it is very difficult to assess this in a satisfactory manner. External reliability, i.e. consistency over time, is measured by test-retest (Bryman & Cramer 2009), but to examine whether respondents filled out the form in the same way a few weeks afterwards is difficult to implement. It will be very expensive, and one cannot expect the participants to answer the same questions twice in a short time interval (Ringdal 2007). It will also be possible that real change can lead to underestimation of reliability (Hellevik 2002). This is particularly relevant to questions about depression as this may vary within relatively short time periods. The possibility cannot be excluded that some respondents are exaggerating or underestimating high or low response options (values) in questions.

### 3.2.3 Representativeness

Representativeness means that the selection we have made measurements on is representative of the entire population, making it possible to generalize (Hellevik 2002). To determine if a sample is representative of the population it is drawn from it is useful to do calculations on the level of significance. This will be further discussed in chapter 3.4.1.

As HUNT 3 has a lower response rate than earlier HUNT studies I have to take into account that my results would possibly be different if more people had participated. The reasons for reduced participation may include increased "time squeeze" and less interest in public health than previously (Holmen et. al. 2003). In HUNT 1 non-participants as a group had poorer health than participants, but this increased morbidity affected only 12% of non-participants, mainly elderly people (Holmen et. al. 1990). The reasons for not participating were lack of time, lack of interest and moving out of the county. In the not interested group they found both those who were opposed to the survey, those who believed it was unnecessary and those who did not care (Holmen et. al. 1990).

In relation to mental health are three main reasons for under-reporting by questionnaire. Firstly, a number of people with mental health problems often live in institutions, and are thus not included in the survey. Secondly, there will be a drop-out of people who refuse to answer because it requires time and effort (Peterson 2000). This might be reinforced by the



depression, when some of the symptoms are decreased energy and loss of interest (WHO 2001). The last reason is if the issues are perceived as too personal, which is also highly relevant to mental health, since it can be taboo. If the participant feels shame, lower self-esteem or loss of prestige by answering questions this can lead to a reduced desire to respond too (Peterson 2000). In addition, these conditions may lead to more positive answers to show off a better image. Yet survey most likely gives a more accurate picture of reality than interviewing, as it is perceived as less personal.

Even though non-participation could affect the results there are some evidence that non-participation does not lead to substantial bias (Galea & Tracy 2007). In two identical surveys with participation proportions of 36 % and 61 % there were almost no differences in the 91 variables tested (Keeter et. al. 2000).

Overall, participation percentages are very high in the HUNT surveys, and drop-out will therefore probably not have led to major changes in the results (Holmen et. al. 1990).

### **3.3 Operationalization of variables**

In this section I will introduce all the variables used in the study, starting with the outcome variable depression measured by HADS-D. Then I will go through the demographic variables and area variables, finishing off with introducing the risk and protective factors.

#### **3.3.1 Outcome variable**

##### ***3.3.1.1 Depression measured by HADS-D***

In this study, HADS (The Hospital Anxiety and Depression scale) is used as a measure of depression. Originally, the HADS was developed to indicate the possible presence of anxiety and depression in somatic out-patients aged between 18 and 65 years (Spinhoven et. al. 1997), but several studies have confirmed that this tool is also valid in epidemiological studies, population groups and primary care (Snaith 2003). HADS consists of 14 questions where 7 deal with anxiety symptoms and 7 deal with depression symptoms (Herrmann 1996).

### HADS property as "case-identifier"

Each of the 14 questions is answered on a four-point Likert scale (0-3), with a final score of 0-21 on the HADS-D (depression) and 0-21 on HADS-A (anxiety). Different studies have reached different conclusions about whether HADS can be used as 'case-identifier'. This means the ability to find those individuals who with clinical interview would have been diagnosed with depression. Originally it was recommended to use four pillars of the scale where a score of 7/8 were possible cases of anxiety or depression, scores above 10/11 were probable cases, while a score of 14/15 had severe case of depression or anxiety (Herrmann 1996). According to Spinhoven et. al. (1997) HADS is best suited as a screening questionnaire and not for identification of unipolar depression due to low PPV (positive predictive value). PPV is the proportion of individuals with positive tests that are correctly diagnosed. They found no 'cut-off-point' which gave a reasonable PPV combined with a satisfactory degree of sensitivity (proportion of actual positives that are classified as such). Bjelland et. al. (2002), however, found that a "cut-of-point" of 8 + is optimal for identifying both anxiety and depression based on ICD-9. Both the sensitivity and specificity (the proportion that is actually negative, and are classified as this) is of 0.90. Wilkinson and Barczak (1988) also found that the HADS had an ability to find the DSM-III-defined psychiatric morbidity with 8 + as 'cut-off-point. As Bjelland et. al. (2002) is a newer source, and in addition, a literature review based on 747 studies, I would emphasize this when choosing the "cut-of-point." It should be noted that this dissertation aims to study the distribution of self-reported depression (illness) and not to decide whether it should be given a clinical diagnosis (disease), but the HADS ability to act as a "case identifier" will still be relevant to my selection of "cut-off-point". Therefore it is important to note that when I later talk about depression in the analysis I refer to the odds of having a HADS-D score of 8 or above, not of people 'being depressed'. It should also be noted that HADS could have been used as a continuous variable to avoid the somehow artificial border between depressed and non-depressed. However I have chosen to replicate what other people have done earlier due to better possibility for comparison.

### Correlation with other measures of depression and mental health

HADS has been shown to have similar sensitivity and specificity of the GHQ (General Health Questionnaire) (Bjelland et. al. 2002). In addition, there is a moderate to strong correlation (0.6 to 0.8) between the HADS and the scales BDI (Beck's Depression Inventory) and Stai (Spielberg's State-Trait Anxiety Inventory) (Bjelland et. al. 2002), but HADS is more

normally distributed by measurements of medical patients (Herrmann 1996). The correlation between HADS and MHI-CONOR, which is also used as a measure of depression in HUNT II study, is  $r=0.7$  for the total HADS and HADS-A, and HADS-D is somewhat weaker correlated ( $r=0.60$ ) (Søgaard et. al. 2003). In other words, the HADS has a good to very good concurrent validity, i.e., whether a measure correlates with a previously approved, valid measure of the same phenomenon (Bjelland et. al. 2002).

There are arguments in both directions when it comes to the content validity of HADS-D, i.e. if the measurement covers the main aspects of the concept (Ringdal 2001). In order to avoid "noise" from somatic diseases, all physical symptoms of depression (e.g. headache, insomnia) which could also be related to somatic illness are excluded (Bjelland et. al. 2002). To separate out emotions such as grief from depression, the questions were centred on the loss of pleasure (anhedonia), which is one of the main symptoms of major depressive illness (Snaith 2003). Other important aspects of depression such as hopelessness, guilt and low self-esteem are omitted. But it is precisely this narrow definition of depression that may be one of the reasons for the robustness of the factor structure (Mykletun et. al. 2001). In addition, the ability to act as a "case identifier" implies that the main aspects of depression are covered.

#### Inter correlation and consistency between the subscales

When it comes to discriminatory validity, i.e., low correlations between measures of different concepts (Bryman & Cramer 2009), there has been some discussion if the subscales HADS-A and HADS-D really measure different moods, as they have a correlation of between 0.45 and 0.75 (Herrmann 1996, Bjelland et. al., 2002). The relationship between anxiety and depression in the literature has been seen as (a) different points along the same continuity, (b) different manifestations of a common disease, (c) heterogeneous syndromes associated due to shared subtypes, (d) separate phenomenon that can develop into another over time, or (e) conceptually and empirically distinct phenomena (Clark & Watson 1991). ICD-10 classification is in category (e).

Some studies, including Mykletun et. al. (2001) HADS-study based on the HUNT 1 data, has found that section 7 of anxiety, "I can sit at ease and feel relaxed" to a greater extent correlates with depression than anxiety (Mykletun et. al. 2001). They also found that section 6 of depression, "I feel cheerful" also serves as a measure of anxiety. This has meant that more

people have suggested that the HADS should rather be seen as a one-dimensional scale of mental stress (Pallant & Tennant 2007, Razavi et. al. 1990).

Clark and Watson (1991), however, have proposed a tripartite model. In this model, anhedonia is specific to depression, "hyperarousal" is specifically for anxiety, while the high correlation between anxiety and depression is caused by a common non-specific "negative affect" that is shared between both syndromes, and that it is therefore a need for a collective diagnosis, "combined depression-anxiety". HADS-D is mainly focused on anhedonia, but it correlates strongly with HADS-A, which Spinhoven et. al. (1997) explains is due to HADS-A scale measuring "negative affect" to a greater extent than "hyperarousal" (Spinhoven et. al. 1997). But when Burns and Eidelson (1998) tested Clark and Watson's tripartite model with identical data sets, they came to the conclusion that the correlation is not due to joint symptoms or a concept of "negative affect", but rather that depression and anxiety share a common causal factor, and that the subscales thus have high validity even if the concepts correlate (Burns & Eidelson 1998). There are also researchers who believe that low correlation between anxiety and depression is a hallmark of good discriminatory validity (Bjelland et. al., 2002). All in all, the two-factor structure is most often invoked. When Mykletun et. al (2001) tested HADS in the HUNT 1 data they found that the two factor structure explains a higher proportion of the variance than the three and one factor structures.

In my study, I will just only use the HADS-D, since depression and anxiety are classified as two different phenomena in ICD-10 and this classification is also used in a Norwegian context. The fact that Mykletun et. al. (2001) study supports the two-factor structure is also crucial as it is based on the HUNT 1 study.

### Reliability

With regard to internal reliability, i.e. whether it is internal consistency between the indicators in an index (Ringdal 2001), it is recommended that Cronbach's alpha should be at least 0.60 for a survey to be reliable. This criterion was met in all studies of the HADS (Bjelland et. al. 2002), where the average values were as high as 0.8 (Spinhoven 1997). In HUNT 1 they found slightly higher reliability for the HADS-A, but both scales can be considered to be highly reliable (values between 0.73 to 0.85) (Mykletun et. al. 2001). External reliability is

considered to be very high,  $r > 0.80$  at a second round survey within 2 weeks (Spinhoven 1997, Herrmann 1996).

### **3.3.2 Demographic classifications**

#### **3.3.2.1 Age**

Age is used as a continuous variable in the unadjusted association table. In the main analysis however it is divided into four groups: 20-29, 30-49, 50-69 and 70+. These age groups are chosen in relation to different life stages. From 20-29 people are often still not settled down, while at 30-49 most people have children, a steady job and a home. At age 50-69 most children have left the home, while at 70+ most people have reached their pension age.

In the separate work analysis age is divided into slightly different groups as very few people working in the youngest and oldest age groups: 20-39, 40-49, 50-59 and 60+.

#### **3.3.2.2 Marital Status**

Marital status is categorized as: unmarried, married, widower, divorced and separated. The original categories of surviving partner, registered partner and divorced partner are merged together with widower, married and divorced in that order.

#### **3.3.2.3 Socioeconomic status measured by occupation**

The three most important measures of socioeconomic status are education, income and occupation (FHI 2005). As I did not have access to any individual information other than occupational, it has been natural to choose this. Occupation as a measure of social status is not unproblematic. Firstly, it is not always a natural hierarchy between the different professions. Farmers' position in the hierarchy is depending on the local situation. Place plays in other words an important role. Second, people can change work several times during their career. The third reason why the profession can be problematic is that there are new jobs constantly created as the labour market progresses, while the old jobs will be eliminated. The fourth and final problem is the classification of the unemployed and part-time workers (FHI 2005). Since I only have one variable as a measure of socioeconomic status, it is important not to draw conclusions concerning socio-economic status in general, but rather only the aspect the

variable actually measures (occupation), otherwise one goes beyond what the data provides knowledge about (Hellevik 2002).

The classification used in this study is the STYRK instrument. This is based on the International Standard Classification of Occupations – ISCO-88, prepared by ILO. The Norwegian standard is based on EUs version of ISCO (ISCO-88(COM)) and it classifies occupation by specialisation and four different skill levels by education length (SSB 1998). There are 10 different occupation groups which are further divided in subgroups. In this study, only the main groups are used, but group 0 is recoded as missing:

1. Legislators, senior officials and managers
2. Professionals
3. Technicians and associate professionals
4. Clerks
5. Service workers and shop and market sales workers
6. Skilled agricultural and fishery workers
7. Craft and related trades workers
8. Plant and machine operators and assemblers
9. Elementary occupations
0. Armed forces and unspecified

In the work analysis the occupations is re-categorized into jobs requiring high (1-5) and low (6-9) education.

### **3.3.3 Area factors**

#### **3.3.3.1 Urbanity**

Residence is in principle based on election unit and then aggregated to the municipality. First, I will examine the place of residence in terms of urbanity / rurality. Levanger, Steinkjær, Namsos, Stjørdal and Verdal are coded as urban. The reason why I choose to omit Nærøy from the urban category is that the proportion of people living in village areas is not greater than 31.1%. The urban municipalities in Nord-Trøndelag are so called "over bound cities. This means that people who live in more rural areas will also be counted as urban. This may be a limitation since the rural residence may have other characteristics affecting health – like fewer facilities etc. But at the same time these people are still parts of the urban economy and politics of this municipality, and that may be of greater importance for health than the local area characteristics.

#### **3.3.3.2 Climate**

In this task, I am also comparing residential area by climatic conditions like rainfall and temperature. This data material is the normal for 1961 - 1990, collected from the Norwegian Meteorological institute. Since there is no data for Inderøy, the rainfall and temperature from Mosvik is used as the two municipalities are now merged.

#### **3.3.3.3 Hospital area**

I will also divide municipalities by the hospital areas Innherred and Namdal to control for possible health inequalities. There has been shown to be a higher incidence of heart disease and measured risk factors for heart disease, such as daily smoking in Namdal, and it is therefore conceivable that there may be differences in mental health as well, although this was not found in HUNT 2 (Fretland & Krüger 1998). Municipalities belonging to Innherred are: Snåsa, Steinkjær, Verdal, Meråker, Stjørdal, Levanger, Inderøy, Mosvik, Frosta and Leksvik. The rest belong to Namdal.

#### **3.3.3.4 Moving rates**

Municipalities will also be divided by moving rates, as this might reflect the area's attractiveness in terms of service accessibility and labour market. Depopulation is as

mentioned in the theory chapter one of the indicators of a disintegrated society. If the migration occurs due to poor service and labour markets it may conceivably lead to a general impact on depression prevalence in the area. Decreases in population in some municipalities may however not be a problem unless they affect important social institutions (Fylkesplan 2000). Moving rates is given as a positive or negative net number of the immigration per 1000 inhabitant into each municipality.

### **3.3.3.5 Education**

Socio economic status will also be measured on area level. But here education will be used as a proxy, i.e. the percentage of people with high education in a municipality. These numbers are collected from SSBs statistical database from 2010. The advantage of using education as a measurement is that it is easily ranged and quite static after the age of 25 (FHI 2005). A problem is that education after high school level may have different effect on individuals. Also the sizes of education groups have changed a lot the last 30 years (FHI 2005). Since education is used as an area variable it will, as stated in the theory chapter, affect people's health in a different way than the individual measurement. It is possible to imagine that areas with high level of people with high education are more integrated, as there must be available opportunities for educated people in the area. Highly educated people usually also have more resources, and might therefore stand stronger in NIMBY cases. This may as noted affect individual based depression.

## **3.3.4 Risk and protective factors**

### **3.3.4.1 Negative life events**

Negative life events were measured with three questions about stressful life events over the past 12 months. The indicators include the death of a close family member, if they have been in imminent danger because of the accident, war, disaster or violence and whether they have been through a breakup. This goal is somewhat incomplete as it lacks the relevant issues of economic nature, unemployment and severe disease (Korkeila et. al. 2003).



#### **3.3.4.2 Loss of caregivers**

Loss of caregivers is measured by the question *"Did either of your parents die when you were a child?"*. The answer categories are divided into 'no', 'before age of 7' and 'age between 7-18 years'.

#### **3.3.4.3 Childhood Experience**

Since a number of factors in childhood may influence later depression is also the question *"When you think of your childhood would you describe it as:"* included. The response options are a Likert-item from "very good" to "very difficult". Since this is a fairly general question, I would expect that different people respond to different conditions. Nevertheless, the question is mainly interpreted in the direction of negative events in childhood, and it is mentioned in the theory chapter that several factors in childhood that may influence later depression.

#### **3.3.4.4 Social networks**

Social networks will be measured using several different questions. On a personal level emotional networks are measured by the question: *"Do you have friends you can speak to confidentially?"*, while tangible networks are measured by the question: *"Do you have friends who can give you help when you need them?"*.

The question of participation in social activities such as sports, outdoor activity, dance, parish work, theatre/music and club meetings, which is one of the dimensions of loneliness mentioned by Paykel and Cooper (1992), is also used as an indicator. This variable is transformed into dichotomous indicator of whether or not a person has participated in any of these activities in the last 6 months.

Living arrangements will also be used as an indicator of social networks, where the answer categories are alone, with parents, with partner, with people over 18 and people under 18.

Social network is also measured on neighbourhood level by three different 5 category Likert-items: *"We do not trust each other here"* is a measure of social capital, *"I feel a strong sense of community with the people living here"* is used as an indicator of social cohesion, while *"People like living here"* is an indicator both social capital and cohesion.

#### **3.3.4.5 Being oppressed**

This is measured by the question: *“Has anyone at any time in your life tried to oppress, degrade or humiliate you over an extended period of time?”*.

#### **3.3.4.6 Pets**

Since dogs has shown to have greater positive impact on health than other pets (Siegel 1990), the original answer categories are kept: dogs, cats, ferrets / birds or none.

#### **3.3.4.7 Alcohol behaviour**

As mentioned, alcohol consumption may be related to depression. Bang Nes & Clench-Aas (2011) use actual consumption measured in units per week, where a consumption of 14 units for women and 21 units for males per week is considered risky - or "drinking on red." The advantage of this measure of alcohol consumption is that it is objective. Nevertheless, there are problems associated with that people often do not know what a unit is, and it is not always stated. In the HUNT study one of the questions is *“how many glasses of wine/beer/liqueur do you usually drink in a course of two weeks ...”*. But then one may ask: *“how big is a glass?”*. This is clearly subject to interpretation variability. In addition, it is problematic that people often distort their own consumption and underestimate their normal drinking level (Twiggs et. al. 2000). There will also be a problem that not everyone remembers how much they drank (especially those who drink a lot) and that drinking behavior often varies from week to week (Twiggs et. al. 2000). In this study a glass is treated as a unit, and the weekly consumption of each type of alcohol and the total consumption have been calculated. In the logistical regression model only total weekly consumption is used. Another issue connected to this way of calculating consumption is the fact that we don't know if the units are consumed in one or more sittings, which is of crucial importance since binge drinking is more harmful.

Another measure that is being used to identify problematic drinking behaviour is the CAGE-score. This is taken into use at the “Levekårsundersøkelsen” from 2005 (Myklestad et. al. 2008). This is an instrument with four questions related to alcohol behaviour, originally developed by Ewing and Rouse in 1970 for identifying alcoholics in a hospital setting (Twiggs et. al. 2000). If you answer yes to two of the questions there is a very high likelihood of addiction, but yes to one question gives a probability of more than 80% that the person is addicted to alcohol (Myklestad et. al. 2008). When it comes to using CAGE to screen for

alcohol problems in the population, there have been varying results. Bissons et. al. (1999) study did not support CAGEs ability as a screening tool for alcohol problems in the general population, but Spencer et. al. (1987) and Colhoun et. al. (1997) found the CAGE instrument valid. Since WHO has also recommended the instrument (Myklestad et. al. 2008) I will consider it as a relatively useful measure of alcohol behaviours. Nevertheless, it is important to ask a few critical questions to the index. The problem with this way of measuring alcohol behaviour is that the questions are very subjective. Answering yes to the question “*Have you ever felt that you should reduce your alcohol consumption?*” does not necessarily mean that this is because you feel this because of a very high consumption. This can also be linked to economic factors, and this will particularly be relevant in a country like Norway where alcohol is expensive. It may also be linked to the context where you want to feel this more so in a religious environment that "looks down on" alcohol consumption, than in an environment with high tolerance of alcohol consumption. It has been shown that people in the rental sector more often become categorized with problematic drinking behaviour with CAGE, even if the actual consumption is considered acceptable (Twiggs et. al. 2000), which may indicate that individuals interpret the questions differently. Nevertheless, the majority (82%) of those who "drink on red" do not score high on the CAGE (Twiggs et. al. 2000). A major advantage of CAGE in relation to the measurement of actual consumption is that none of the questions require you to remember far back in time or to have knowledge of the units. In this study each of the four questions are kept separate, but there is also a new variable constructed to indicate a CAGE score over 2 as this is the most common way of using the measurement-tool. Since there is a high percentage of missing (around 15 %), I have coded this into a separate group. I could have ignored the missing as I have done with most of the other variables, but this would have weakened the study since I would lose as much as 15 % of the cases in the logistic regression model. Another solution could have been to recode all the missing towards an average; however this would have put all the missing into either CAGE over 2 or fewer than 2, making the sample skewed. It is however important to note that it's not unproblematic to recode the missing into a separate group. This will be discussed further in chapter 6.

#### **3.3.4.8 Tobacco habits**

Both snuff and cigarettes are measured in connection to tobacco habits. Smoking was measured by the following question: “*Do you smoke?*” The question has 6 answer categories categorised by type of tobacco (cigarettes versus cigarillos/pipe/cigar) and how often (never,

quit, occasionally and daily). Snuff is measured by the question “*Do you or have you used snuff?*”, with 4 answer categories: never, quit, occasionally and daily.

#### **3.3.4.9 Personality**

Personality traits are measured by a variety of questions from the Eysenck Personality Questionnaire (EPQ). Six of the measurements are related to whether one is introvert / extrovert, while the remaining six deals with neurotic personality traits. The extrovert personality is recognized by having lots of friends, enjoying practical jokes, liking change, optimistic worldview, aggressive behaviour and more. The introvert on the other hand is quiet, has fewer friends, likes planning, have a pessimistic world view, have higher impulse control and don't lose his temper very easy (Eysenck & Tambs 1990). The measurement of neurotic traits is more concerned about if a person is moody, irritable, and nervous and tense (Eysenck & Tambs 1990). A total score is calculated by adding the scores together, giving a total score between 0 and 6 on each of the measurements. Thereafter the measurement is treated as a continuous measure.

#### **3.3.4.10 Physical Activity**

Physical activity is measured using the question: “*How often are you physically active?*”. This variable is kept as it is in the unadjusted associations, but recoded into three groups (never, less than once a week and more than once a week) in the main model. There is also asked a question about physical inactivity where the participants answer how many hours a day they usually sit.

#### **3.3.4.12 Life Satisfaction**

Life satisfaction is measured with the question “*When you think about how you feel at the moment, are you generally satisfied with life or are you mostly dissatisfied?*”. The answer categories are a 7 item Likert-item ranged from ‘very satisfied’ to ‘very dissatisfied’.

#### **3.3.4.13 Self-assessed health**

The questionnaire includes a question on how people assess their current health. The question has four response categories from ‘poor’ to ‘very good’. This is however left out of the main analysis due to the fact that it may measure the same as depression to some extent.

#### **3.3.4.14 Family member with mental illness**

There is one question about whether parents, children or siblings have had any mental problems. The answer category is 'yes' and 'no'.

### **3.3.5 Risk and protective factors related to work environment**

All variables mentioned under work environment are only measured from the part of the sample that has answered job as main category, and is therefore put into a separate model. There are several questions connected to work environment – both social and physical. The first question asked is if you have a job, study or if your job is to be a housewife/househusband. You cannot fall into two of these categories, so if you have a job next to your studies you will be classified as a student. If people have answered yes to questions about shift work or overtime, but not registered as working, student or housewife, I have recoded them to working.

#### **3.3.5.1 Shift work**

Shift work is measured by the question "*Do you have shift work, night work or are on call?*".

#### **3.3.5.2 Overtime**

Overtime is measured by the question "*Do you work over 40 hours a week?*".

#### **3.3.5.3 Employment type**

Employment type is measured by amount of physical activity undertaken on a daily basis. The answer categories are *mostly sitting*, *much walking*, *much walking and lifting* and *heavy physical labour*. In the final analysis sitting is compared against everything else.

#### **3.3.5.4 Occupational stress**

Occupational stress is measured with some of the questions (9 in total) from the Swedish Demand-Control-Support questionnaire (DSCQ). This questionnaire is supposed to measure

psychological demands (D), social support (S) and control over working situation (C) (Sanne et. al. 2005). According to the strain hypothesis people in jobs with high demands combined with high control (active jobs) and low demands combined with low control (passive jobs) will achieve intermediate scores. People with high demands combined with low control (high strain) on the other hand will have higher scores of depression and anxiety. Low demands and high control jobs (low strain) will have the opposite result with better health. Strain is measured by dividing demand by control (Sanne et. al. 2005).

There is also an expanded hypothesis called iso-strain hypothesis, which includes the variable support. The most negative health effect is experienced by people in high strain jobs combined with low support (iso-strain jobs) (Sanne et. al. 2005). In the main model strain and iso-strain is left out of the model to make it simpler.

## 3.4 Statistical methods

### 3.4.1 Significance

If we get a difference between the variables, it is important to determine whether this difference is significant. Significant differences imply with a 95% confidence that the difference is not due to chance for a given p value of 0.05 (Bryman & Cramer 2009). If we choose to reduce the p-value to 0.01, we can say with 99% confidence that the difference is not due to chance, thus reducing the risk for type I error, i.e., draw conclusions that there is a significant difference when it is not (rejecting a true null-hypothesis). But at the same time this will increase the risk for type II error, i.e. concluding that there is no significant difference when it is (not rejecting a false null-hypothesis) (Bryman & Cramer 2009).

### 3.4.2 Cross tabulation and chi square

For categorical variables cross tabulation and calculation of the chi-square is used. This is used to calculate the probability that there is a relationship between two variables. The chi square test is a test of statistical significance, giving the probability that the observed relationship between two variables has arisen by chance (Bryman & Cramer 2009). The chi square is expressed as:

$$X^2 = \sum ((O-E)^2 / E)$$

Where O is observed frequencies and E is expected frequencies. A large  $X^2$  does not necessarily indicate a strong effect size but it does suggest strong statistical significance. It tells us how confident we can be that there is a relationship between two variables.

### 3.4.3 T-test

The Independent-Samples T -Test procedure tests the significance of the difference between two sample means. The t equals the difference between the mean of two samples divided by the standard error of difference in means and is expressed as:

$$T = (Z_t - Z_c) / (\sqrt{(\text{var}_t / n_t) + (\text{var}_c / n_c)})$$

Where the  $Z$  values are the sample means,  $\text{var}_x$  equals the variance of group  $x$  and  $n_x$  equals the number of people in group  $x$ . The  $t$ -value will be positive if the first mean is larger than the second mean and opposite if it's smaller.

### 3.4.4 Logistic Regression

Logistic regression is in many respects similar to Ordinary Least Squares regression, except for the fact that the outcome variable is categorical (usually binary). One can therefore predict the probability of a person belonging to one of two groups based on other modelled covariates. In this thesis I will predict if a person is depressed or non-depressed based on explanatory variables described above.

In Ordinary Least Squares regression one predicts the value of variable  $Y$  from a predictor variable  $X_1$  or several  $X_s$ :

$$Y_i = b_0 + b_1X_{1i} + e_i$$

In logistic regression you rather predict the probability of  $Y$  occurring given a known value of  $X_1$  or  $X_s$ :

$$P(Y) = 1 / (1 + e^{-(b_0 + b_1X_{1i})})$$

There are three central terms in logistic regression: odds ratio, probability and logit.

Odds is defined as

$$\phi = P/(1-P)$$

where  $P$  is the *probability* of success ( $Y = 1$ ) and  $1-P$  is the probability of failure ( $Y = 0$ ). If the probability of success equals 0,5 then the odds ratio equals 1. If the probability is higher than 0,5 then the odds ratio is higher than 1, and opposite if its lower than 0,5. In other words: high probability gives high odds.



The last term, logit, makes it possible to get a probability between 0 and 1 without limiting the regression coefficients. The logit, or the logarithm to the odds when  $Y = 1$  is the dependent variable and is expressed like:  $L = \ln[P/(1-P)] = \ln \varphi$

The logistic regression equation could therefore be described as:

$$L = \ln[P/(1-P)] = \ln \varphi$$

The logistic coefficient is hence the change in logit from a one unit change in the independent variable.

To understand the effect size we look at the odds ratio or the  $\text{Exp}(B)$ . This is calculated by using the antilogarithm of the logit. Odds ratio gives the difference between two odds. An example would be if we were to check if the odds of having a depression are higher for men than woman. If the odds ratio equals 1 then the odds of depression is equal for both sexes. If it is above 1 then the odds is higher for men than female when using women as the reference category (Eikemo & Clausen 2007).

There are several methods of logistical regression. I have chosen a stepwise backward method since causality is not of interest. This means that you start the model with all variables and then remove one by one starting with the least significant one. In the end you end up with a model which only contains the statistically significant predictors (Field 2009). Because I had so many different predictors I first divided the variables in groups, performed stepwise regression on each group before I then combined the remaining significant variables for a final model. I have also made a separate model for people who work due to the fact that the variables concerning work environment are only.

### 3.5 Mapping using GIS

The reason I have chosen to use GIS in the thesis is that map representations more easily provide a (visual) overview of distribution patterns within the municipal units, than can be achieved with tables. One can thus easily detect clusters and thus get a better idea of which areas may be in need of intervention. Maps have been used for hundreds of years to describe the spatial variation in health and disease, and as choropleth maps are the most common type of chart for presentation of disease (Meade & Emch 2010), I have chosen to use this.

Choropleth maps are constructed from values describing the non-overlapping areas such as counties or municipalities. Each region is coloured / shaded to represent the value of a specific variable (Longley et. al. 2005).

Although the map can be used to facilitate communication, it is important to remember that the map can also be used to send out the wrong information, both consciously and unconsciously. One problem with choropleth maps is that large (but possibly uninteresting) areas can dominate the map visually (Longley et. al. 2005). In addition, it is important to consider how to divide the data into intervals. If the distribution of data is divided into too many intervals, this will lead to problems with determining changes, since the brain is only able to distinguish between 6-7 classes in black / white, and fewer in colours. If you have too few classes, however, you will lose information on detail (Meade & Emch 2010). There are four different ways to divide into classes (Longley et. al. 2005):

- quantiles
- natural breaks
- equal interval
- standard deviation

The most commonly used method in health science is to divide into quantiles (Meade & Emch 2010). Quartiles (four-category classification) is widely used in statistical analyses, while quintiles (five-category classification) is well suited for uniformly distributed data. The problem with this scheme is that since the limits are based on the aim that all classes should be as large as possibly so, nearly identical values could fall into different classes, while very different values can end up in the same class (Longley et. al. 2005).

An alternative is division into natural breaks that are boundaries between each group based on natural groupings of data values. This can either be done inductively by a computer algorithm that looks for big jumps in data values, or deductively by dividing into the known / relevant sections (Longley et. al. 2005). Natural break classification can inductively be a more interesting way to classify data, but the problems arise if one wants to compare two maps (Meade & Emch 2010).

Same interval is a selection where the values of each interval are equal, but each class has a different number of observations. This division is best when normally distributed data, as it might otherwise run the risk that you get classes with few or no observations (Meade & Emch 2010).

The final way to divide into classes is the standard deviation method. This involves GIS software calculations on the average value and generate class differences in standard deviations above and below the average. It is common to use a two-color scale to visualize above and below the average (Longley et. al. 2005).

I have chosen to map with quantiles since this is the most common way of mapping in health research. Even though this might not be the best way to map all the individual maps I find it better to use the same style of mapping on all the maps to make it easier for the reader to understand the maps and to make it possible to compare maps to some extent.

## **3.6 Methodological problems**

### **3.6.1 Ecological, atomistic and psychologistic fallacy**

Empirical results have shown that both individual and area factors are important in explaining the health of a population, but this varies between groups, places and time periods (Shaw et. al. 2002). Yet the explanations of the contextual drivers are often missing in the research context, and if you are left with differences after individual factors are controlled for, this is often explained by the fact that individual factors are not well measured (Macintyre & Ellaway 2003). The reason why context factors are often left out is the danger of ecological fallacy – to make assumptions about individuals based on area characteristics. If there is a

high prevalence of depression in areas with high unemployment this does not necessarily mean that individuals without work are more depressed. But there is a distinct difference between using aggregated data to explain the individual characteristics and having an ecological perspective on how the social and physical environment affects the health of individuals and populations (Macintyre & Ellaway 2003).

Nevertheless, it is important to be aware of this fallacy. The atomistic fallacy is also a danger when undertaking area analyses. If all the inhabitants of an area are socially active, have a high social networks, etc. one cannot necessarily conclude that the neighbourhood will be characterized by harmony and good health. Social capital among the citizens can actually correlate with a conflict-ridden environment. Such a form of fallacy is often the result of the area descriptions are often aggregated on the basis of individual characteristics and not the actual range of factors such as house prices, job opportunities, etc. (Macintyre & Ellaway 2003). Since this study is an analysis of individual as the unit of analysis and the individual as "level of inference" it is the psychologistic fallacy that will be most relevant. This means that if one found that depression is higher among immigrants than among natives, there is a danger of attributing causal explanations of immigration per se or genetic factors, and ignoring contextual explanations. It may also be possible that depression is only related to immigration in areas where they are the minority (Diez-Roux 2003).

### **3.6.2 Latency period**

Another problem related to health research is the question of time. People often talk about the latency period, meaning that exposure to risk factors and health outcomes do not necessarily correspond in time, but that health outcomes may be years or decades after (Gatrell & Elliot 2009). This means that there will be a time delay between exposure (exercise, smoking, social networks, etc.) and outcome (depression), which can lead to underestimation of actual disease incidence in the population (Meade & Emch 2010). For example, difficulties in school and in relation to parents have proved to be triggers for later depression (Lewinsohn 1994).

### **3.6.3 Migration as a confounding variable**

Migration can often lead to a distorted picture of the health situation. A common assumption is that the current residence is a good enough measure of exposure to possible risk factors, which may be a reasonable starting point for diseases with short latency period (Gatrell &

Elliott 2009). When it comes to depression this may develop rapidly over days or weeks, but the most common is that the symptoms develop gradually over time (Eknes 2006). Current state of health may thus reflect the previous residence (Gatrell & Elliott 2009), although this will probably be a lesser problem in Nord-Trøndelag since there is little migration out of the county (HUNT 2009).

#### **3.6.4 Ethical considerations**

When it comes to ethical considerations, this is a very relevant topic in health-related tasks, since health information is particularly sensitive. To access the HUNT material one is required to seek approval from the REK (Regional Etisk Kommittee) for the project. The material I have access to is de-identified, so that the participant remains anonymous (HUNT 2009).

Presented geographic patterns must be based on large populations (local units) so that individual communities are not identified. If for example one wants to look into the incidence of depression for women 20-29 years, the population size (population of women in this age group) must be increased significantly, which means that one needs much larger municipality units. However since I have not used stratified groups based on age and gender I will not have these issues. Another important point is that depression is often associated with stigma, and that one should be careful to identify individual municipalities. If the population of a place feel inferior to other places, this can lead to psychosocial stress (Jørgensen 2009). This will be further discussed in chapter 4.

In municipalities such as Leka which has a population of just under 600 (SNL 2010) there could have been problems with identification - meaning that one can identify people by linking age, sex and other variables. This problem will however be avoided due to use of total population on individual data.

## 4.0 Study area and geographical distribution of area factors

In this chapter I will review the general geography of the study area, as well as some demographic factors (population structure, education, climate etc.) that may be relevant to the occurrence of depression. It is important to remember that the maps I have made have parameters based on same class size. This has in some of the maps led to identical values falling into different classes while very different values have ended up in the same class.

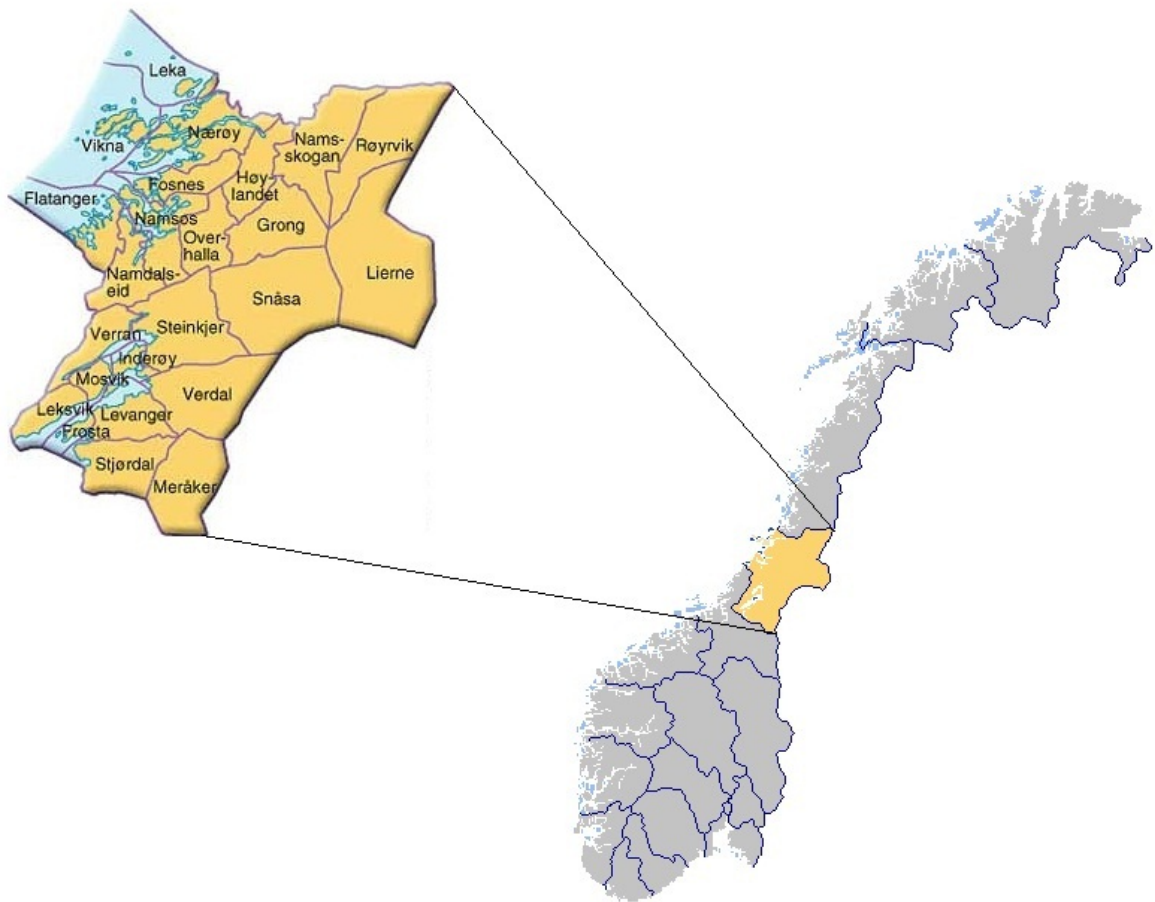


Figure 4.1 Study area: Nord-Trøndelag County

Nord-Trøndelag county boundaries in the south to Sør-Trøndelag county, in the east to Jämtland County, Sweden, in the north to the county of Nordland and in the west to the Norwegian Sea. The county stretches over 22 396 km<sup>2</sup> (NTFK 2010).

As stated in the theory there may be troubles connected to drawing boundaries when doing area studies. I will use the administrative municipalities as area units since this is most convenient. However it is important to notice that there may very well be differences within each municipality that are masked in the maps.

There are 23 municipalities in Nord-Trøndelag today, since Inderøy and Mosvik were recently merged. But since Inderøy and Mosvik were separate in the HUNT 3 study, I will continue using 24 municipalities in the analysis. Six of the municipalities have villages with city status: Namsos, Steinkjær, Verdal, Levanger, Stjørdal and Nærøy (Kolvereid). Nine of the municipalities are located next to the Trondheim Fjord (Verran, Steinkjær, Inderøy, Verdal, Mosvik, Levanger, Leksvik, Frosta and Stjørdal), seven of them, have coastline on the Norwegian Sea (Leka, Vikna, Nærøy, Fosnes, Namsos, Namdalseid and Flatanger), while the rest are considered inland (Røyrvik, Namsskogan, Høylandet, Grong, Overhalla, Snåsa, Lierne and Meråker) (Knudsen 2011, NTFK 2010).

Nord-Trøndelag can also be divided into Innherred and Namdalen, corresponding to the two hospital sites in the county (Fretland & Krüger 1998).

### Hospital Area

Quantiles

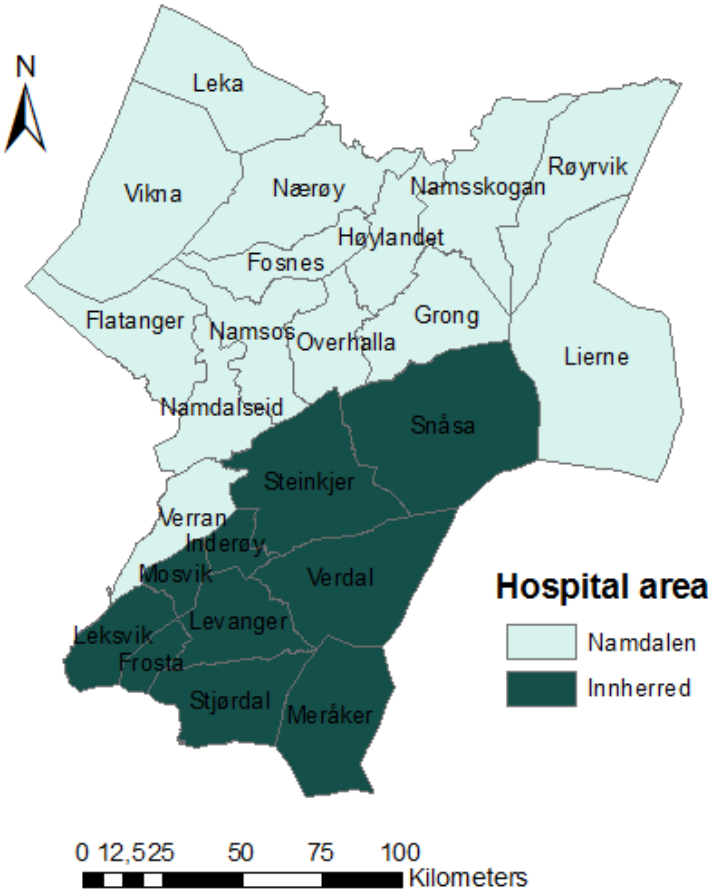


Figure 4.2 Municipalities divided by hospital area

## 4.1 Population and settlement

There were recorded 131 842 inhabitants in Nord-Trøndelag pr. 1. October 2010, and in the last 30 years there has been an increase in the population by 8% (Fylkesplan 2000). The settlement is mainly along an axis from Namsos in the north to Stjørdal the south, and the population has increased to a greater extent in the south and in urban areas (Knudsen 2011). Almost 70% of the population live in small towns of Namsos, Steinkjer, Verdal, Levanger and Stjørdal.

### Urbanity Quantiles

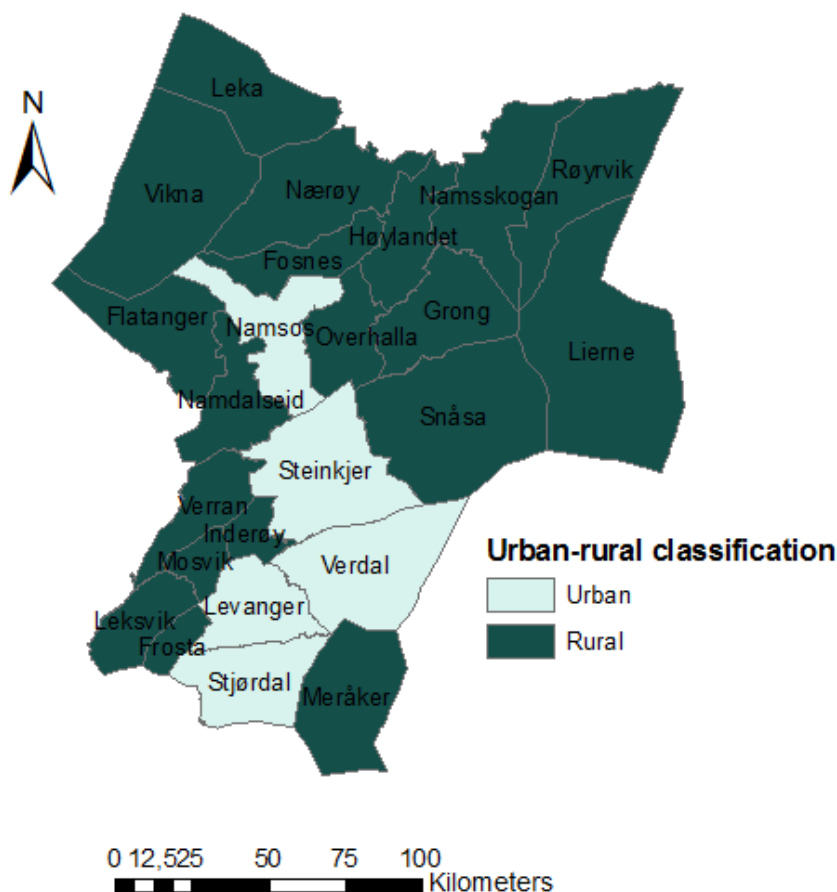


Figure 4.3 Municipalities divided by urbanity / rurality

Although the county as a whole has experienced population growth, parts of Fosen, inner-middle- and outer Namdal has experienced a decrease (Knudsen 2011). In other words, there has been centralization, like in the rest of the country. This is largely due to the competitive



advantage that proximity to resources (fish, minerals, energy, and agriculture) once brought are no longer applicable in today's information society. Service industries are located in central areas and thus there is reduced growth potential in rural areas. In addition, more children are born in the cities (Fylkesplan 2000).

As we can see in the map below the net migration per 1000 inhabitant varies between -35.5 and 14.6. Here we can see the problem of using quantiles, as the highest outmigration contains numbers between -35.5 and -13.9, while the middle class only have a variety between -5.3 and -1. Also the fourth class contains both positive and negative numbers.

### Nett migration per 1000 inhabitant Quantiles

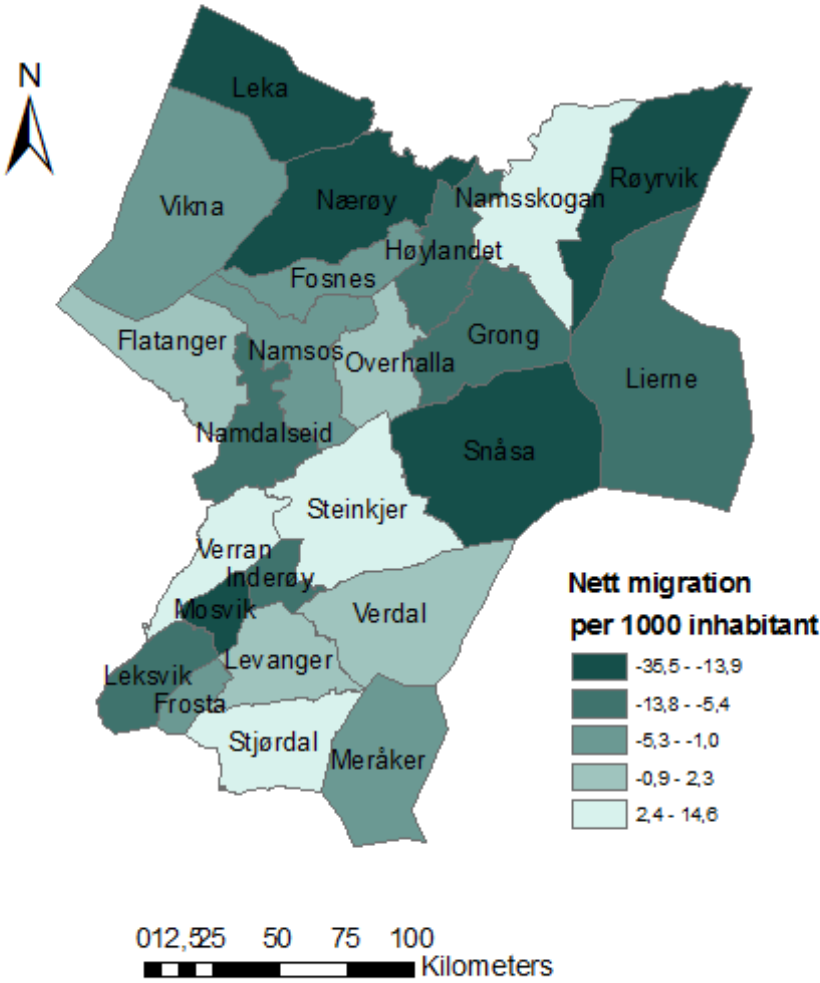


Figure 4.4 Net migrations per 1000 inhabitant, 2006

Urban settlement/village is defined by SSB as areas with at least 200 inhabitants and where the distance between the houses do not exceed 50 meters. As mentioned, there has been a centralization process in Nord-Trøndelag, and today 58.1% of the inhabitants live in towns, compared with 79.5% nationwide. The county as a whole can thus be considered to be relatively sparsely populated compared with the rest of the country. However, the variation between the different municipalities is great. In Namsos 81.2% of the population lives in urban areas, while Leka, Namsskogan, Fosnes, Mosvik and Frost have no urban areas at all (SSB 2011).

## Percentage in villages

Quantiles

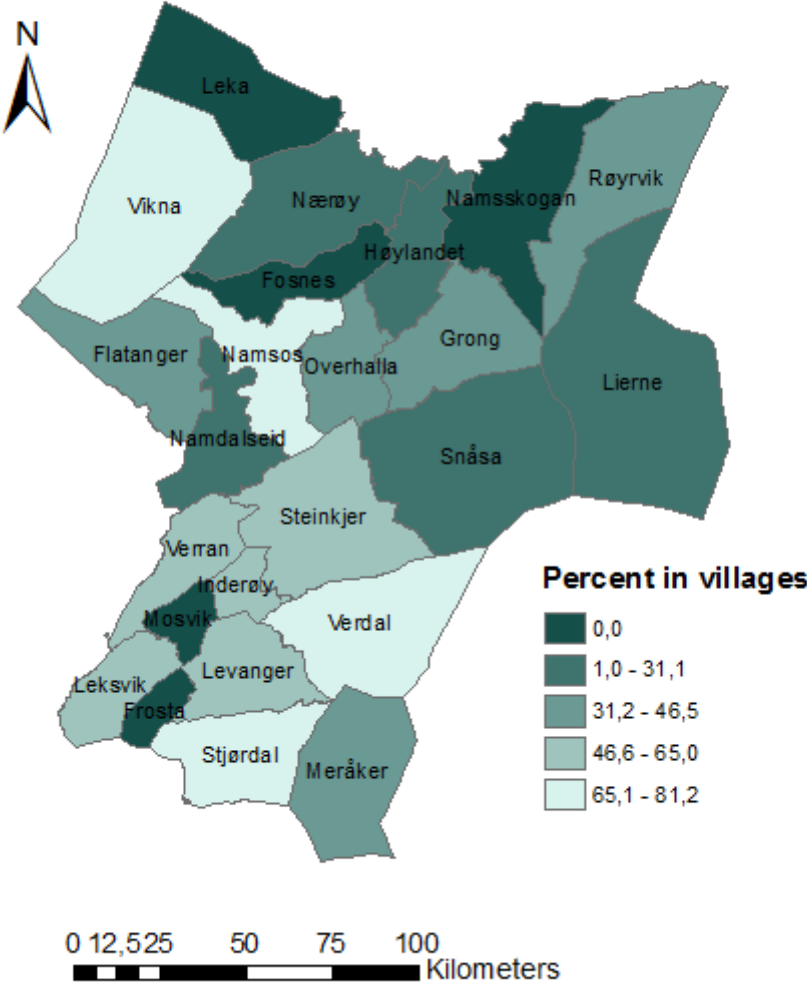


Figure 4.5 Percentage living in villages, 2010

SSBs standard classification of towns according to population are divided in 200 - 1 999 inhabitants, 2 000 - 19 999 inhabitants, 20 000 - 99 999 inhabitants and 100 000 inhabitants or more. In Nord-Trøndelag nine municipalities have populations less than 2000, and only two municipalities are in the second highest village level and non at the highest level. This may affect the prevalence of depression in the various municipalities, as it is referred to earlier a higher proportion of depression in urban areas.

### Town size by inhabitants

Manual grouping by SSBs classification of towns

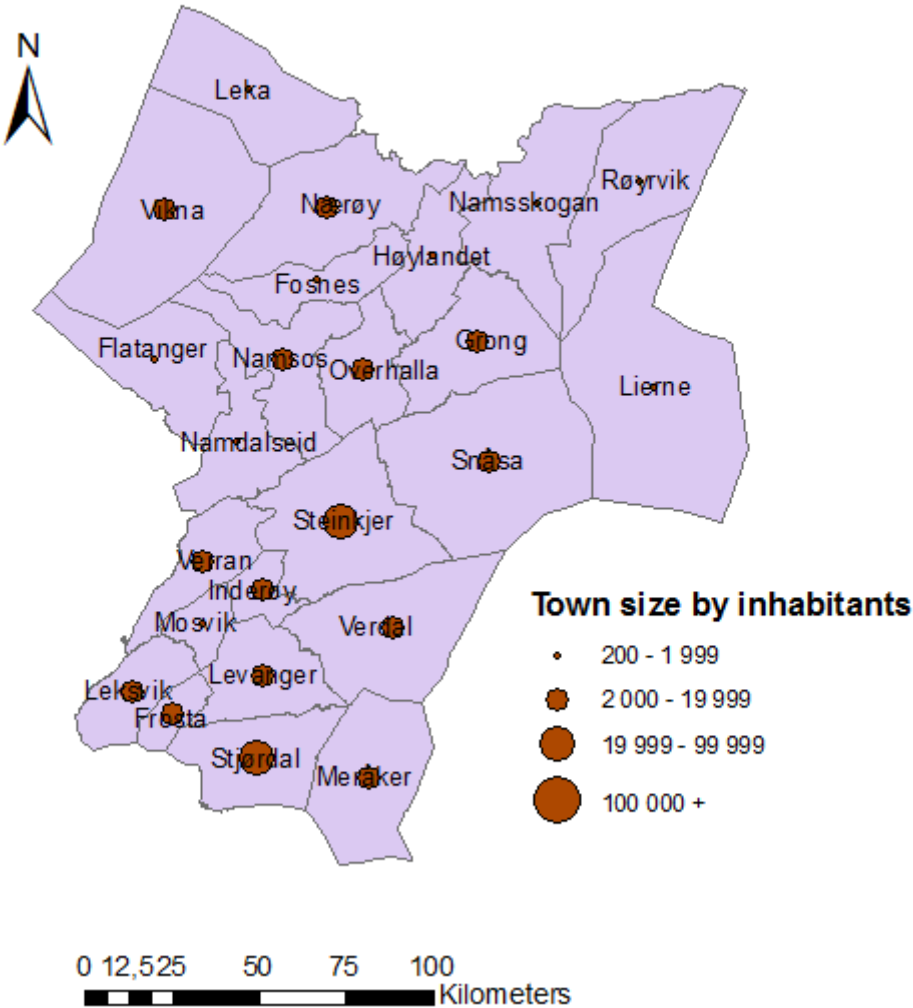


Figure 4.6 Town size by inhabitants

With regard to age distribution in the county, most municipalities has an over-representation of people older than 67 years, and Inner Namdal has 40% more in this age group than the national average. An excess of older individuals also means loss of the younger generations,

something of great importance for further reproduction and labour supply (Fylkesplan 2000). As mentioned above, there is an out-migration of younger groups from the region due to better work opportunities and education. One can then ask the question if the municipalities with a high out-migration appear to be attractive residentially. The age distribution of the population will also be of importance when it comes to depression and alcohol consumption, as younger women report more frequently about depression symptoms and younger men have higher alcohol consumption.

**4.2 Climate**

**Mean yearly temperature, normals for 1961 - 1990**  
Quantiles

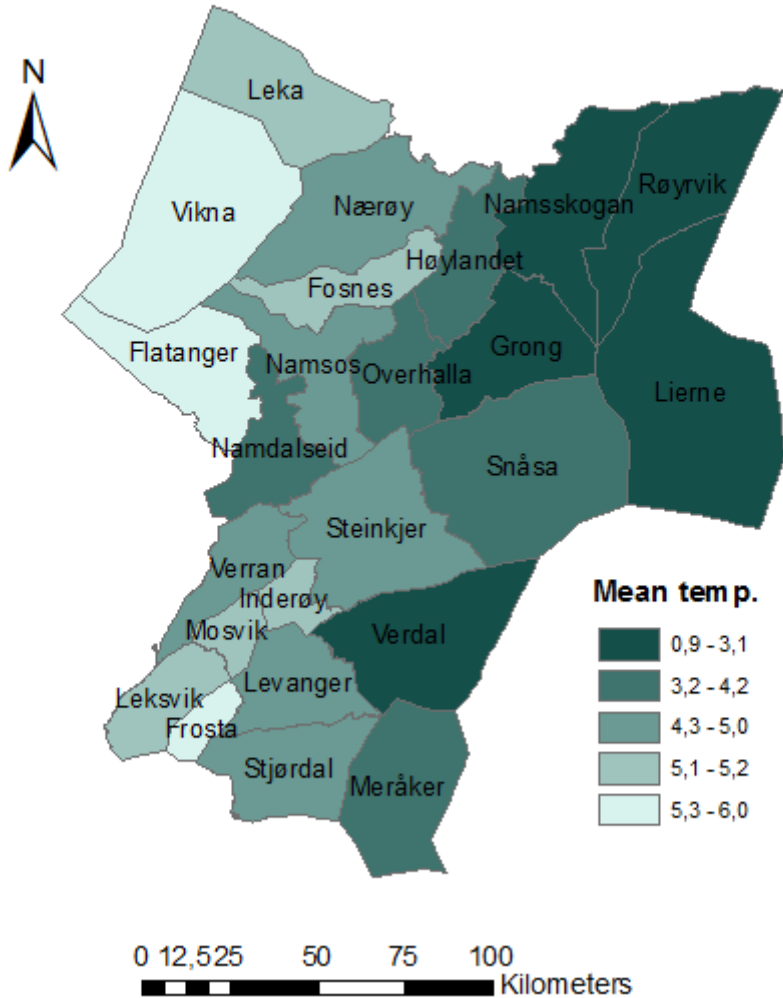


Figure 4.7 Mean yearly temperatures normal for 1961 -1990

Temperature and rainfall maps show that the coastal climate is characterized by higher temperatures and more precipitation. The continental municipalities near the Swedish border other hand have lower mean temperature and less precipitation.

# Rainfall normals for 1961 - 1990

Quantiles

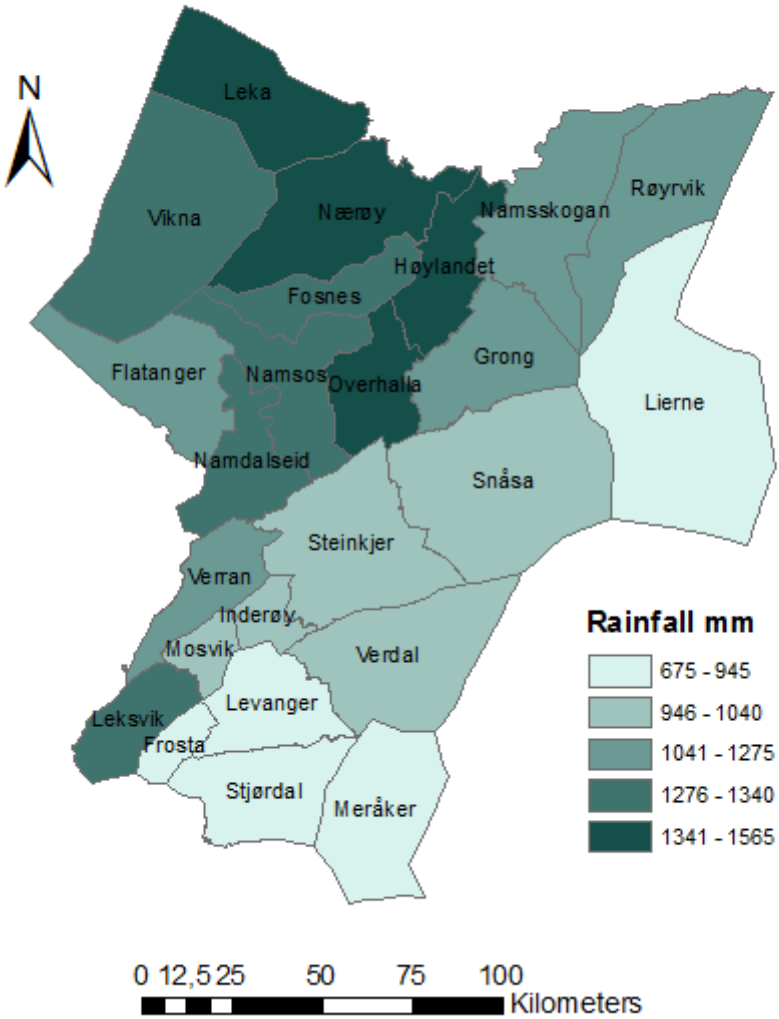


Figure 4.8 Precipitation normal for 1961 - 1990

### 4.3 Education

## Percentage of people with high education

Quantiles

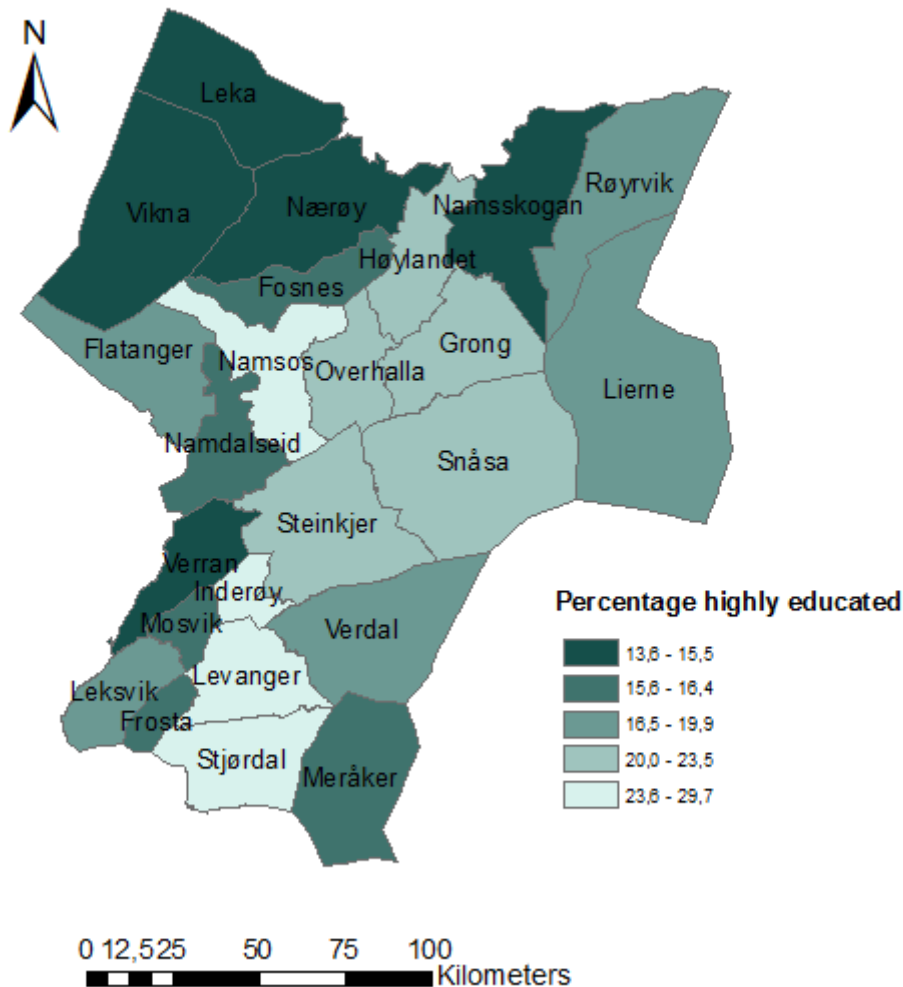


Figure 4.9 Percentage of people with high education, 2010

In 2010, the proportion with university or college education was 22, 4% in Nord-Trøndelag, against 27.8% on a national basis (SSB 2010). With the exception of Levanger municipality which is above the national average, all the other municipalities are below. The percentage with higher education is also largely in the biggest and most important towns, with the exception of Verdal located in the middle layer. The lowest education is found in areas along the coast and the Swedish border (SSB 2010). Education is a good measure of socioeconomic status in that it is easy to rate and that most are completed by the age of 25 years (FHI 2005).

The problem is that education after high school may have a different impact on individuals' health. In addition, educational groups changed in the last 30 years (FHI 2005), and as there is an increasing number of people taking higher education this might be a poor measure of socioeconomic status in our society.

#### **4.4 Depression and participation percentages**

The distribution of depression based on HADS-D score over 8 shows that the highest percentages of depressed respondents are located in Lierne, Snåsa, Verran and Fosnes. The lowest percentages are in Vikna, Namsos, Steinkjær, Stjørdal and Levanger. However the proportions are not very high or very low compared to the average score across the country, so there is no municipality where depression stands out with a particularly high prevalence (all were within around +/- 4% of the country average). This is one reason for showing the individual municipalities. Also it is important to note that if you look at the participation map, Lierne and Snåsa are among the municipalities with highest participation proportions, which could affect the results since depressed people tend to have a higher non-response rate than non-depressed people. It may therefore be possible that Lierne and Snåsa actually provide a more true depression proportion than Vikna and Stjørdal which are in the group of lowest response percentage. It would therefore be inappropriate to study each municipality separately since there may be response biases related to the proportions. However there is an interesting pattern in this map, where all the municipalities with low HADS-D scores have a high percentage of people living in villages or urban areas.

There is a slight problem connected to the comparison between the participation map and the HADS-D map. The HADS-D map is based upon a total population of 40 466 people, while the map of participation is based upon an n-value of 41 193 people i.e. all people answering both questionnaires and the interview. In the participation map, people not answering the HADS-D questions are not excluded from the sample. However this discrepancy does not distort the rate differences at municipality level.

Due to the pattern between the two maps I also did a correlation between the two variables to see if there was an actual connection between a municipality's depression percentage and

reporting percentage. I did however not get a significant correlation between the two ( $r = 0.176, p = 0.410$ ). This implies that the statement of Galea & Tracy (2007) is true, i.e. that low participation does not necessarily cause substantial bias after all.

### Percentage participated

Quantiles

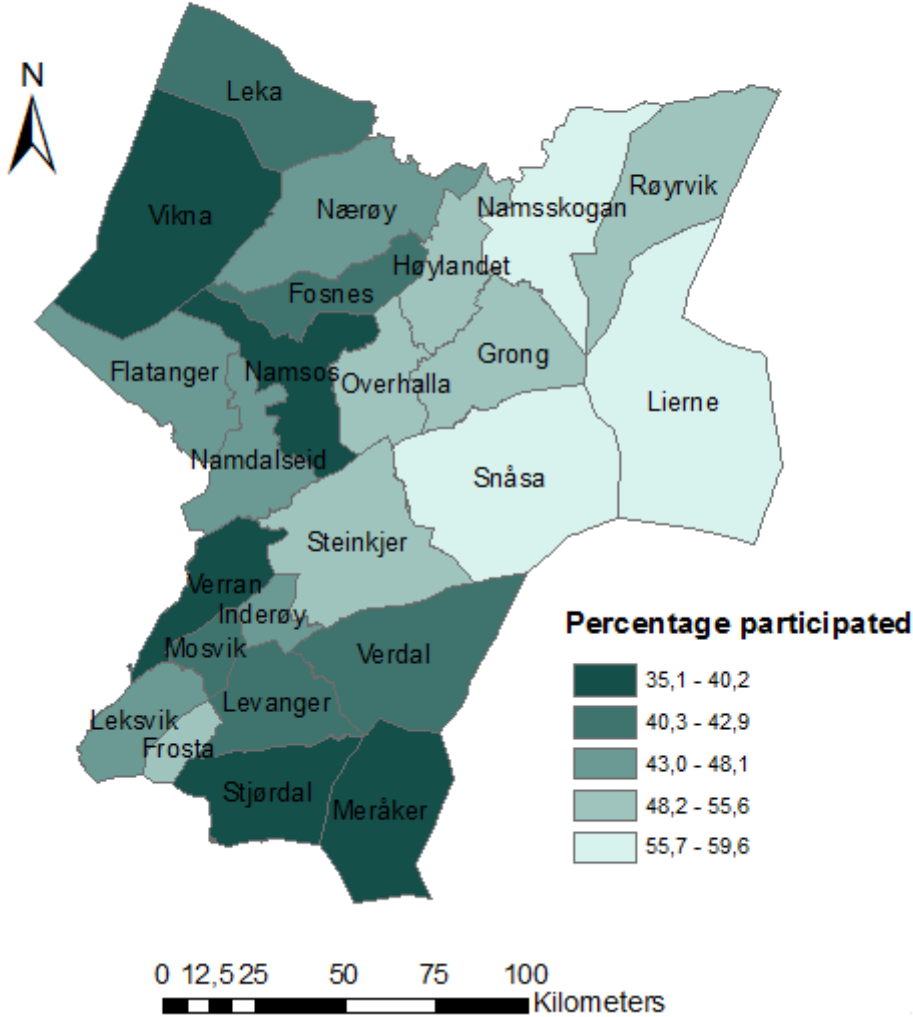


Figure 4.10 Percentage participated in HUNT 3



Percentage with depression based on HADS-D score of 8 and above  
Quantiles

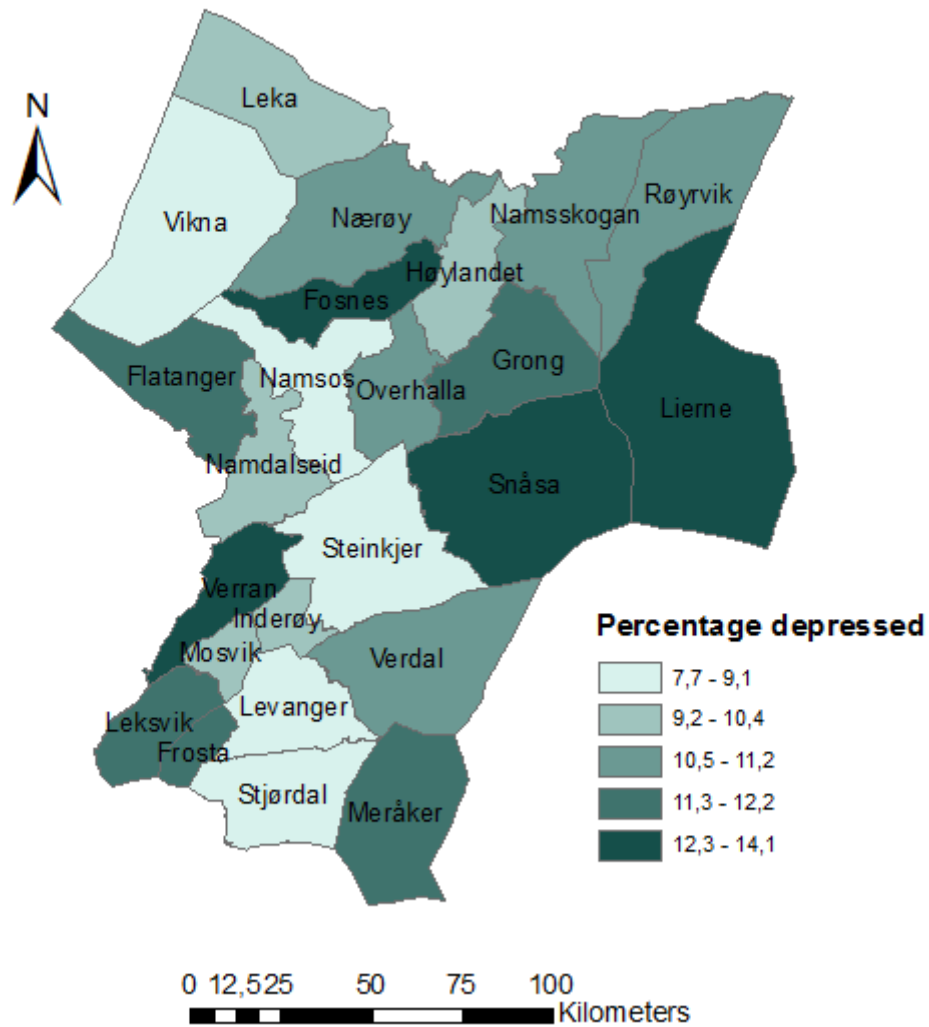


Figure 4.11 Percentage depressed based on HADS-D score of 8 and above

## 5.0 Results

In this chapter I present the findings from my study. I start with introducing the descriptives stratified by gender and urbanity in 5.1 and 5.2 Then I present the unadjusted associations in 5.3 before I present the two logistical models in 5.4 and 5.5.

### 5.1 Descriptives stratified by gender

Table 5.1 presents some of the characteristic of the participants' stratified by gender. In HUNT 3, 17787 men (44.0 %) and 22679 women had a valid HADS-D score after removing all participants who did not answer the majority of questions on questionnaire two. There are a slightly higher percentage of men with a HADS-D score  $\geq 8$ , 10.6 % versus 8.8 % for women. Also the CAGE score is higher for men; 13.3 % have a CAGE score above 2, whilst the equivalent for females is 3.5 %. It is worth noting that 20.1 % of the women's CAGE scores are missing (10.7 % for men) which may affect the results since it might be that the females missing would have a higher percentage of CAGE score above 2 than those answering the question. The average age is also slightly higher for men, 55.4 years versus 53.6 years for women.

While a higher percentage of men are working, (76.5 % versus 72.8 %) a higher percentage of women study, (4.8 % versus 2.5 %) or have the responsibility for the home, (3.8 % versus 1.2 %). When it comes to occupation, women dominates shorter college education, the sale industry and unskilled professions. Men on the other hand dominate management positions and manual professions. Women are more likely to live alone, (17.9 % versus 13.5 %) and without a partner; 75.3 % of women live with a partner, while 81.4 % of the men do the same. They are however slightly more likely to live with people under the age of 18; (24.5 % versus 20.7 %). When it comes to marital status, men have a higher chance at being in the married or single group than women, and women have a much higher chance of being in the widow(er) group. Urbanity between the sexes is almost equal, 63.5 % (men) versus 64.3 % (women).

Table 5.1 Variables and percentage distribution between genders

Variables		Men	Women
N		17787	22679
%		44.0	56.0
Average age		55.4	53.6
% working		76.5	72.8
% students		2.5	4.8
% responsibility home		1.2	3.8
% occupational status	Legislator, senior officials and managers	10.9	3.8
	Academia	8.9	8.2
	Shorter college education	16.4	22.8
	Office/service occ.	4.1	9.8
	Sales/service/care	8.6	36.7
	Farming/forestry/fishing	15.7	4.7
	Trade/craft	20.5	1.6
	Machine operator/transport worker	13.4	2.8
	Unskilled labour	1.4	9.5
% marital status	Unmarried	22.1	19.2
	Married	65.0	57.8
	Widow(er)	3.7	12.5
	Divorced	8.0	9.3
	Separated	1.1	1.2
% living situation	Alone	13.5	17.9
	Parents	2.2	1.3
	Spouse/partner	81.4	75.3
	Persons over 18	9.5	10.9
	Persons under 18	20.7	24.5
% urban		63.5	64.3
% CAGE over 2		13.3	3.5
% CAGE missing		10.7	20.1
% HADS-D over 8		10.6	8.8

## 5.2 Descriptives stratified by urbanity

Table 5.2 presents characteristics of the population based on rural or urban residence. In HUNT 3 there are 14 400 (36.0 %) people living in rural areas versus 25 550 (64.0 %) living in urban areas. The average age in rural areas is slightly higher than in urban areas.

Percentage working and studying are slightly higher in urban areas, while the percentage responsible for the home is slightly higher in rural areas.

When it comes to occupation we can see a tendency of higher percentages of jobs requiring high education in urban areas.

The percentages for marital status are quite similar in urban and rural areas, with two exceptions; rural areas have higher percentage widow(er) and urban areas have a higher percentage of divorced people.

Living arrangements are also quite similar between urban and rural areas, except for a slightly higher percentage of people living alone in rural areas and a slightly higher percentage living with people under 18 in urban areas.

The percentage of people with a CAGE-score over 2 is slightly higher in urban areas than rural. But it is worth noticing that the percentage of missing is higher in rural areas, which as noted above could affect the results.

When it comes depression proportions, rural areas have a higher percentage of people with a HADS-D score over 8.

Table 5.2 Variables and percentage distribution between urban and rural population

Variables		Rural	Urban
N		14400	25550
%		36.0	64.0
Average age		55.4	54.0
% working		74.0	74.9
% students		3.0	3.9
% responsibility home		3.7	2.1
% occupational status	Legislator, senior officials and managers	6.9	7.1
	Academia	5.3	10.2
	Shorter college education	17.1	21.5
	Office/service occ.	6.5	7.6
	Sales/service/care	24.6	23.9
	Farming/forestry/fishing	14.4	7.1
	Trade/craft	10.1	10.1
	Machine operator/transport worker	9.3	6.6
	Unskilled labour	5.9	5.9
% marital status	Unmarried	20.2	20.4
	Married	61.3	61.1
	Widow(er)	9.7	8.0
	Divorced	7.7	9.3
	Separated	1.1	1.2
% living situation	Alone	16.4	15.6
	Parents	1.6	1.7
	Spouse/partner	78.1	78.2
	Persons over 18	10.2	10.2
	Persons under 18	22.4	23.2
% CAGE over 2		7.6	7.9
% CAGE missing		18.3	14.4
% HADS-D over 8		11.0	8.8

## 5.3 Unadjusted associations

### 5.3.1 Population factors

Table 5.3 shows the unadjusted associations between HADS-D and different potential explanatory variables. In the group of population factors, we can see that there is a significant association between gender and depression, where men are 23 % more likely to have depression compared to women. Furthermore age is significant, where the older you are the more likely you become to have depression. There is 2.2 times greater chance of having a depression in the oldest age group than in the youngest. To have a family member with mental problems also increases the chance of being depressed by 1.7 times.

### 5.3.2 Behavioural factors

When it comes to behavioural factors, having a CAGE score over 2 is significantly associated with depression, where the likelihood of being depressed is 2.3 times greater. The opposite result is found with alcohol consumption, where people who are not depressed drink significantly more, and have 0.6 times less chance (almost half as likely) of having a depression.

People never smoked and people occasionally smoking cigarettes have a significantly lower percentage of depression, whilst the other groups have a higher percentage of depressed people. The group who never took snuff are also less likely to be depressed based on HADS-D. People who have quit or do it occasionally show the opposite trend, while daily snuffers have same percentage of depressed and 'non-depressed'. Compared to former studies these results are not as expected since smoking have been significantly associated with depression, also in a Norwegian context (Mykletun et. al. 2009, Myklestad et. al. 2008)

Personality seems to have a strong association with depression. Neurotic people have 12.8 greater chance of being depressed, while extroverted people have an odds ratio of depression of 0.14 (almost a tenth as likely).

Physical activity shows a significant association with depression, both measured in activity level and passivity level.

### 5.3.3 Environmental factors

All life events measured – both recently and past events, are significantly associated with depression. The odds ratio for childhood difficulties shows that there is a 2.4 higher chance of being depressed for the group above the mean difficulties score.

Social networks on both personal and neighbourhood levels are significantly associated with depression, but pet ownership is not. While living alone seems to increase chance of depression, all other living arrangements seems to decrease the chance. When it comes to marital status there is a significantly lower chance of depression amongst married people when having unmarried as a reference category. All other categories give a higher chance of depression. When it comes to participation, which also says something about social networks, there is a significant lower chance of depression in all groups.

Work environment related questions were only examined for people who are working. There is a significantly lower chance of having depression amongst those in jobs with lots of walking and lifting compared to jobs with mostly sitting. However there is a 39 % higher chance of depression when comparing heavily physical labour against mostly sitting. When it comes to type of industry, there seems to be a significantly higher chance of depression in manual jobs compared to unskilled work. The opposite is true for the academic, management and office jobs. The DSCQ measurement shows that demand is positively associated with depression, while control and support are negatively associated with depression.

Measurement of the physical environment shows that people living in urban areas are significantly less depressed than people in rural areas by 22,3 %. Climatic factors also seem to be associated with depression, where there is 18, 2 % higher chance of depression in rainy areas. There is also significantly lower chance of depression in warmer areas. Migration out of the municipality also seems to be associated with depression, as there a significantly higher out migration in the group of HADS-D score  $\geq 8$ .

Of the general health questions, life satisfaction is significantly negatively associated with depression. Self-perception of health is also significantly associated with depression as would be expected since mental status is an important part of one's total health status. For this reason this variable is left out in the later multiple regression models due to the fact that it may suffer from the problem of reverse causality.

**Table 5.3** Unadjusted associations between Hospital Anxiety and Depression Scale (HADS-D) and background variables

	HADS-D < 8	HADS-D ≥ 8	X <sup>2</sup> /t	P- value	OR	Missi ng %
<b>Population factors</b>						
Male	43.5 %	48.6 %	37.495	<0.001	1.229	0
Age	53.9	58.7	-18.348	<0.001	2.195 <sup>2</sup>	0
Family member with mental problem	19.0 %	29.2 %	217.595	<0.001	1.764	4.4
<b>Behavioural factors</b>						
<b>Alcohol</b>						
<i>CAGE-score</i>						
Felt to reducing alcohol intake	10.2 %	18.6 %	202.427	<0.001	2.019	15.1
Criticised about use of alcohol	7.0 %	13.7 %	171.584	<0.001	2.091	15.6
Felt guilty drinking	12.9 %	21.4 %	166.500	<0.001	1.833	15.7
Have had a pick me up drink in the morning	2.0 %	5.4 %	133.311	<0.001	2.720	15.5
CAGE over 2	7.2 %	13.5 %	407.558	<0.001	2.288	-
CAGE missing	15.2 %	23.1 %		<0.001	1.859	-
<i>Consumption</i>						
Glasses of beer a week	0.839	0.845	-0.192	0.848	0.851 <sup>3</sup>	7.7 <sup>10</sup>
Glasses of wine a week	1.089	0.805	9.653	<0.001	0.581 <sup>3</sup>	7.7 <sup>10</sup>
Glasses of spirits a week	0.357	0.410	-3.158	0.002	0.991 <sup>3</sup>	7.7 <sup>10</sup>
Total amount a week	2.285	2.060	4.619	<0.001	0.610 <sup>4</sup>	7.7 <sup>10</sup>
<b>Tobacco</b>						
Never smoked	46.2 %	39.8 %	56.178	<0.001	0.770	2.5 <sup>10</sup>
Quit smoking	31.8 %	34.1 %	8.969	0.003	1.114	2.5 <sup>10</sup>
Occasionally cigarettes	9.0 %	8.5 %	1.101	0.294	0.938	2.5 <sup>10</sup>
Occasionally cigars	1.6 %	2.7 %	21.797	<0.001	1.656	2.5 <sup>10</sup>
Cigarettes Daily	17.1 %	23.8 %	103.190	<0.001	1.511	2.5 <sup>10</sup>
Cigars Daily	1.2 %	2.5 %	44.539	<0.001	2.105	2.5 <sup>10</sup>
Used snuff						
Never	86.4 %	85.2 %	8.197	0.042	1	3.6
Quit	4.5 %	5.4 %			1.229	
Occasionally	2.9 %	3.2 %			1.120	
Daily	6.2 %	6.2 %			1.010	



## Personality, EPQ

### *Neurotic*

Worry about terrible things	16.1 %	37.9 %	1069.246	<0.001	3.178	3.7
Felt indifferent	19.3 %	58.8 %	2926.836	<0.001	5.967	4.3
Nervous problem	13.3 %	47.5 %	2810.941	<0.001	5.871	4.0
Lose interest	34.3 %	73.4 %	2154.699	<0.001	5.257	4.4
Easily hurt	40.4 %	64.1 %	759.455	<0.001	2.631	4.4
Worried	25.2 %	63.6 %	2406.364	<0.001	5.196	3.8
Total score	1.47	3.45	-68.800	<0.001	12.831	9.3

### *Extroverted*

Takes first step to make new friends	44.1 %	24.7 %	511.016	<0.001	0.416	4.7
Lively person	71.9 %	46.0 %	1044.572	<0.001	0.333	4.2
Likes life and excitement around you	54.9 %	32.7 %	657.441	<0.001	0.399	4.6
Like meeting new people	90.5 %	72.3 %	1112.055	<0.001	0.273	3.8
Mostly quiet and reserved	33.9 %	59.4 %	942.064	<0.001	2.851	3.9
Life of the party person	53.1 %	29.9 %	703.370	<0.001	0.377	5.9
Total score	3.81	2.46	-68.800	<0.001	0.137	6.9

## Physical activity

Sitting hours a day	5.759	6.050	-5.769	<0.001	1.242 <sup>8</sup>	13.3	
Exercise	Never	4.3 %	9.5 %	344.751	<0.001	1	1.6
	Less than 1/w	15.2 %	21.2 %			0.642	
	Once a week	21.3 %	21.1 %			0.455	
	2-3 times/w	40.4 %	31.5 %			0.358	
	Nearly every day	18.8 %	16.7 %			0.407	

## Environmental factors (social and physical)

### Life events

#### *Last 12 months*

Family member died	10.1 %	13.9 %	55.089	<0.001	1.448	1.9	
Imminent mortal danger	2.8 %	5.8 %	97.798	<0.001	2.097	1.7	
Relationship ended	9.5 %	12.9 %	45.597	<0.001	1.416	1.9	
Parental loss	No	92.5 %	90,9 %	11.988	0.002	1	1.4
	Before 7 years	2.4 %	2.7 %	12.370	0.002	1.147	
	7-18 years	5.2 %	6.4 %	12.370	0.002	1.257	
Childhood difficulties	1.66	2.10	-32.241	<0.001	2.439 <sup>5</sup>	0.9	

## Social network

### Personal level

Emotional support	92.8 %	75.9 %	1225.983	<0.001	0.245	0.8
Tangible support	96.2 %	84.0 %	1084.744	<0.001	0.209	0.9

### Neighbourhood level

Sense of community	3.99	3.57	23.219	<0.001	0.462 <sup>5</sup>	1.0
Distrust (Lack of social capital)	2.15	2.69	-24.994	<0.001	2.554 <sup>5</sup>	1.9
Like living here (Social cohesion and social capital)	4.55	4.18	31.641	<0.001	0.388 <sup>5</sup>	0.8

Pet ownership	Pet ownership	64.9 %	64.8 %	0.021	0.884	0.995	0 <sup>10</sup>
	Dog ownership	17.9 %	18.0 %	0.001	0.971	1.040	0 <sup>10</sup>
	Cat ownership	20.1 %	20.7 %	0.899	0.343	1.002	0 <sup>10</sup>
	Other pet ownership	2.7 %	3.1 %	2.361	0.124	1.163	0 <sup>10</sup>
Living arrangement	Live alone	15.2 %	23.5 %	183.802	<0.001	1.724	0.2 <sup>10</sup>
	Parents	1.7 %	1.6 %	0.022	0.881	0.980	0.2 <sup>10</sup>
	Spouse/partner	78.8%	70.3 %	148.287	<0.001	0.636	0.2 <sup>10</sup>
	Other over 18	10.4 %	9.3 %	4.188	0.041	0.888	0.2 <sup>10</sup>
	Other under 18	23.4 %	17.2 %	76.991	<0.001	0.679	0.2 <sup>10</sup>
Marital Status	Unmarried	20.6 %	19.7 %	114.810	<0.001	1	0.1
	Married/reg. Partner	61.5 %	55.5 %			0.943	
	Widower/surv. Partner	8.3 %	11.9 %			1.506	
	Divorced/ div. Partner	8.5 %	11.1 %			1.365	
	Separated	1.1 %	1.7 %			1.611	
	Partner						
Been oppressed for a long time period	18.1 %	33.9 %	495.173	<0.001	2.312	7.6	
Participated in	Club meeting	42.2 %	29.6 %	216.978	<0.001	0.577	4.0
	Music, singing, theatre	19.9 %	13.1 %	101.684	<0.001	0.605	3.2
	Parish work	5.5 %	4.5 %	7.205	0.007	0.802	3.1
	Outdoor activity	80.1 %	65.5 %	422.710	<0.001	0.472	4.4
	Dance	36.6 %	22.8 %	281.710	<0.001	0.511	3.3
	Sports	60.6 %	43.7 %	389.994	<0.001	0.506	4.0

## Work environment

Have a job		75.7 %	60.6 %	322.038	<0.001	0.494	15.9 <sup>10</sup>
Student		3.9 %	2.9 %	6.853	0.009	0.744	15.9 <sup>10</sup>
Housewife/ husband		2.5 %	3.9 %	19.330	<0.001	1.559	15.9 <sup>10</sup>
Work shift at night or are on call <sup>1</sup>		28.8 %	28.6 %	0.025	0.875	0.991	0
Work over 40 hours weekly <sup>1</sup>		27.3 %	29.0 %	2.198	0.138	1.084	0
Employment type by activity level <sup>1</sup>	Mostly sitting	33.1 %	33.6 %	25.264	<0.001	1	2.4
	Much walking	31.8 %	29.2 %			0.907	
	Much walking and lifting	27.1 %	25.9 %			0.942	
	Heavy physical labour	8.0 %	11.3 %			1.390	
<i>Occupation<sup>1</sup></i>							
Unskilled labour		4.2 %	5.5 %	119.856	<0.001	1	3.6
Machine operator/ transport worker		6.4 %	9.8 %			1.190	
Trade/craft		9.7 %	12.3 %			0.986	
Farming/forestry/fishing		7.4 %	10.9 %			1.139	
Sales/service/care		23.1 %	21.3 %			0.714	
Office/service occ.		6.8 %	7.9 %			0.895	
Shorter college education		23.9 %	19.2 %			0.623	
Academia		11.0 %	6.7 %			0.470	
Legislator/senior officials/ managers		7.3 %	6.5 %			0.687	
DCSQ <sup>1</sup>	Social support	10.16	9.26	25.094	<0.001	0.269 <sup>9</sup>	0 <sup>13</sup>
	Demand	8.65	8.87	-5.057	<0.001	1.360 <sup>6</sup>	0
	Control	9.53	9.16	8.336	<0.001	0.580 <sup>7</sup>	0
	Strain	0.94	1.03	-9.716	<0.001	1.702 <sup>15</sup>	0
	Iso-strain	0.10	0.12	-20.186	<0.001	2.971 <sup>14</sup>	0

## Area factors

Urban		64.5 %	58.8 %	48.365	<0.001	0.787	1.3
Precipitation		1042.85	1056.42	-3.803	<0.001	1.182 <sup>2</sup>	1.3
Temperature		4.375	4.304	4.363	<0.001	0.916 <sup>2</sup>	1.3
Moving rates		1.137	0.429	4.479	<0.001	0.783 <sup>12</sup>	1.3

Hospital area	Innherred	73.3 %	69.8 %	20.737	<0.001	0.845	1.3
Highly educated		22.232	21.604	8.264	<0.001	0.723 <sup>11</sup>	1.3

### General health questions

Life satisfaction		5.74	4.64	67.508	<0.001	0.153 <sup>5</sup>	1.2
Health status	Poor	0.9 %	6.1 %	2439.830	<0.001	1	2.9
	Not so good	22.2 %	50.7 %			0.327	
	Good	59.8 %	40.4 %			0.097	
	Very good	17.1 %	2.8 %			0.023	

<sup>1</sup>Only calculated for people answered “have a job” as their main occupancy at the moment

<sup>2</sup> Calculated after visual binning and then comparing oldest 25 % versus youngest 25 %

<sup>3</sup>Calculated for drinkers versus non-drinkers

<sup>4</sup> Calculated comparing non-drinkers versus people drinking 2.7 glasses or above

<sup>5</sup> Calculated by comparing mean and above versus mean and below

<sup>6</sup> Calculated comparing less than 8 versus 10 and above

<sup>7</sup>Calculated comparing less than 9 versus 11 and above

<sup>8</sup> Calculated comparing less than 4 versus 8 and above

<sup>9</sup> Calculated comparing less than 10 versus 12 and above

<sup>10</sup>Recoded missing into ‘no’ or ‘0’ if ticked any other of the boxes in the question

<sup>11</sup> Calculated comparing less or equal to 17.8 versus 23.9 or above.

<sup>12</sup> Calculated comparing less or equal to -4 versus 8,9 or above.

<sup>13</sup>Recoded missing into mean

<sup>14</sup>Calculated comparing less than 0,074999 versus 0,110000 and above

<sup>15</sup>Calculated comparing less than 0,75 versus 1,09 and above

#### **5.4 Main logistical regression model**

After undertaking stepwise logistic regression the variables still significantly associated with depression are presented in table 5.4. Gender still has an association with depression, whereby males have 58 % greater chance of depression compared to females. It also shows that the older you get the higher the chance of having a high HADS-D score.

Regarding use of alcohol, there is still a significant association between CAGE score over 2 and depression. Yet there is also significant association between a lower alcohol consumption and depression. This will be explained in later in the discussion.

Having a job is negatively associated with depression, and thus it appears to act as a protective factor.

After controlling for other variables participation in music and outdoor activity is still significant associated with depression.

Interestingly, all variables measuring social networks on a personal level are still significant, while sense of community feeling seems to no longer be significant on a neighbourhood level.

Childhood difficulties, neurotic personality and reporting being in imminent mortal danger the last 12 months are still positively associated with a high HADS-D score, while exercise, extroverted personality, high life satisfaction and high mean temperature is still negatively associated.

**Table 5.4** Results from logistical regression with Hospital Anxiety and Depression (HADS-D) as dependent variable

N = 28 089

Missing = 12 377

		OR	95 % CI	P-value
Constant		7.951	-	<0.001
Male		1.580	1.413-1.766	<0.001
Age	20-29	1		
	30-49	1.669	1.326-2.102	<0.001
	50-69	2.064	1.648-2.586	<0.001
	70 +	3.234	2.162-4.836	<0.001
CAGE	Over 2	1.542	1.319-1.803	<0.001
	Missing	0.986	0.840-1.159	0.868
Alcohol consumption weekly		0.977	0.957-0.997	0.024
Have a job		0.838	0.744-0.943	0.003
Participation music/theatre		0.854	0.743-0.983	0.028
Participation outdoor activity		0.837	0.738-0.950	0.006
Tangible support		0.785	0.652-0.945	0.011
Emotional support		0.710	0.614-0.822	<0.001
Distrust		1.105	1.058-1.153	<0.001
Like living here		0.818	0.765-0.875	<0.001
Childhood difficulties		1.085	1.026-1.147	0.004
Imminent mortal danger, last 12. months		1.337	1.042-1.716	0.023
Exercise	Never	1		
	Once a week or less	0.784	0.628-0.978	0.031
	More than once a week	0.645	0.516-0.806	<0.001
Extroverted		0.790	0.768-0.813	<0.001
Neurotic		1.570	1.524-1.617	<0.001
Mean temp.		0.919	0.875-0.965	0.001
Life satisfaction		0.491	0.465-0.518	<0.001

## 5.5 Work environment model

Recall that work environment variables were only examined for the part of the sample that has a job (Table 5.5). Sex is still significant, and men have a 17, 9 % higher chance of depression than women. Age is also still significantly associated with depression, where the two highest age groups have higher chance of a high HADS-D score. Of the people working in manual and unskilled jobs there is a 50, 2 % higher chance of depression. The DCSQ scale also seems to still be associated with depression, where support and control reduces the chance, while high demands increases the chance of depression.

**Table 5.5** Results from logistical regression on work environment with Hospital Anxiety and Depression (HADS-D) as dependent variable

N = 24 366

Missing = 952 (24 366)

		OR	95 % CI	P-value
Constant		1.349	-	0.225
Male		1.179	1.054-1.318	0.004
Age	20-39	1		
	40-49	1.217	1.054-1.407	0.008
	50-59	1.458	1.271-1.673	<0.001
	60 +	1.397	1.178-1.657	<0.001
Occupation	Low education (manual workers and non- educated)	1.502	1.342-1.681	<0.001
DCSQ	Support	0.706	0.684-0.728	<0.001
	Demand	1.045	1.015-1.075	0.003
	Control	0.927	0.902-0.952	<0.001

## 6.0 Discussion

In this chapter I will discuss the results against findings in other studies. I have split the chapter in two where I in 6.1 discuss the main logistic regression model and in 6.2 discuss the results of work environment.

### 6.1 Main logistic regression model

One of the main goals of this study was to look at the association between different behavioural and environmental factors associated with depression measured in HADS-D. The main advance of this study compared to other similar studies is the size of the sample population and the number of different variables taken into account.

#### 6.1.1 Population factors

##### 6.1.1.1 Gender/sex

Some population factors have been tested in relation to depression. The first interesting finding in this thesis is that men have a 58 % higher chance of having depression. This is contrary to earlier findings where most studies shows a higher prevalence of depression for women (Nielsen 1995, Eknes 2006, Sandanger et. al. 2004, Nes & Clench-Aas 2011), and the gender disparity in non-participants cannot explain the difference. Nielsen 1995 mentions that gender roles may be an important reason why woman are more depressed then men, and their theory may also explain the finding in this study. Since gender roles have become more similar and the fact that depression is more accepted by men it could also be that men find it easier to report depression symptoms. But the fact that also Nes & Clench-Aas (2011) show a higher prevalence of depression in woman suggests that this may not be the only explanation. It may also be that the Hospital Anxiety and Depression scale is a better measure of depression than the questionnaire used to measure lifetime prevalence of depression in the “Psyisk helse i Norge” survey, since it does not take into account physical symptoms of depression. Furthermore HADS-D measures feelings in the last 14 days and not in a whole lifetime, which makes it easier to remember. All in all it seems like men have standard depression symptoms, which makes the theory about men showing depression through irritation rather than having a depressed feeling more unlikely.



### ***6.1.1.2 Age***

In this sample, age is clearly associated with depression, where the older you get the higher chance of having a high HADS-D score. This is also contrary to most former research, where for example Nes & Clench-Aas 2011 found that there was higher depression prevalence in the younger part of the population. It is also contrary to the Mirowskys and Ross (1992) findings where depression seems to affect the youngest and the oldest part of the population instead of following a linear curve. The results however confirm Stordals (2005) findings from the HUNT 2 study. The reasons for higher depression in elderly could be that physical illness is greater, social status is lower and personal control is lower (Mirowsky & Ross 1992). The reason why studies show contradictory results may be explained by different measurement tools used to define depression, or that the age groups have different cut-off points. Non-respondent fraction may also indirectly influence the findings. It could also be that the findings have an element of being place-specific, since I have obtained the same results as Stordal (2005). This could for example be related to what types of facilities are offered for elderly people. As mentioned, Nord-Trøndelag has a high percentage of old people. It would therefore be possible to imagine that there are fewer resources for this age group than in other regions with a smaller group of old people. However this will also be dependent on local politics. It is also possible to envision that the high percentage older people in Nord-Trøndelag could affect the results since the proportion older will be higher compared to other age groups.

### ***6.1.1.3 Mental problems in the family***

As mentioned in the theory chapter there seems to be less genetic factors connected to unipolar depression. This study confirms that having other family members with depression does not significantly affect the risk of having high HADS-D score. This question does however also concern environmental effects of having a family member with mental issues – which has earlier been suggested to increase chance of depression (Eknes 2006).

## 6.1.2 Behavioural factors

### 6.1.2.1 Personality

This study confirms that there is an association between personality and depression. As in the study by Cheng and Furnham (2003), neurotic personalities seems to be more at risk of depression, while extroverted people seems to be negatively associated with depression. However it is not possible to say anything about the causality. It could also be possible that depression leads to a more nervous and introverted personality due to symptoms like decreased energy level and lack of self-esteem. Also it is worth noting that some of the questions related to personality are quite close to the characteristic of a depressed person, i.e. “*Do you often feel that you lose interest?*” and the symptom of loss of interest.

### 6.1.2.2 Exercise

As expected, exercise is significantly negatively associated with depression even after adjusting for other variables. This confirms earlier studies (Nes & Clench-Aas 2011, Martinsen 2000). It also seems like the people exercising more than once a week are less depressed than people exercising once a week or less when using ‘never’ as reference category. However it is not possible to say which way the direction of causality goes. It could also be that the happier you are the more energy you have to exercise. The type, duration and intensity of exercising are also not taken into account which makes this measurement somewhat diffuse. I could have used more differentiated measurement of exercise but this would have made it more difficult to compare with former studies as most of them only have a general question about exercise, i.e. Nes & Clench-Aas study from 2011.

### 6.1.2.3 Alcohol

I have kept two types of measurements of alcohol in the same model, CAGE and consumption measured in glasses pr. week. This could seem problematic as I could get problems of multicollinearity. This is however checked by doing a collinearity test. Also I have theoretical grounds for them being different (i.e. not measuring exactly the same thing – this is further discussed below). Their joint inclusion in the model also suggests they have an independent

association with the outcome as they don't change direction between the unadjusted model and the main regression model. Interpretation of the correlation between the CAGE and alcohol consumption can however be problematic for cases with low consumption.

When it comes to alcohol consumption the results may seem unexpected at first, since a CAGE score over 2 is significantly positively associated with high HADS-D score, while high consumption is the opposite. According to previous studies a CAGE score over 2 would increase chance of depression, which this study also confirms. As previously noted high alcohol consumption is associated with higher symptoms of depression (WHO 2004). This study does not confirm this as people who drink more have a lower HADS-D score. However this could be due to several reasons. First of all there is a difference between the drinking habits between the depressed and non-depressed where the non-depressed drink more wine (ref. table 5.3), and the depressed drink more liquor (ref. table 5.3). Wine drinking is often looked upon as a more high class phenomenon which means that other factors in these people's lives could protect against depression. However this is only an assumption and it should be further investigated if there is a connection between type of alcohol and social class. Secondly the consumption variable does not say anything about how many drinks consumed in one sitting, which probably would have given a better picture of depressed peoples drinking behaviour. Thirdly I have compared the non-drinkers versus everyone else, and Skogen et. al. (2009) found that alcohol consumption and depression fits a U-curve, where the abstainers and the heaviest drinkers are more depressed than people drinking in moderation. Their study was based on HUNT 2, which support my findings to a greater extent since it is somewhat the same study population and the same measurements used. It is also important to state that the CAGE score also indicates who has a negative 'relationship' with alcohol, not just the consumption rate. There could therefore be better measurements of people with a problematic drinking behaviour.

#### **6.1.2.4 Tobacco**

Contrary to prior research, smoking behaviour does not seem to be associated with depression after controlling for other variables. This might seem surprising since so many other studies (including Norwegian once) have found it significant, but this study controls for a great number of other types of variables. Smoking may therefore be a confounder variable and not directly linked to depression. Smoking habits are also changing, with fewer people smoking

today. The model presented here is trying to explain variables associated with depression, and if smoking is an outcome of depression and not the other way around it is actually good that the model does not show smoking as statistically significant. Lower prevalence would therefore lead to a stronger association with depression as solely people with mental health issues will end up still smoking.

### **6.1.3 Environmental factors**

#### **6.1.3.1 Life events**

Life events are said to affect depression, which is partly confirmed by this study. As mentioned in the methodology, this study has a limited number of life events covered and only if the person reports having been in imminent mortal danger do they appear to be significantly increasing chance of depression. The reason why my results are not as expected could be due to the fact that I am controlling for more or other variables than previous studies. Even though this variable might seem to have a natural one way causality, it may be that depressed people have a higher chance of getting into negative situations. What could be interpreted as mortal danger may also vary between people who express depression and others. As noted in the theory, depressed people have a harder time staying in a relationship and a harder time holding on to a job. Concerning the question of imminent mortal danger, impaired concentration (a symptom of depression) could affect the chance of getting into accidents and also suicidal actions will be covered by this question.

#### **6.1.3.2 Social network**

Several of the social network measurements are significantly associated with HADS-measured depression. First of all both tangible and emotional support is significantly associated with lower depression scores. This confirms as expected the outcomes of Grav et. al. (2011), who also used HUNT 3. However this study has used more variables than Grav et. al. which arguably makes the finding even more robust. It is however not possible to state if mentally healthy people are more social then depressed people, or if social support protects against depression.

Participation in society seems to also affect depression scores to some extent, but only participation in music/theatre and outdoor activity is significant after controlling for other variables. This finding could therefore imply that it is the specific activities that are associated with depression and not the participation itself. Music has been used as therapy against depression, and four out of five studies show a reduction in symptoms when using music compared to ordinary care (Maratos et. al. 2009). Outdoor activity could also be associated with depression in other ways than participation itself. First of all people answering this question may not have performed this activity with other people at all, and it may therefore be an inferior measurement of participation. Secondly, all outdoor activity involves exercise which is associated with depression itself. Thirdly, as stated in the theory, natural environment may have psychological benefits (Krenichyn 2006, Vogt 1987).

According to Dalgard et. al. (1995) social support is important for mental health only for those exposed to environmental stress or negative life events. In this study there is not a very strong association between negative life events and depression. Social support at the individual level is significantly negatively associated with depression, even after controlling for negative life events. This seems to imply that social support is important not only for those experiencing negative life events.

On a neighbourhood level both the questions about distrust and if people like living in the neighbourhood are significantly associated with depression scores. Sense of community is not associated with depression, which confirms what Mair et. al. (2010) found in their study on social ties. However it is also possible that non-depressed people are more trustful with their neighbours and happier about their residence due to the fact that they are not suffering from depression. Depressed people may feel alienation or being “outsiders” in the local community.

As previously noted, studies have showed that single people and people living alone have lower mental health than married and people living with a partner (Nes & Clench-Aas 2011, Myklestad et. al. 2008). This was however not significantly associated with depression in this study after controlling for other variables. The reason for this could be that family structure is changing, with more people getting divorced and living without a partner. This could affect both how people perceive this form of living arrangement, i.e. that its more socially accepted, and also when more people are in this situation it could be easier to socialize in other arenas outside of the family and home.

Also pet ownership seems to have no association with HADS-D scores, not even before controlling for other variables. As stated earlier, previous studies have had varying results about this topic.

Being humiliated over a long time period was significant positively associated with depression in the unadjusted associations, but after controlling for other variables it is no longer significant.

### ***6.1.3.3 Childhood***

The question about childhood difficulties confirms what earlier studies have shown (Eknes 2006), i. e. that childhood experience may later affect depression. However as mentioned earlier, this question only concerns the general childhood experience and does not say anything about specific events in the childhood that may cause later depression symptoms. Therefore it is unclear what exact reasons and events in the childhood that could have affected the development of depression. Even if this seems to be a more logic causality of this variable since the childhood is in the past, it could also be possible that depressed people have a more selective negative memory of their childhood. Having a general negative mind-set might make depressed people focus more on the negative events when answering the question.

Loss of parents in childhood does not seem to be associated with depression after controlling for other variables. This is opposite of Brown and Harris's (1978, cited in Eknes 2006) research, but it confirms Lewinsohns findings from 1994.

### ***6.1.3.4 Life satisfaction***

Life satisfaction is still significant after controlling for other variables. This might seem logical as some would argue that life satisfaction measures the same as depression. I have however kept the measure in the model due to as stated in the theory people with depression might not have the lowest life satisfaction. Also some researchers (Bradburn & Caplovitz 1965, Diener & Emmons 1985) have identified that negative and positive affect is not correlated with each other. However in my findings there seem to be a connection between life satisfaction and depression. The reason why I have got different results might be due to different measurements on positive and negative emotions, and the fact that my measurements are concerned of a more general life-experience.

#### 6.1.4 Area factors

##### 6.1.4.1 Climate

There seems to be a significant association between temperature and depression. Higher temperature is part of a coastal climate. Nevertheless high precipitation which also is characteristic of the coastal climate is not significantly associated with a low HADS-D score. In the unadjusted association model it is actually opposite. Temperature might therefore be a residual confounding variable, where there are other factors that actually are associated with depression. This could be related to industrial structure, coastal manners/mentality, open landscapes etc. However it is important to notice that the temperature used is average temperature over a 30 year period and it is not divided by season. It could therefore be possible that the places with lowest temperature, i.e. the municipalities with continental climate, have other more seasonal reasons for high depression proportions. It could be that the variable “cold winter with much snow” is the main factor of depression. This would support Lester’s (1970) findings where amount of snow affects the suicidal rates. There could also be reasons to argue that low winter temperatures contribute to isolation in separate dwellings which in turn has a harmful effect on social life, social networks, coherence and support.

##### 6.1.4.2 Urbanity

As mentioned before, most studies show a higher rate of depression in urban areas. This study shows a higher depression percentage in rural areas in the unadjusted associations. Also in the maps there is a pattern showing that the lowest depression proportions are in the urban areas. The reason for this result may be place specific, since Nord-Trøndelag has no large cities. As mentioned in the theory, they will therefore have less segregated areas compared to big cities like Oslo and avoid the problems connected to “breeding and drift”. You could therefore imagine that they have the diversity and facilities of a city, but due to the size they might avoid problems of anonymity, inequality, noise and pollution. The association is however no longer significant after controlling for other variables. This does not automatically make urbanity less important as it could be due to the fact that there are no really large urban areas in Nord-Trøndelag, possibly making the effect of urbanity smaller than it would do in counties with larger city areas. Also urbanity is a very complex measure containing lots of elements with specific social systems, specific industrial structure, specific behavioural characteristics etc.

and when controlling for these individual factors you will automatically remove the residual variation that may be associated with urbanity.

#### ***6.1.4.3 Moving rates***

The people with HADS-D scores below 8 are more likely to live in areas with higher positive in-migration than the people with higher HADS-D score. However this is no longer significant after controlling for other variables. Decreasing population may therefore not necessarily reflect a shrinking labour market and reduction in facilities such as shops, entertainment, schools etc.

#### ***6.1.4.4 Hospital area***

In the unadjusted associations Innherred show a lower odds ratio of having a HADS-D score above 8. However, after adjusting for other variables this is no longer significant, confirming the findings of Fretland and Krüger (1998).

#### ***6.1.4.5 High education***

High education is no longer significant after controlling for other variables. This could imply that I have controlled for causal factors that would associate education with depression (e.g. having a job).

### **6.2. Work environment**

Having a job is significantly associated a lower odds of depression, which confirms previous studies. It is however difficult to say if people having a job is less likely to be depressed or if depressed people are less likely to have a job since mental illness makes it more difficult to work. When it comes to working shift there is no significant association with depression, which is contrary to Eknes' (2006) statement. However it is still possible that people with depression have been working shift hours before and changed job or that depressed people are less capable or less likely to choose a job like this, which in turn would explain why the percentage of high and low HADS-D score is equal between shift workers.



Working more than 40 hours of week also seems to not be associated with depression scores. This is contrary to the findings in Hordaland Health Study (Kleppa et. al. 2008). This could be due to chance or it could be down to the sorts of jobs the long-hours workers do.

Type of job in terms of activity level shows a significant positive association with depression if you have a job that is manly sitting or if your job is characterised by heavy physical labour. This is however not significant anymore after controlling for other variables.

Occupation shows a significant association with depression. In the final model, the different professions are divided into two groups of low and high education skills. People with jobs that demand no education or low education are significantly more depressed than people in high education jobs.

The DSCQ variables are all associated with depression after controlling for other variables. People with high control over their work, and people with high social support are less depressed than people with less control and support. The opposite is true for demands, where high demands are positively associated with HADS-D score of 8 or above. When it comes to strain and iso-strain this is also negatively associated with depression in the unadjusted variables. It is left out of the work model due to strong overlap with the individual variables control, demand and support, and to keep the model as simple as possible. This all confirms the findings of Sanne et. al. (2005).

## 7.0 Conclusion

In this chapter I will make a summary of the results connected to the problem of this thesis.

The problems were:

- Identify the geographic distribution of depression measured by HADS in Nord-Trøndelag
- Investigate whether there is a possible association between depression and *area factors* like:
  - urbanity
  - climatic factors
  - moving rates
  - hospital areas Innherred and Namdalen (functional regions)
  - education level
- And further control for possible confounding factors for depression:
  - Examining relationships between various behavioral and environmental factors at *individual level* (tobacco, physical activity, alcohol consumption, personality, work environment, social networks) related to depression

### 7.1 Geographical distribution of depression measured by HADS-D in Nord-Trøndelag

There were no ‘extreme’ depression scores in any of the municipalities in Nord-Trøndelag, but Lierne, Snåsa, Verran and Fosnes showed the highest proportions of depression based on HADS-D score above 8. The lowest proportions were in Vikna, Namsos, Steinkjær, Stjørdal and Levanger. However as stated earlier it is important to look at the scores compared to participation since depressed people usually have a higher non-response rate. It may therefore be possible that Lierne and Snåsa which were in the highest response group actually gives a more true picture of depression proportions than Vikna and Stjørdal which are in the group of lowest response proportions. Therefore it is more interesting to look at general patterns instead of individual municipalities. One particularly interesting pattern in the depression map

is that all the municipalities in the 'low proportion group' have a high percentage of people living in villages or urban areas. This is also further confirmed in the later analysis where people living in urban areas are less likely to be depressed based on HADS-D score above 8. However, it is no longer significant after controlling for other individual variables.

## **7.2 Area factors associated with depression**

As already stated there seems to be a link between urbanity and depression based on the maps, where the lowest proportion of HADS-D score are located in areas with high percentage of people living in urban areas. I cannot find any other very distinct patterns. A visual comparative associative analysis is demanding due to different classification interval and different size of communities. It would in further studies be possible to do a correlation between the aggregated variables like percentage of HADS-D and percentage of high education to see if there are any patterns not recognised intuitively through the maps.

## **7.3 Environmental and behavioural factors connected to depression**

In this part of the thesis there are several interesting findings conflicting former studies. First of all, the fact that men have a 58 % higher chance of reporting depression is quite surprising. This is contrary to earlier findings where most studies shows a higher prevalence of depression for women (Nielsen 1995, Eknes 2006, Sandanger et. al. 2004, Nes & Clench-Aas 2011).

A second interesting finding is that age seems to be associated with depression; whereby the older you get the higher chance of having a high HADS-D score. This is also contrary to most former research, where depressions often have been associated with younger age or in a U-shaped relationship to age (Nes & Clench-Aas 2011, Mirowsky & Ross 1992). Although it confirms the findings of Stordal (2005) also based on HUNT data. The similarity with Stordals findings could be explained by similar measurement tools or that the results are place-specific.

The findings related to alcohol is also very interesting as a high CAGE-score is positively related to depression, while a high consumption is negatively related to depression. The reasons were as mentioned related to both CAGE being a better measurement of alcohol dependence as it is not connected to memory and also the fact that type of consumption may

be related to class. This should be further investigated. It should also be investigated if the results would follow Skogens et. al. (2009) U-curve. Furthermore the amount of drinking in one sitting would be interesting to add to the results to get a more accurate view of drinking behaviour. However it could be as stated, that CAGE-score is more connected to bad attitude towards alcohol and that this is more important than amount of alcohol consumed.

It is also quite surprising that tobaccos which have been one of the most important factors in other studies are not significantly connected to depression in this study.

When it comes to social networks this works as a protection factor both on personal level and neighbourhood level. Participation does also seem to affect depression, but this could be due to the specific activities and not the participation, since only some of the activities (music/theatre and outdoor activity) showed an association with depression scores. Even though social networks seems to be associated with depression, living alone or being single does not seem to be significantly associated with depression after controlling for other variables. This is contrary to earlier findings.

Negative life events seems to only partly be associated with depression, where being in imminent mortal danger seems to be the only variable significantly associated. Childhood difficulties is however significantly associated with depression, confirming previous studies (Eknes 2006).

Both exercise and personality factors confirm previous findings (Cheng & Furnham 2003, Nes & Clench-Aas 2011, Martinsen 2000) as they are both significantly associated with depression measured by HADS-D score.

Contrary to Næss' theory and former research (Bradburn & Caplovitz 1965) showing that positive and negative experiences being independent components of mental well-being, life satisfaction is significantly associated with depression.

In the area related factors it is most interesting that temperature is associated with depression. As stated previously this could be due to temperature being a residual confounding variable. But it could also be that cold weather lead to social isolation and therefore more testing is needed to see if there are more seasonal variations between weather and depression.

Some of the area factors like urbanity are significant in the unadjusted associations, but when controlling for other variables the effect of urbanity disappears. However this could be due to

the fact that urbanity is a very complex measure containing lots of elements with specific social systems, specific industrial structure, specific behavioural characteristics etc. and when controlling for these individual factors you will automatically remove the contents of urbanity. And the geography is still important when it comes to planning and public health, as the context is still there – the depressed people still live in rural areas, at least in this study.

In the work environment analysis having a job was positively associated with depression, confirming previous findings (Nes & Clench-Aas 2011). Type of occupation based on educational level show that high education is significantly associated with lower HADS-D score. This is supported by the Krokstad & Westin (2002) findings of more health problems in low educated people. Control, demand and social support measured by DSCQ does also confirm previous studies (Sanne et. al. 2005), where high control and high support are significant negative associated with depression, while high demands is significant positively associated with depression.

#### **7. 4 Theoretical implications**

The Triangle of Human ecology seems to be a convenient framework to find associations between possible influential factors not only to somatic disease but also to depression. It is however very important to enlighten the importance of mutual interaction between the behavioural, environmental and population factors. Exercise is one of the best variables to demonstrate this as the choice of doing exercise is highly dependent on available space to do so. A limitation of the model is that it does not demonstrate the factor of time and latency period. Disease is not just dependent on the present time but also past events. In relation to depression, imminent mortal danger in the last 12 month is a relevant example. The model does also assume a strong association between exposure in the local environment and disease. However a proportion of the population will not depend much on the local neighbourhood. An example would be a person commuting between an urban work environment and a rural living situation. The behaviour of this person might as well be coloured by the urban environment and not the rural. Also immigrants from one area could bring exposure from another area in their potential development of illness. Even though the model has habitat as a separate component, I would also therefor like to make the model more geographical to demonstrate that different places have different behaviours, different local habitats and different population composition. These different places do again have influence on each other. I have

made my own proposal of how the model could be taken one step further based on both theory I have read, and on results from my own study:

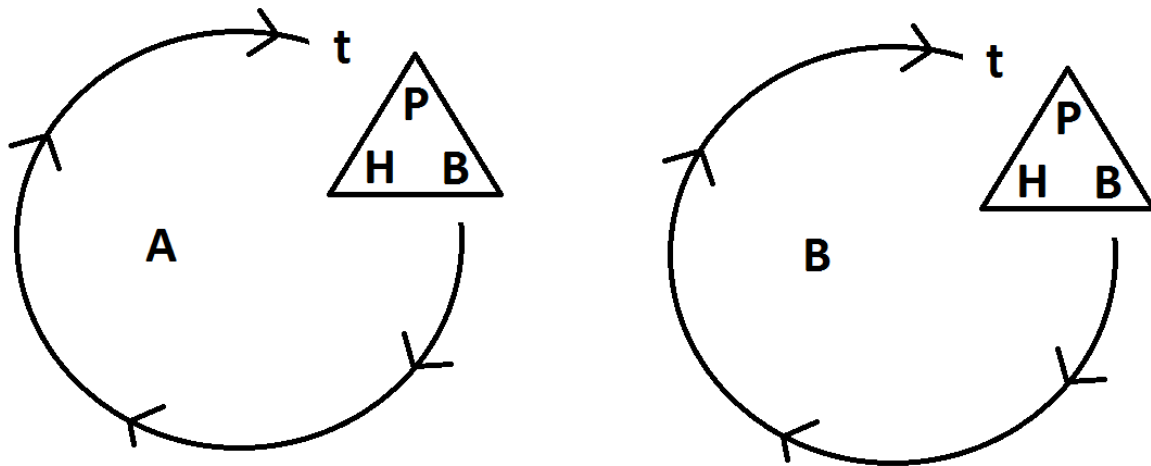


Figure 7.1 Where A and B is two different places, t is time and the triangle moving along the timeline still contains the three components population (P), habitat (H) and behaviour (B).

## 7.5 Limitations and advantages of the thesis

One of the biggest limitations of this study is that it is a cross-sectional study, and therefore it is not possible to say anything about causality. Another limitation is that the analysis done is done for the whole sample and not split into different sex and age groups. It would be interesting to see if you find the similar results for men and woman as some claim that male and female are involved in two ‘different cultures’. Previous studies have for example showed that women more often take on more responsibilities and have less control over work tasks at work (Sandanger et. al. 2004). However not stratifying the sample by sex and age may not be a limitation since the sample is larger and the results are therefore stronger. Also it is arguable that the male and female culture is more similar today.

Another limitation of the study is that there are not any large urban areas in Nord-Trøndelag, which could affect the results in this part of the analysis. A lack of large urban areas makes it also more difficult to generalize the findings. The fact that it’s also less than 3% non-Caucasians makes generalization difficult.

Further is this study is also based on self-report and not depression as a clinical diagnosis. It is also a limited heterogeneity in my outcome since all municipalities have depression proportions within around  $\pm 4\%$  of the country average.

The main strength of this thesis is the size of the sample population and the number of different variables controlled for. Also the response rate is relatively high compared to other studies. Nord-Trøndelag is also a county with quite low in- and out migration, making it less problematic to treat current residence as main exposure to possible risk factors.

Other strengths are a well characterised cohort, validated measures of outcome (HADS) and exposure (e.g. CAGE), careful analysis strategy dealing with confounding via multivariable models and integration of both individual and area data.

## **7.6 Final comments**

Depression is a growing health problem in all parts of the world. It has therefore been very interesting to find out more about what factors might influence depression. As we can understand depression is a very complex disease with lots of different plausible causations. Even though it has not been possible to say anything about causality in this thesis I have found associations interesting for further investigation.

For public health and planning purposes it is also very helpful to know in what areas to give the main focus. Even though the geographical context seems less important than individual characteristics, as a determinant of depression, the depressed people are still located somewhere – in this study in the rural areas.

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## **Appendix 1**

## **Appendix 2**

## **Appendix 3**