
The effect of living environment on the risk of an anxiety disorder or depression: a multilevel analysis of the province of Groningen.



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ABSTRACT

The mortality due to mental disorders in Groningen is higher as compared to the national Dutch average. The mental disorders examined here; anxiety disorder and depression, contribute to the highest disease burden in Groningen. This study described the effect of the living environment on the risk of an anxiety disorder or depression of people in the province of Groningen, as well as ascertaining the role of the control of individual characteristics to this relationship.

The theoretical framework, which has guided this research, is based on the theories 'Drift and breeder hypothesis', 'Composition and context' and the 'Dynamic Stress-Vulnerability model'. These theories have provided a framework for the interpretation of the empirical findings.

Multilevel analysis of 'health survey 2010' data of the health authority in Groningen (GGD) on 4394 adults 19 years and older nested within the 23 municipalities was used. Resulted from a multilevel logistic model hardly or no effect was found from the living environment characteristics on the risk of an anxiety disorder or depression, in addition to individual characteristics. However, green space significantly affected the risk of an anxiety disorder or depression for woman. Where a higher amount of green space decreased the risk of an anxiety disorder or depression. For males no significant effect of living environment characteristics were found.

There was limited evidence of the association of living environment characteristics with the risk of an anxiety disorder or depression. However, a specific association is found for green space and the risk of an anxiety disorder or depression among woman, in addition to individual characteristics. Which may suggest that females are more susceptible for the living environment in terms of green space.

KEY WORDS: Mental health, anxiety disorder, depression, living environment, socio-economic status, green space, urbanity, multilevel analysis, Groningen.

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LIST OF ABBREVIATIONS

CBS.	Central Bureau for Statistics in The Netherlands.
DSMIV.	Diagnostic and statistical manual of mental disorders
GGD.	Community Health Services
K10.	Kessler psychological distress scale
RIVM.	The National Institute for Public Health and the environment
SCP.	The Netherlands Institute for Social Research
VROM.	Ministry of Housing, Spatial Planning and Environment
WHO.	World Health Organisation.

1. INTRODUCTION

Mental health is an essential component of health; mental health is more than the absence of mental disorders, it is a state of well-being (WHO, 2014^a). The importance of positive mental health is emphasized in the World Health Organization's (WHO) definition of health: "... a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (WHO, 2012). Mental health is related to the promotion of well-being, prevention of mental disorders, and treatment and rehabilitation of people with a mental disorder (WHO, 2014^b). Mental health reflects itself by the individual capacity to lead a life with the ability to work, study, form and maintain relationships and make important daily decisions (WHO, 2012).

Mental health is a complex phenomenon that is influenced by a multiplicity of factors such as socio-economic conditions, biological functionality, individual family situations, as well as social and environmental factors (European Communities, 2005). According to the WHO these individual characteristics, socio-economic circumstances and environmental factors interact with each other in a dynamic way; they can promote or may constitute a risk to the individual's mental health state. Risks concerning mental health involve an interaction of age and time. Which manifest in risk factors at all stages in life in diverse setting and levels. Examples of possible risk factors at the individual level are; poor nutrition, harmful alcohol use, criminal or anti-social behaviour, difficulties at school and unemployment. Examples of possible risk factors at area level are; poor housing/living conditions, low socio-economic status, urbanisation and neighbourhood violence. Furthermore, the vulnerability to mental disorders differs among groups in society. People with certain characteristics may be more vulnerable to mental health problems. According to the WHO these are people who live in poverty, people with chronic health conditions, women, older people, minority groups and people exposed to war and conflict (WHO, 2012).

Poor mental health causes loss in quality of life. Besides the losses in quality of life, poor mental health might result in higher society costs, mainly through loss of productivity (European Communities, 2005). Especially in the younger population where mental ill health¹ results in increased rates of school drop-out, crime, drugs addiction, violence, erratic behaviour and psychological suffering (Schrijvers & Schoemaker, 2008). A recent study estimated the cumulative global impact of mental disorders in terms of lost economic output at 16.3 million dollars (US) between 2011 and 2030 (World Economic Forum, 2011). Thereby people with mental disorders have higher rates of disability and mortality, as a result of physical health problems and suicide (WHO, 2013^a).

The focus of prevention and promotion of mental ill health often involves actions to create healthy living conditions and environments which support mental health, thereby allowing people to adopt and maintain healthy lifestyles (WHO, 2007^a). Creating a healthy living environment involves integrating mental health promotion into policies such as; supporting children, improving access to education, housing improvement and socio-economic empowerment (WHO, 2014^a).

¹"Mental ill health includes mental health problems and strain, impaired functioning associated with distress, symptoms, and diagnosable mental disorders, such as schizophrenia and depression" (European Communities, 2005).

1.1 Overview global, European and Dutch situation

Worldwide mental ill health has its impact. Mental, neurological and substance use disorders are responsible for 13% of the total global burden of disease in the year 2004. Depression by itself is accountable for 4.3% of this burden, and is the largest single cause of disability worldwide, especially for women (WHO, 2013^a). Furthermore, depressive disorders and anxiety disorders are leading causes of Years Lost due to Disabilities (YLDs) at global level, both are in top five (WHO, 2013^b). Mental disorders are one of the most important, but also most treatable causes of suicide. Every year, nearly one million suicides are committed worldwide (WHO, 2013^c). The mental health action plan 2013-2020 has formalized universal goals concerning the promotion of mental health. The global targets by the year 2020 are: 80% of the countries should have at least two national, multisectoral mental health promotion and prevention programmes; the rate of suicide in countries should be reduced by 10%; 80% of the countries should be routinely collecting and reporting at least a core set of mental health indicators every two years through their national health and social information systems (WHO, 2014^a).

According to the WHO 20% of the disease burden in the European region is contributed to mental ill health. One out of four people will come into contact with mental problems at a certain time in their life (WHO, 2013^d). Moreover, 27% of the European adults experience mental ill health. In Europe there are 58,000 suicide cases annually. The most frequent forms of mental ill health in Europe are anxiety disorders or depression (European Communities, 2005). According to the European Commission the recent rates of European mental ill health are high compared to the rest of the world, and these rates are foreseen to increase in the near future. Thereby, in 2020 depression will be the highest-ranking cause of disease in the developed world (European Communities, 2005). Recently the European Union (EU) has increased its focus on promoting good mental health and the prevention of mental disorders. The importance of promoting good mental health and preventing mental disorders in Europe has been formalized in the 'Mental Health Declaration for Europe' (WHO, 2004). The EU believes that mental health is important for a healthy social economic environment. The aim of the department of social health is public protection and social integration of people with a mental disorder. This is due to the fact that the risk of social exclusion and poverty is higher for people with a mental disorder (RIVM, 2013^a).

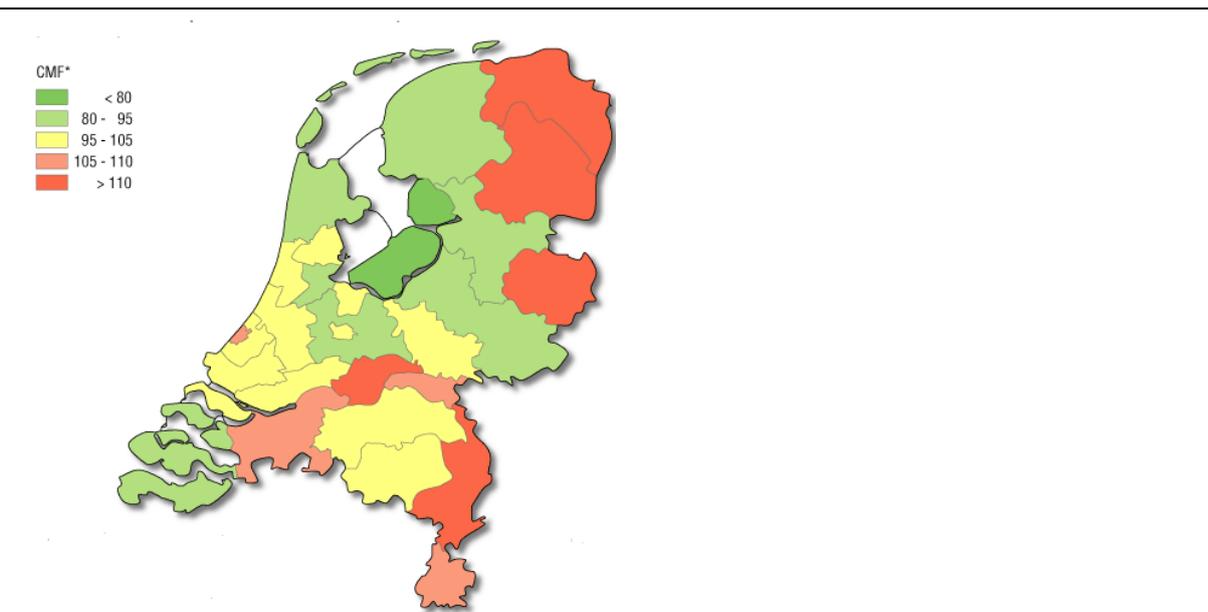
Consistent with what is observed in the rest of the world and Europe, The Netherlands also shows mental ill health as a large contributor to the nation's disease burden (WHO, 2008). In the Dutch population 10% suffers from mental disorders (CBS, 2013). In The Netherlands diseases such as anxiety disorder and depression have an enormous influence on the degree of mental ill health, these diseases are long lasting and recurrent. All this results in a decreased quality of life (RIVM, 2004). In The Netherlands actively promoting mental health and prevention of mental disorders is not a part of general healthcare policies in contrast to what is recommended by the EU and WHO (RIVM, 2012^a).

In the province of Groningen (located in the north of The Netherlands), the impact of mental ill health is also clearly visible. In Groningen, again the highest disease burden is caused by anxiety disorders and depression. These diseases contribute to a higher mortality rate. The mortality rate due to mental disorders in Groningen is above the Dutch national average (RIVM, 2012^b). The expectation is that the high incidence of ill mental health will increase (GGD, 2012).

1.2 Background of the province of Groningen

In the province of Groningen the mortality is 3% higher (age- standardized) compared to the mean mortality in The Netherlands (GGD, 2010). In figure 1 the mortality due to mental disorders in the Netherlands is shown. The average mortality due to mental disorders for The Netherlands is 100 deaths per year. The province of Groningen is one of the four provinces with an average mortality due to mental disorders, which lies above the national average. (RIVM, 2012^b).

Figure 1 Age- and sex- standardized mortality due to mental disorders The Netherlands, 2007- 2010.



Source: RIVM, 2012.

Furthermore, people with mental disorders in Groningen also experience a high disease burden. This is observed even more so in people with anxiety disorders or depression, both are in the top four of illnesses with high disease burden (GGD, 2010). The average risk of an anxiety disorder or depression in the province of Groningen is 38% (sex and age standardized), which is 1.8% lower compared to the mean Dutch risk of an anxiety disorder or depression (RIVM, 2014^a).

However, the demand for mental health care in the province of Groningen has increased. In 2003, 5% of the population in the province of Groningen received a form of mental care. Including 2.1% who had started treatment in the beginning of 2003 and 2.9% who had already started a treatment contract (GGD, 2006). In the years after 2003 the demand of mental treatment increased. This resulted in an increase to 8% of the province's population who received mental care in 2008 (GGD, 2010). In 2010, there was a 14% increase visible of people who were treated in curative mental health care compared to national treatments. The higher treatment rates in the province of Groningen differs between age groups, where the age group 0-17 year received 50% more mental health care, 18-41 year 6% more, 42-64 year 3% more and 65 year and older 16% more (GGD, 2013).

In Groningen the public mental health care institute (Lentis direct) carries out a large range of prevention activities, with the aim of promoting mental health. This is done in collaboration with local organizations in promoting connection to the local municipal policy. Their prevention activities are directed at different groups of people such as adolescents, residents, health care workers, volunteers

and professionals (Lentis, 2013). In 2012, Groningen public mental health care focused mainly on prevention, knowledge transfer, network development and registration. Nonetheless, it is expected that the high mental health problems in population of Groningen, including those that avoid health care, will increase (GGD, 2012).

As previously mentioned, one form of intervention is to create a living environment that supports good mental health (WHO,2007^a). The living environment is determined by various characteristics of the social and physical environment. In The Netherlands a healthy living environment is determined by a clean and safe place to live, the ability to healthy mobility, nature, green, water, ability to exercise and play, variety of public space, environmental quality, housing quality and adequate socio-economic status (RIVM, 2014^b).

Based on different reviews it can be stated that living environmental characteristics (socio-economic living environment and built environment) can have an effect on mental health. However, this effect is smaller when controlled for individual characteristics (Truong & Ma, 2006; Mair, Diez Roux & Galea, 2008).

This study's emphasis lies on a multi-level relationship between the individual characteristics and the living environment characteristics on the risk of an anxiety disorder or depression. This perspective is also called an integrative approach. This approach emphasizes the dynamic interaction of intra-personal and higher (area) level characteristics (Galinha & Pais-Ribeiro, 2011).

1.3. Objective and research questions

This research will assess whether the living environment is associated with the risk of an anxiety disorder or depression of people in the province of Groningen, as well as ascertaining the role of the control of the individual characteristics to this relationship.

Main research question:

What is the effect of living environment characteristics on the risk of an anxiety disorder or depression of the population in the province of Groningen in addition to individual characteristics?

Sub questions:

- *To what extent do individual characteristics explain the relationship between living environment and the risk of anxiety disorder or depression, of the population in the province of Groningen?*
- *To what extent does socio-economic living environment at the municipality-level affect the risk of an anxiety disorder or depression, of the population in the province of Groningen?*
- *To what extent does the physical living environment at the municipality-level affect the risk of an anxiety disorder or depression, of the population in the province of Groningen?*

1.4. Scientific and societal relevance

1.4.1. Scientific relevance

This study will analyse the effect of the living environment characteristics socio-economic environment, urbanity (housing density) and green space on the risk of an anxiety disorder or depression, in addition to individual characteristics. Built environment is consistently associated with depression, however the number of studies are small (Mair, Diez Roux & Galea, 2008). Besides the epidemiological studies concerning the relationship between nature and health are also rare (RMNO, 2004). This study will provide more insight and knowledge of the effect of built environment and nature by studying the effect of urbanity and green space along with the effect of socio-economic environment on mental health, in specific for the risk of an anxiety disorder or depression.

1.4.2. Societal relevance

The mortality due to mental disorders in Groningen is higher as compared to the national Dutch average (RIVM, 2012^b). The mental disorders examined here; anxiety disorder and depression, contribute to the highest disease burden in Groningen (GGD, 2010). For this reason Groningen can be seen as an example region to examine the influence of the living environment on the risk of an anxiety disorder or depression. It will contribute to an understanding of how the living environment affects the mental disorders. This knowledge will provide information for oriented policy to prevent a further increase of mortality due to mental disorders.

1.5. Structure of the thesis

The introduction provided background information, the research questions and the relevance of this research. In the theoretical framework the terminology, relevant theories and a literature review will be elaborated. The data and method chapter provides information relating to the data, characteristics of the survey population, and the methods that are used for the analysis of the data. The results section presents the results of the analysis, divided in paragraphs which all represent one of the research questions. The conclusion and discussion chapter elaborates on the results and a link will be created with the theoretical framework and previous literature. Finally, the strengths and limitations of this study will be described along with future directions.

2. THEORETICAL FRAMEWORK

The theoretical framework upon which this research is based consists of the following theories; Drift hypothesis and breeder hypothesis, composition and context and the Dynamic Stress-Vulnerability model. These theories have provided a framework for the interpretation of the empirical findings. The literature review will give an overview of former studies, related to individual and environmental risk factors of mental ill health. Prior to the clarification of drift hypothesis and breeder hypothesis, composition and context, the Dynamic Stress-Vulnerability model and the literature review, the definitions of mental health, mental disorder, anxiety disorder and depression, will be described.

2.1. Definitions

2.1.1. Mental health and mental disorder

The American Psychological Association (APA) (2007) defines mental health as a state of mind characterized by emotional well-being, good behavioural adjustment, relative freedom from anxiety and disabling symptoms, and a capacity to establish constructive relationships and cope with the ordinary demands and stresses of life. In contrast, mental disorder is defined as a disorder characterized by psychological symptoms, abnormal behaviours, impaired functioning, or any combination of these. Such disorders may clinical significant distress and impairment in a variety of domains of functioning and may be due to organic, social, genetic, chemical, or psychological factors (APA, 2007).

In the extent to which the prevalence of mental disorders (DSM-IV) has been studied globally, anxiety disorder is the most common mental disorder; mood disorders are the second most common mental disorders (WHO, 2004). Consistent with what is observed in the rest of the world, Europe and The Netherlands also show anxiety disorders and mood disorders as the most common mental disorders (Alonso et al., 2004).

2.1.2. Anxiety disorder

According to the *Diagnostic and Statistical Manual of Mental disorders (DSM IV)* anxiety is a state of fear, or feelings of fear. Anxiety is a normal response to imminent danger. Inappropriate reactions of fear can lead to dysfunction in daily life, which is termed anxiety disorders. An anxiety disorder is described as a class of mental disorders that are characterized by excessive or inappropriate fear responses (Nevid, Rathus & Green, 2008). The DSM-IV differentiates the following specific/distinct types of anxiety disorders: separation anxiety disorder, selective mutism, specific phobia, social anxiety disorder (social phobia), panic disorder, panic attack specified, agoraphobia, generalized anxiety disorder, substance/medication-induced anxiety disorder, anxiety disorder due to other medical conditions, other specified anxiety disorder and unspecified anxiety disorder (APA, 2013).

2.1.3. Depression

According to the *Diagnostic and Statistical Manual of Mental disorders (DSM IV)* depression is described as people who suffer from one, or more than one episodes of severe depression without the feeling of mania or hypomania. The person experiences a gloomy mood (sad, desperate feelings) or loses interest/fun in daily activities during a period of at least two weeks (Nevid, Rathus & Green, 2008). Depressive disorders include disruptive mood dysregulation disorder, major depressive disorder (including major depressive episode), persistent depressive disorder (dysthymia), premenstrual dysphoric disorder, substance/medication-induced depressive disorder, depressive due to another medical condition, other specified depression disorders, and unspecified depressive disorder (APA, 2013).

The specific definitions for the diverse forms of anxiety and depression are provided in the *Diagnostic and statistical manual of mental disorders (DSM-IV)*.

2.1.4. Relationship of anxiety disorder and depression

Anxiety is one of the most common mental disorders correlated to depression (Wolman et al, 1994). This is partially explained to due to the overlap in diagnostic criteria. However, even when the overlap of the diagnostic criteria is taken into account, we can speak of comorbidity; co-occurrence of more than one disorder in an individual at a given time (Frances et al., 1992; Ingram et al., 1998).

2.2. Theories

2.2.1. Drift hypothesis and breeder hypothesis

The drift and breeder hypotheses are complementary explanations of explaining variation in health. The drift hypotheses refer to spatial concentration of illness, which can be caused by direct selection and indirect selection. Direct selections refers to individuals moving to (or from) specific environments or remain there (Verheij, 1996). Direct selection takes place when the health of people affects their probability of living in a favourable environment, which indicates that the health of individuals may affect the area where they live (Maas, 2008). However, longitudinal studies concerning health related migration showed that direct selection cannot cause geographical differences if demographic and socio-economic characteristics are taken into account. (Verheij, 1996).

Indirect selection refers to vulnerable individuals move to (or from) specific environments or remain there (Verheij, 1996). According to Maas (2008) indirect selection takes place when individuals with specific characteristics which are related to health, for example income, can afford to live in a favourable environment. Indirect selection can be controlled for by taking demographic and socio-economic characteristics into account (Maas, 2008).

The breeder hypothesis indicates that spatial variations are due to exposure to environmental factors as well as spatial variation in health behaviour, or illness-related behaviour (Verheij, 1996). For example males who were raised in urban areas had a higher incidence of schizophrenia than men who were raised in rural areas. Employed in the model were the illness-related behaviour factors cannabis use, parental divorce, and family history of psychiatric disorder (Lewis, 1992) The Drift and breeder hypothesis distinguish clearly the role of the individual and the area, in other words composition versus context.

2.2.2. Composition versus Context

In order to explain variation in health most studies end up with the question ‘are health inequalities due to composition or context?’. Which is an issue concerning a fundamental question about the causes and distribution of ill health in Western societies and influences policies and implications. Composition refers to the individual level, understanding health inequalities by individual characteristics. Individual or compositional type of characteristics are: age, sex, ethnicity, lifestyle, and socio-economic position (Shaw et al., 2002). An example of the individual characteristic sex is shown in the study of Ivory et al. (2011); women in general had a lower score on mental health as compared to men. Another example is the study of Nazroo (1997) where differences in health, in terms of both morbidity and mortality across ethnic groups were shown. For instance in the United States where non-Hispanic Blacks and Native Americans are reported to have higher rates of mortality than non-Hispanic Whites (Nazroo, 1997). If individual characteristics would entirely explain the health inequalities it may be assumed that the persons environment has no affect and individual characteristics are able to explain all differences in health (Shaw et al., 2002).

Context refers to the area level, where health inequalities are explained by area characteristics. Area or context type of characteristics can be: available health services, whether the area is rural or urban, the presence of a factory and absence of facilities (for example public green). But also less concrete features such as sense of community, rates of crime or the fear for crime (Shaw et al., 2002). For example the review of Verheij (1996) showed that several studies found a direct effect (controlled for individual factors) of stress-indicating factors that are associated with urbanity; the extent to which a place is urban (Verheij, 1996). According to Shaw et al. (2002) context can be divided into social environmental context and physical environmental context. The social environmental context can be subdivided by tangible fabric, state fabric, social fabric and equality. Tangible fabric refers to physical and material features, nature of housing, shops and available facilities. State fabric refers to systems and access of state support. Social fabric indicates community coherence and social support and equality refers to equality in material wealth and opportunity. Examples of the physical environmental context are nature, pollution and exposure to radiation. However, characteristics are not always classified as either compositional or context. For instance, an individual can have a low socio-economic position, but the area the person lives in can have a high socio-economic position. Obvious is that both composition and context matter in order to explain variation in health, much less obvious is to determine how much the composition or context matter. The balance between composition and context may vary according to place, group, health outcome and research approach and technique (Shaw et al., 2002).

2.2.3. ‘Dynamic Stress-Vulnerability model’

A model that focuses as well on composition as on context is the Dynamic Stress-Vulnerability model (appendix 1). This model gives an overview of the determinants, which may affect the risk of mental ill health.

The Dynamic Stress-Vulnerability model is developed to explain the origin of psychotic episodes in schizophrenia (Zublin & Spring, 1977). Based on the work of Zublin & Spring (1977), Nuechterlein & Dawson (1984) extended the model with vulnerability factors and environmental stress factors. The Dynamic Stress-Vulnerability model can be seen as an integrative approach because of the dynamic interaction of individual- and higher level characteristics (Diener, 2000; Galinha & Pais-Ribeiro, 2011). The model shows how personal factors (psychobiological vulnerability), environmental factors (social or physical Vulnerability) and life events influence the risk of mental ill health (Maas &

Jansen, 2000). The Dynamic Stress-Vulnerability model highlights a dynamic balance and an interaction of the different factors in the model. Likewise the model emphasises the independence from the effect of the different determinants as an important aspect of the model (Ormel et al., 2001). In order to study the effect of determinants on the risk of mental ill health, the Dynamic Stress-Vulnerability model is often used (Brown & Harris, 1978; Folkman & Lazarus, 1988; Goldberg et al., 1990; Meehl, 1990; Cohen et al., 1995; Ormel et al., 1999; Ormel et al., 2000; Maas, 2008). According to Ormel et al. (2001) The Dynamic Stress-Vulnerability model contains four important main indicators for the risk of mental ill health:

The Demographic determinants have a clear reference to the psychobiological vulnerability as well as the social and physical vulnerability. Therefore the demographic determinants sex and age considered separately and are not classified as psychobiological vulnerability or the social and physical vulnerability (Ormel et al., 2001). Psychobiological vulnerability and social and physical vulnerability can be related to the terms composition and context. Psychobiological vulnerability refers to composition, thus the individual level, and social and physical vulnerability can be related to context, the area level.

Psychobiological vulnerability determines the resistance and resilience of the individual. Psychobiological vulnerability consists of the following factors: Genetic factors, traits and health (Maas & Jansen, 2000). The effect of psychobiological vulnerability on mental health is both indirect and direct. Indirect seeing psychobiological vulnerability effects mental health through the experience and behaviour of a person, their environmental control, signification (the way in which a person experiences reality) and a person's coping ability (the way a person copes with life events and the effect on emotional, mental and behavioural field). The relation with psychobiological vulnerability, the experience and behaviour of a person is an interacting relationship; this indicates that psychobiological vulnerability may affect the experience and behaviour of a person but also the other way around. Likewise, the direct relationship between psychobiological vulnerability and mental health is an interacting effect (Ormel et al., 2001).

The social- and the physical vulnerability consists of factors such as: social support/relationships, social-economic status and urbanisation (Maas & Jansen, 2000). According to the model, social and physical vulnerability interact in a similar way with mental health - as does the psychobiological vulnerability. The indirect effect is interrelated with the experience and behaviour of a person, their action area (time/space to act), signification (the way a person experiences reality) and coping ability. In this case the social and physical vulnerability also interact with experience and behaviour of a person. Which is similar as interacting relationship of experience and behaviour with psychobiological vulnerability. Likewise, the direct effect between social and physical vulnerability and mental health is an interacting effect (Ormel et al., 2001).

Life events are drastic events, and are seen as a large contributor to a person's mental health state. Drastic event may cause instability, however, people react differently to drastic life events. A life event can be the death of a partner but also entering into a new relationship or starting a new job (Ormel et al., 2001). What kind of life events people experience has to do with their action area environmental control, and coincidence. Action area can be explained through the limits that a person has been exposed to by their social and physical environment. The environmental control is determined by the ability of a person, within his or her action area, to avoid or to realise certain circumstances (Maas & Jansen, 2000). If these life events eventually cause or contribute to causation of mental disorders depends on signification and coping (Ormel et al., 2001).

The relations of the main indicators of the Dynamic Stress-Vulnerability model on the risk of mental health have been confirmed by research done in Groningen on neuroticism (emotional instability), life events and depression (Ormel et al., 2000).

The theories concerning Drift and breeder hypotheses and Composition and context gave an overview of how individual and environmental characteristics may manifest and affect (ill) health. The Dynamic Stress-Vulnerability model has done so specifically for (ill) mental health. However, less clear was how much the individual and environmental characteristics affect mental health. This research will focus on the effect of the living environment characteristics (socio-economic environment, urbanity and green space) on the risk of an anxiety disorder or depression in addition to individual characteristics. Furthermore, it will aim to give an indication of the strength of the relationship between the living environment and the risk of an anxiety disorder or depression in addition to the individual factors.

2.3. Literature review

The theories have provided insight in how individual characteristics and environmental characteristics may affect mental health or health. However, how much individual or environmental characteristics may affect mental health is not obvious and probably will vary between place, group, health outcome and research approach and technique (Shaw et al., 2002). The literature review will give an overview of previous research concerning the effect of individual characteristics and environmental characteristics on mental health and general health. These findings will give insight of expectations and consequences concerning this current study.

In the beginning of the 1990's, research of area level social fragmentation (inhibiting levels of social cohesion and social capital available to residents) focused mainly on the Congdon index at area level (Ivory et al., 2011). The research of Congdon (1996) focused on geographical variations in suicide and mental ill rates. Suicide was associated with social fragmentation, where increasing fragmentation was associated with suicide (Congdon 1996; Evans et al., 2004). Besides, it has been shown that increasing neighbourhood social fragmentation is associated with lower mental health. Ivory et al. (2011) focused on the neighbourhood social fragmentation and its influence on mental health. They examined the relationship using the New Zealand index of neighbourhood social fragmentation (NeighFrag) and self-reported mental health. In order to examine this relationship they took individual characteristics into account with the use of multilevel methods; the included individual level characteristics were education, age, labour force status, sex and self-identified ethnicity. The results showed that women in general have a lower score on mental health as compared to men. These findings confirm previous studies where women showed more risk of depression than men (Steptoe & Feldman, 2001; Harpham et al., 2004). In addition to the effect of sex, younger age groups (14-24), unemployment, lack of qualifications and living in more fragmented and deprived neighbourhoods predicted the lowest mental health outcome; both for men and women. Ethnicity (standard ethnicity categories, relevant to the New Zealand population) showed different results for both sexes. Women with Maori ethnicity and men with Pacific ethnicity were associated with poorest scores of mental health. With this multilevel research they established that increasing neighbourhood social fragmentation is associated with lower mental health, especially for unemployed women. The study results found limited evidence of association of fragmentation with non-mental health outcomes, which suggest specificity for mental ill health (Ivory et al., 2011).

Likewise, some support was found of social capital offering protection against common mental disorders. This effect was shown in the multilevel study of Stafford et al. (2007) which focused on the effect of social capital on common mental disorders (CMD), controlled for age, sex and social class. The prevalence (unadjusted) of CMD was higher for women compared with men, CMD increased with decreasing social class and CMD was higher for people with deprived household and neighbourhoods. The effect of social capital (area level) on common mental disorders was limited because of individual socio-economic disadvantages, which highlights the importance of the relationship between personal socio-economic disadvantages and CMD (Stafford et al., 2007).

Meanwhile, socio-economic disadvantages manifest not only at individual level. The socio-economic status (SES) at area level is an environmental characteristic that is often investigated in relation with health and mental health. It has been shown that low socio-economic environment can have a negative effect on physical and mental health, since living in a poor neighbourhood has been associated with higher levels of depressive symptoms in older adults, above and beyond individual vulnerabilities. Which is shown in a multilevel analyse by Kubzansky et al. (2005) controlling for age, ethnicity, years of education and marital status. Women, people with less education and people reporting more disability were increasingly associated with symptoms of depression. Taking into account the individual characteristics led to a smaller effect of living in a poor neighbourhood on depressive symptoms (Kubzansky et al., 2005). Besides, poor mental health was significantly associated with area level income deprivation and low social cohesion. Which is shown in the study concerning the joint effect of community and individual-level socio-economic deprivation and social cohesion on mental health. The following individual characteristics were taken into account; sex, social class, employment status, household income, tenure, council tax band and social cohesion. Females, lower social class, medium and low household, not being employed and living in non-owner occupied housing and the lowest value council tax bands were associated with lower mental health scores. Regardless of the individual effects low mental health scores were significantly associated with higher levels of area income deprivation and lower levels of social cohesion (Fone et al., 2007). Another multi-level study found that the socio-economic status of neighbourhood is associated with incidence of depression, independent of individual socio-economic status, age, sex and ethnicity. Lower individual socio-economic status, females and lower social support were associated with higher incidence of depression. At neighbourhood level relative odds of incident depression were 2.19 higher (95% CI 1.04 to 4.59) for participants living in low compared with high SES neighbourhoods (Galea et al., 2007). Similar results concerning area level effects were found in the research of Haomiao et al. (2009) a study concerning County-Level Social Environment Determinants of Health-Related Quality of Life among US adults. Haomiao et al. (2009) conducted multilevel research which showed that individual health-related quality of life is not only determined by their personal level characteristics, but is also socially determined. In their analyses they found that a higher number of age is associated with fewer mentally unhealthy days. Being African American, Hispanic, female, unemployed or unable to work, was positively correlated to mentally unhealthy days. In contrast, the study describes that being white, having income and high education level was negatively associated with mentally unhealthy days. The multi-level study proved in addition to the individual effects that the low socio-economic environmental characteristics were associated with the perceived low physical and mental health (Haomiao et al., 2009).

On the other hand, some studies did not find an effect of socio-economic environment on health/mental health. For instance the study of Henderson et al. (2005), where neither socio-economic characteristics as ethnic density at neighbourhood level were associated with depressive symptoms, after including individual socio-economic characteristics (Henderson et al., 2005). Similar results were

shown in the study of Hybels et al. (2006) where the conducted linear regression showed that socioeconomic disadvantage was associated with increased depressive symptoms. However, after controlling for individual characteristics (age, sex, self-reported ethnicity, marital status, education and income) by a multilevel analysis no effect of socioeconomic disadvantage on depressive symptoms were found (Hybels et al., 2006). Again, in the study of Aneshensel et al. (2007) the effect socio-economic disadvantage at depressive symptoms in older individuals (>70 years), after controlling for individual characteristics, showed no effect. However, after controlling for the individual characteristics sex, age, ethnicity, marital status, education, income, wealth, religion and health status depressive symptoms were positively associated to neighbourhood stability (Aneshensel et al., 2007).

Built environment can be seen as a part of the physical environmental context (Shaw et al., 2002). Built environment is defined as the human-made space in which people work, live and recreate. It includes buildings and spaces that people create and modify (Roof & Oleru, 2008). High quality built environment has shown a positive relation with health and mental health. For instance, a significant association was shown between the prevalence of depression and living in housing areas characterized by dwellings with predominantly deck access and those of most recent (post -1969) construction, independent of the individual characteristics socio-economic status and individual characteristics of dwellings (Weich et al., 2002). In addition an association was found of the quality of built environment and the presence of common mental disorders, the lower the quality of the built environment the higher the presence of common mental disorders. However a smaller effect was shown due to the multilevel analyse adjusting for the individual characteristics. In this study built environment has been determined by four factors; general quality, facilities, green areas and empty sites. Individual characteristics were determined by age, sex, self-rated presence of disease, marital status, housing type, income, number of supportive people, units of alcohol consumed daily (Araya, 2007). A review concerning 72 studies found that the quality of built environment affects mental health in two major ways, direct and indirect. Indirect the built environment effects mental health by altering psychosocial process with known mental health consequences. The indirect pathways in which built environment affects mental health are personal control, social support and repair and recovery from cognitive exhaustion and stress. For example, many people charring a room interferes with developing supportive social relationships within the household. Direct characteristics of the built environment who have negative influence on mental health are according to Evans (2003); high rise housing, poor-quality housing, residential crowding (number of people per room) and loud exterior noise, bad air quality, toxins (e.g., lead, solvents) and insufficient daylight (Evans, 2003).

Another concept which can be related to built environment is urbanisation. Increasing levels of urbanisation is associated with an increased mental ill health since indirect higher levels of urbanisation can have an effect by changes in social support and life events; this negatively affects mental health (Harpham, 1994). Increasing levels of urbanisation are also associated with an increased risk of a psychosis or depression for both women and men. This effect is shown in a follow-up study concerning Swedish men and women between the age of 25-64 by their first hospital admission for psychosis or depression. Urbanisation was defined by population density. The association of urbanisation and psychosis or depression was adjusted for age, marital status, level of education and immigrant status. The effect of urbanisation, after adjusting for individual characteristics, was higher for psychosis as compared to depression (Sundquist, 2004).

Epidemiological studies concerning the relationship between nature and health are rare. Up to now, two large studies have been performed. These studies have found that more green has a positive effect on health. The first study, performed in the Netherlands, showed that people with access to/living in a

green environment tend to experience a better general health. The second was a longitudinal study in Japan which also found evidence for a positive relationship between nature and health (RMNO, 2004).

The percentage of green space in peoples living environment has shown a positive association with a person's perceived general health. Which is shown in a multilevel study in the Netherlands by Maas (2008) controlling for socio-demographic characteristics. The study used three models, where the first included socio-demographic characteristics, second model added urbanity (based on number of household per square km) and the third model the percentages of green space (urban green, agricultural green, forests and nature conservation areas in a range of 1 and 3 km) were added. Urbanity showed a significant contribution to perceived general health, where less urban areas showed an effect on better perceived general health. By the addition of the percentage of green space, the effect of strong urban areas became insignificant, which illustrated a negative correlation between the percentage of green space. Likewise this has indicated that the percentage of green space has a stronger relation with perceived general health (Maas, 2008). In another study a specific relation was found where physician-assessed morbidity is related to green space in people's living environment. They found the strongest correlation for anxiety disorders and depression in people living in environments with lessened green space. This multilevel study was controlled for demographic and socio-economic characteristics. In addition the study used interaction effects between respective age groups, SES groups and urbanity and the green space indicator. This showed that the highest relation with green space and children younger than 12, people between 46 and 65 and lower educated groups. The interaction with urbanity showed that there was no relation between green space and the prevalence of disease in very strong urban areas, which indicates that urbanity again influence the relation between green and health (Maas et al., 2009).

In the Netherlands higher prevalence of mental ill health is shown for women, elderly (75 years or older), people with a low level of education, people with low income, non-western immigrants (especially people from Turkey and Morocco), people from (high) urban areas, singles, disabled and unemployed people, physically unhealthy people, people who have very little contact with family and/or friends, Muslims, people who never drink alcohol and people who smoke every day. These relations were shown by the CBS who indicated difference with the use of Oneway ANOVA's. Mental health itself was measured by the Mental Health Inventory 5 (MHI-5) (CBS, 2011).

Living environment affects health and mental health. A review of specific research on neighbourhood characteristics and depression show a strong relationship between these two factors. Of the 45 studies, 37 have reported an association of at least one neighbourhood characteristic with symptoms of depression. Seven out of ten longitudinal studies reported associations with at least one neighbourhood characteristic with incident depression. 52% of the structural features (social economic, racial composition and built environment) were associated with depression. The percentage was even higher regarding social processes (disorder, social interactions and violence); 68% was associated with depression/ depression symptoms. Controlling for individual-level characteristics often reduced the effect of the association between neighbourhood characteristics and depression. Built environment was the most consistently associated with depression, but the number of studies was small (Mair, Diez Roux & Galea, 2008). This confirms findings of a previous review that found 27 out of 29 studies with a significantly association between mental health and (at least one) neighbourhood characteristic (socio-demographic characteristics to physical environment), after adjusting for individual factors. Again, effect of neighbourhood characteristics were reduced by including individual factors and the effect was in general smaller compared to individual factors (Truong & Ma, 2006).

The discussed theories have emphasized the importance of selection effects and the interaction effects of individuals and their living environment. By controlling for demographic and socio-economic characteristics the effect of indirect and direct selection has been taken into account. In addition, the theories composition and context and the Dynamic Stress-Vulnerability model showed a clear distinction between individual level and area level, both for health and mental health. The distinction of individual level and area level will be taken into account by the use of a multilevel analysis.

The literature review provided understanding of how and to what extent individual and living environment characteristics are related to mental health. The living environment characteristics have shown association with mental health, however, when controlling for individual characteristics this effect is reduced. In general the effect of living environmental characteristics on mental health was modest relative to the effect of individual characteristics. Similar effects are expected in this current study.

2.4. Conceptual model

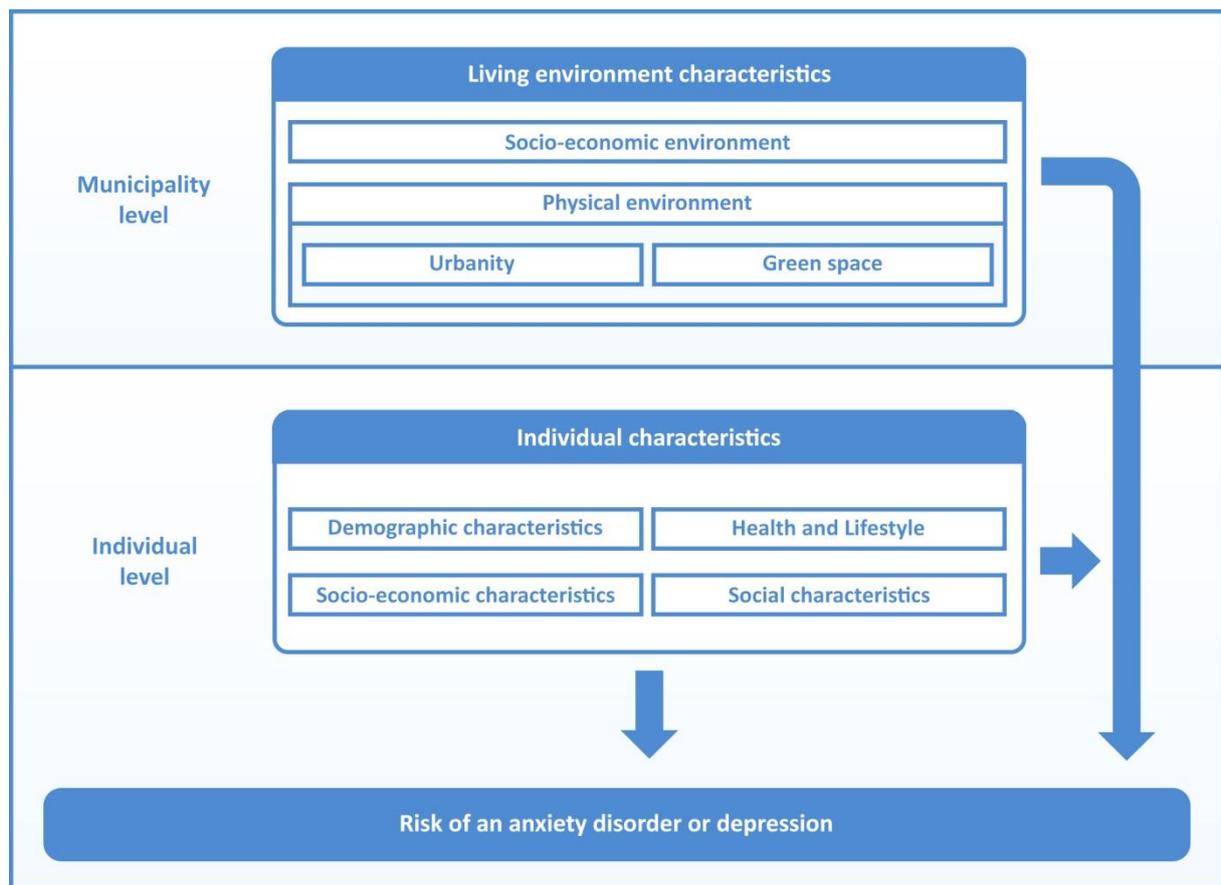
As a result of the theoretical considerations and the literature review the conceptual model is presented in figure 2. The model tries to explain the relationship between living environmental characteristics and their possible effect on the risk of an anxiety disorder or depression, in addition to the individual characteristics. The theories have indicated two levels, the individual level and area level; these are indicated in the conceptual model by individual level and municipality level. The individual characteristics and the individual risk of an anxiety disorder or depression fall within the individual level. Living environment characteristics are covered by the municipality level. Based upon the literature review the following relationships are displayed.

The first possible effect is the effect of individual characteristics on the risk of an anxiety disorder or depression (Truong & Ma, 2006). The individual characteristics that are included in this model are age, sex, ethnicity (demographic characteristics), qualification level, labour force status (socio-economic characteristics), health, lifestyle, social cohesion and social capital (social characteristics).

The second possible effect is the effect of living environmental characteristics on the risk of an anxiety disorder or depression (Mair, Diez Roux & Galea, 2008). The living environment consists of socio-economic environment and physical environment (urbanity and green space). Both factors are expected to affect the risk of an anxiety disorder or depression (Maas et al, 2008; Maas, 2009).

In order to analyse the extent of the effect of the living environment characteristics on the risk of an anxiety disorder or depression the third relation has to be taken into account. The third relation expects the effect of the individual characteristics on the relationship of the living environment characteristics and the risk of an anxiety disorder or depression (Truong & Ma, 2006; Mair, Diez Roux & Galea, 2008).

Figure 2 Conceptual model “The effect of living environment on the risk of an anxiety disorder or depression”.



2.5. Hypotheses

Based on the literature review and the theoretical framework, the following relationships between the living environment characteristics, individual characteristics and the risk of an anxiety disorder or depression are expected:

1. Individual characteristics affect the risk of an anxiety disorder or depression (individual level).
2. Living environment characteristics affect the risk of an anxiety disorder or depression (municipality level).
 - a) The higher the socio-economic status at municipality level, the lower the person’s risk of an anxiety disorder or depression.
 - b) The higher urbanity at municipality level, the higher the person’s risk of an anxiety disorder or depression.
 - c) The higher the green space in the environment at municipality level, the lower the person’s risk of an anxiety disorder or depression.
3. Living environment characteristics affect the risk of an anxiety disorder or depression, in addition to individual characteristics. However this effect is expected to be lower as compared to the effect without individual characteristics.
 - a) The higher the socio-economic status at municipality level, the lower the person’s risk of an anxiety disorder or depression.

- b) The higher the urbanity at municipality level, the higher the person's risk of an anxiety disorder or depression.
- c) The higher the green space in the environment at municipality level, the lower the person's risk of an anxiety disorder or depression.

3. DATA & METHODOLOGY

The objective of this study is to assess whether the living environment affects the risk of an anxiety disorder or depression of people in the province of Groningen, as well as ascertaining the role of the individual characteristics to this relationship. To accomplish this objective, data of a “health survey 2010” of the health authority in Groningen (GGD) is used for analysing the effect of individual characteristics at an individual level. Data from the SCP (Netherlands Institute for Social Research) and CBS (Central Bureau for Statistics in The Netherlands) is used to analyse the effect of living environment characteristics at a municipality level. The extent to which the different characteristics on different levels affect the risk of an anxiety disorder or depression is examined by the use of a multi-level model.

3.1. Data sources and characteristics

The “health survey 2010” of the health authority in Groningen (GGD) focuses on the health of adults and elderly in Groningen (GGD, 2010). According to the GGD (2010) the “health survey 2010” contains a representative sample of 2% of the population (19 years and older) of the province of Groningen. From the representative sample, a total of 9,018 people in the province of Groningen, 4,472 adults responded. According to the GGD (2010) all the health authorities in The Netherlands use nationwide uniform questions in the health surveys, which makes it possible to compare data with other regions. The individual characteristics, which are obtained from “the health survey 2010”, are: age, sex, ethnicity, qualification level, labour force status, health, lifestyle, social cohesion, social capital and the risk of an anxiety disorder or depression. The original questions of the individual characteristics of the “health survey 2010” can be found in appendix 2. In the data set 2,714 (60.69%) respondents have no risk of an anxiety disorder or depression; however 1,680 (37.57%) of the respondents do have a risk of an anxiety disorder or depression. The risk of 78 (1.74%) respondents is unknown and therefore not included in this study. Which led to a study population of 4,394 respondents, 2,432 females (55.35%) and 1,962 males (44.56%). In comparison with the population of the province of Groningen in 2010, the percentage of women in the study sample was higher (55.35% females versus 50.67% females) (CBS, 2014).

Furthermore, in the “health survey 2010” the province of Groningen has 23 municipalities; Appingedam, Bedum, Bellingwedde, ten Boer, Delfzijl, Groningen, Grootegast, Haren, Hoogezand, Leek, Loppersom, Marum, Stadskanaal, Slochteren, Veendam, Vlagtwedde, Winsum, Zuidhorn, Pekela, Eemsmond, Marne, Menterwolde and Oldambt. Since January 1, 2010, the municipality Oldambt exists, since the province of Groningen clustered the municipalities Scheemda, Winschoten and Reiderland as one and refers to them as the municipality Oldambt (Gemeente Oldambt, 2010).

In addition to the “health survey 2010” of the GGD, data of the SCP and CBS is used to obtain the living environment characteristics at municipality level. SCP provided the status scores (2010), which indicates the socio-economic environment at municipality level. The CBS provided the green space scores (2006) and the scores of housing density (urbanity) (2011) at municipality level (SCP, 2012; RIVM, 2011; RIVM, 2014^c)

3.2. Measures

3.2.1. Individual level

The individual level consists of the dependent variable ‘the risk of an anxiety disorder or depression’ and the independent (control) variable ‘the individual characteristics’.

Dependent variable

As an indication of mental health the risk of an anxiety disorder or depression has been measured by the Kessler Psychological Distress Scale (K10). This survey describes the person’s risk of an anxiety disorder or depression. The K10 scale asks 10 questions about feelings and emotions of the past month. Questions about tiredness, nervousness, restlessness, hopelessness, anxiety, gloom, depression and self-esteem (GGD, 2010). The 10 questions can be found in appendix 2 (question 39).

The outcome of this variable is binary, which indicates that there is a risk of an anxiety disorder or depression or no risk of an anxiety disorder or depression. The risk of an anxiety disorder or depression is interpreted according to The Kessler Psychological Distress Scale (K10), Department of Human Services Centre for population studies in Epidemiology (GGD, 2010). The scores were recoded by the GGD in 1=5, 2=4, 3=3, 4 = 2 and 5= 1. By recoding, the low scores indicate a low or no risk and high scores indicate a high risk. In order to create three categories the GGD used the following cut off points: score 10-15=low or no risk, score 16-29 =medium risk and score 30-50= high risk (GGD, 2010). This current study combined the medium and high risk score as an indication of the risk of an anxiety disorder or depression. An indication that is widely used in the Netherlands by the GGDs, CBS and RIVM to indicate the risk of an anxiety disorder or depression (RIVM, 2014^a).

Independent (control) variables

Because of the expected effects of the individual characteristics age, sex, ethnicity, qualification level, labour force status, health, lifestyle, social cohesion and social capital on mental health and on the living environmental characteristics, individual characteristics will be used as a control variable. A control variable indicates a variable that is held constant in order to assess or clarify the relation of the independent variables (the living environmental characteristics) on the dependent variable (the risk of an anxiety disorder or depression) (Franekel, Wallen & Hyun, 2012). The descriptive statistics of the individual characteristics can be found in table 1.

3.2.2. Municipality level

The municipality level consists of the independent variables socio-economic environment (status scores) and the physical environment (urbanity and green space).

Independent variables

The socio-economic environment has been measured by status scores, which indicate the socio-economic status at municipality level. The status scores exist out of the average income per neighbourhood, the percentage of people with low income, the percentage people with a lower education, and the percentage of unemployment. By factor analysis these characteristics were clustered into one: social status. Areas which consist primarily of industry and areas with 100 or less households are not included in the analysis (SCP, 2012). SCP (2010) provided the status scores per

neighbourhood. By using households (2010) as weighting factor the status scores at municipality level are calculated (SCP, 2012).

The physical environment is compiled by urbanity and green space. This study indicates urbanity as housing density (number of dwellings per km²) by municipality (RIVM, 2014^e). Housing density scores at municipality level were provided for all the municipalities, even for the municipality Oldambt. Interwoven with built urbanity is green space. Green space is the amount of green in the living environment. This study specifies green space by the amount of green in a range of 500 meter (m²) from the dwelling at municipality level (RIVM, 2011). The green space scores were also provided at municipality level. However, since the three municipalities Scheemda, Winschoten and Reiderland clustered in 2010 in the municipality Oldambt, the amount of green was provided for the three municipalities separately. The amount of green for the municipality Oldambt is calculated by using the households (2006) as weighting factor (SCP, 2012).

3.3. Analysis

The Dynamic Stress-Vulnerability model specifies clearly which variable belongs to which level, and which direct effects and variation effects can be expected. This is distinctive for a multi-level theory (Hox, 2002). In this study a multi-level model is used to analyse the data. This model is suitable for studies where data for participants are organized at more than one level. The characteristics of analysis are usually individuals who are nested within higher levels, in this current study municipality level (Goldstein, 1999). The importance of the individual factors and their effect on the risk of mental ill health is clearly indicated in the theories and previous literature. By ignoring this relationship there is a risk of overlooking the effect of the living environment characteristics on the risk of an anxiety disorder or depression (Goldstein, 1999). Therefore the individual characteristics indicate the first level (individual level) in the multi-level analysis; the second level will be determined by the living environment characteristics at municipality level. For both levels the effect on the unexplained variance of the risk of an anxiety disorder or depression is presented. In order to obtain the unexplained variance and to answer the research questions three analysis models are used.

This study observed a binary outcome Y_{ij} (*risk anxiety disorder or depression*=1, *no risk anxiety disorder or depression* =0). P_{ij} is the predicted probability of the risk of an anxiety disorder or depression for individual i in municipality j . x_{ij} is an explanatory variable (s) at the individual level and z_j is an explanatory variable (s) at municipality level.

Model 1: Analysing the effect of individual characteristics on the risk of an anxiety disorder or depression (level 1).

$$\text{Log} [P_{ij}/(1-P_{ij})] = \beta_0_j + \beta_1 x_{ij} + \beta_2 x_{ij} + \dots + \beta_p x_{ij} + e_{ij}$$

β_0 is the 'intercept', β_1 to β_p are the effects/coefficients of the p explanatory variables at individual level (individual characteristics), x_{ij} are the individual characteristics, and e_{ij} is an individual error.

Model 2: Analysing the effect of living environment characteristics on the risk of an anxiety disorder or depression (level 2).

$$\text{Log} [P_{ij}/(1-P_{ij})] = \beta_0_j + \beta_1 z_{ij} + \beta_2 z_{ij} + \beta_3 z_{ij} + \mu_j$$

β_0 is the 'intercept' and, β_1 to β_3 are the effects/coefficients of the p explanatory variables at municipality level (living environment characteristics), z_{ij} 's are the living environment characteristics, and u_{ij} is the level 2 error term (municipality level).

Model 3: Analysing the effect of individual factors and the living environment characteristics on the risk of an anxiety disorder or depression (combined model).

$$\text{Log} [P_{ij}/(1-P_{ij})] = \beta_0 + \beta_1 x_{ij} + \beta_2 z_{ij} + e_{ij} + \mu_j$$

The level 2 errors are assumed to be independent from the individual errors. The models are analysed for female and male by a multilevel logistic regression.

3.4. Data limitations and ethical considerations

The individual data of the "health survey 2010" of the GGD will be used, regardless of the possible availability of the individual data of the "health survey 2012" (GGD, 2013) on grounds that most recent data of the living environment characteristics were only available for 2006 (green space), 2010 (status scores) and 2011 (housing density).

The "health survey 2010" of the GGD did not have questions concerning life event, traits and genetic factors, which are emphasised by the Dynamic Stress-Vulnerability model (Ormel et al, 2001). Therefore, these individual characteristics are not included in this study. The study population consists of 55.35% females and 44.56% males. In comparison with the population in 2010 of the province of Groningen which contained 50.67% female and 49.33% male, the study sample was higher for females (55.35% females versus 50.67% females) (CBS, 2014).

In addition, the living environment characteristics status scores (2010), housing density (2011) and green space (2006) at municipality level are derived from different years (SCP 2012; RIVM, 2011; RIVM, 2014). This is due to the fact that the scores for housing density and green space at municipality level are not available for the year 2010. House density (2011) and Green space (2006) are the most recent scores available.

Finally, all data in this study has been treated in confidentially in order to protect the rights of the respondents (Babbie, 2011). The data and the analysis are only used when the identity of a person is not traceable (Rothfusz, 2010).

4. RESULTS

Different multilevel logistic regression models are conducted in order to examine the effect of the living environment on the risk of an anxiety disorder or depression. The results are presented according to the research questions and the corresponding models. Prior to elucidation of the results, the descriptive statistics will be described.

4.1 Descriptive statistics

4.1.1. Individual characteristics

Table 1 presents the descriptive statistics of the individual characteristics and the cross tabulation of the individual characteristics with the risk of anxiety disorder or depression. The total study sample (presented on the left side of table 1) contains 4,394 respondents; 2,432 females (55.35%) and 1,962 males (44.56%). The mean age of the study population for females was 49.16 years ($SD=17.43$) and 51.47 years for males ($SD=17.18$). Of the total study population 95.63% had a Dutch ethnicity. Ethnicity consists of two categories because no cases of other western ethnicities were found.

On the right side of table 1 the cross tabulation of the individual characteristics with the risk of anxiety disorder or depression are presented. From the 1,680 (38.23%) respondents who indicated a risk of an anxiety disorder or depression, 1,064 were female and 616 respondents were male. This shows that 43.75% of the total female population indicates a risk of an anxiety disorder or depression; for the total male population this is 31.40%. For both males and females with a non-western background, people with unemployment benefits and people with moderate to poor health, the highest percentages of a risk of an anxiety disorder or depression were illustrated.

Table 1 Descriptive statistics individual characteristics and cross tabulation individual characteristics and the risk of an anxiety disorder or depression

	Study sample		Risk of an anxiety disorder or depression	
	Female	Male	Female	Male
Individual characteristics	N (%)	N (%)	N (% risk per category)	N (% risk per category)
Overall N (K10)	2432 (100)	1962 (100)	1064 (43.75)	616 (31.40)
Age	49.16(mean) 17.43(SD)	51.47 (mean) 17.18 (SD)		
Ethnicity ¹				
Dutch	2308 (94.36)	1882 (95.52)	1004 (43.50)	580 (30.82)
Non-western	32 (1.88)	30 (1.53)	20 (62.50)	13 (43.33)
Unknown	92 (3.78)	50 (2.55)	40 (43.48)	23 (46.00)
Qualification level				
LO	189 (7.77)	145 (7.39)	105 (55.56)	64 (44.14)
MAVO LBO	720 (29.61)	581 (29.61)	308 (42.78)	187 (32.19)
HAVO, VWO, MBO	722 (29.69)	606 (30.89)	322 (44.60)	185 (30.53)
HBO, WO	669 (27.51)	561 (28.59)	270 (40.36)	154 (27.45)
Unknown	132 (5.43)	69 (3.52)	59 (44.70)	26 (27.68)
Labour force status				
Paid job	1221 (50.21)	1121 (57.14)	483 (39.56)	321 (28.64)

Pension	308 (12.66)	472 (24.06)	126 (40.91)	109 (23.09)
Unemployment benefits	152 (6.25)	161 (8.21)	100 (65.79)	99 (61.49)
Unknown	751 (30.88)	208 (10.60)	355 (47.27)	87 (41.83)
Health				
Outstanding/very good health	801 (32.94)	741 (36.39)	261(26.97)	130 (18.21)
Good health	1248 (51.32)	954 (48.62)	553(44.31)	303 (31.76)
Poor moderate health	356 (14.64)	272 (13.86)	278(78.09)	179 (65.81)
Unknown	27(1.11)	22 (1.12)	17(62.96)	4 (18.18)
Lifestyle ²				
No bad lifestyle	946 (38.90)	552 (28.13)	399 (42.18)	173 (31.34)
One bad lifestyle	1085 (44.61)	898 (45.77)	472 (43.50)	260 (28.95)
Two bad lifestyles	239 (9.83)	353 (17.99)	112 (46.86)	123 (34.84)
Three bad lifestyles	12 (0.49)	54 (2.75)	7 (58.33)	25 (46.30)
Unknown	150 (6.17)	105 (5.35)	74 (49.33)	35 (33.33)
Social cohesion ³				
No social cohesion	210 (8.63)	204 (10.40)	125 (59.52)	108 (52.94)
Medium social cohesion	512 (21.05)	476 (24.26)	295 (57.62)	188 (39.50)
Social cohesion	1692 (69.57)	1256 (64.02)	635 (37.53)	312 (24.84)
Unknown	18 (0.74)	26 (1.33)	9 (50.00)	8 (30.77)
Social capital				
Low social capital	1165 (47.90)	884 (45.06)	575 (49.36)	341 (38.57)
Medium social capital	932 (38.32)	800 (40.77)	372 (39.91)	215 (26.88)
High social capital	303 (12.46)	246 (12.54)	102 (33.66)	51 (20.73)
Unknown	32 (1.32)	32 (1.63)	15 (46.88)	9 (28.13)

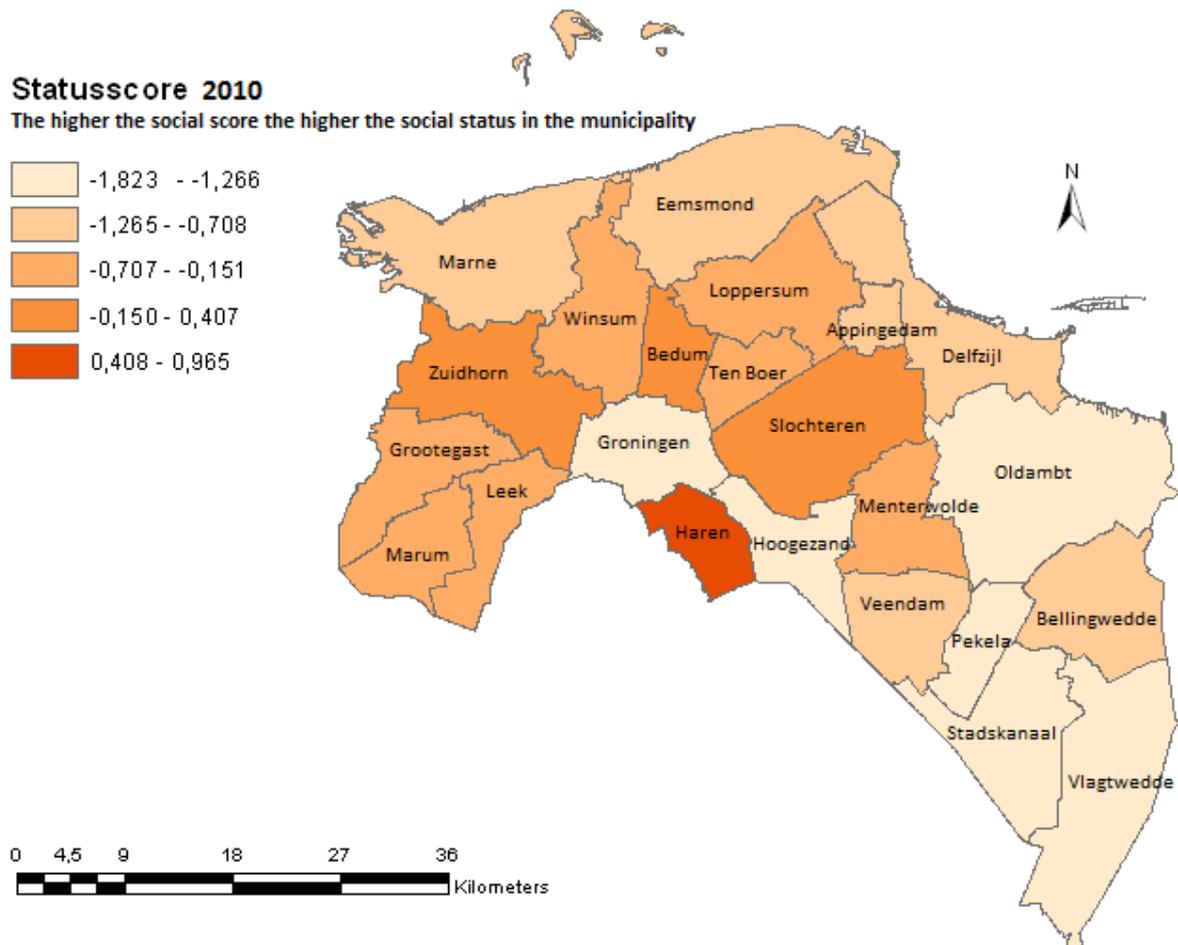
1. Ethnicity is composed according the CBS classification, current study divided the CBS classification in three categories. 2. Specification bad lifestyles: smoking, heavy drinking (alcohol) and obesity. 3. Social cohesion composed out of social and emotional loneliness scale.
Data source: GGD, 2010

Among the 23 municipalities, the population distribution of the study sample shows Groningen as largest municipality with 31.91% of the study sample and Ten Boer as the smallest with 1.18% of the study sample. Compared to the population distribution (2010) of the province of Groningen in 2010, the distribution substantially corresponds. In 2010 Groningen contained 34.01% of the population and Ten Boer contained 1.20% of the population. In general, the distribution between the study sample and the population of the province of Groningen (2010) deviates a bit (CBS, 2014).

4.1.2. Living environment characteristics

The socio-economic environment is indicated by status scores; figure 3 shows the status scores of 2010 at municipality level. The average status score (neighbourhood level) in the Netherlands is 0.17 ($SD=1.16$). The mean status score at municipality level in Groningen is -1.047 ($SD=0.66$), with a minimum of -1.823 in Vlagtwedde and a maximum of 0.965 in Haren. The data shows that almost all municipalities status scores are below the Dutch national average (0.17), except for the municipality Haren, which has a status score of 0.965 . The lowest (< 1.60) status scores are shown for the municipalities Stadskanaal, Vlagtwedde and Pekala.

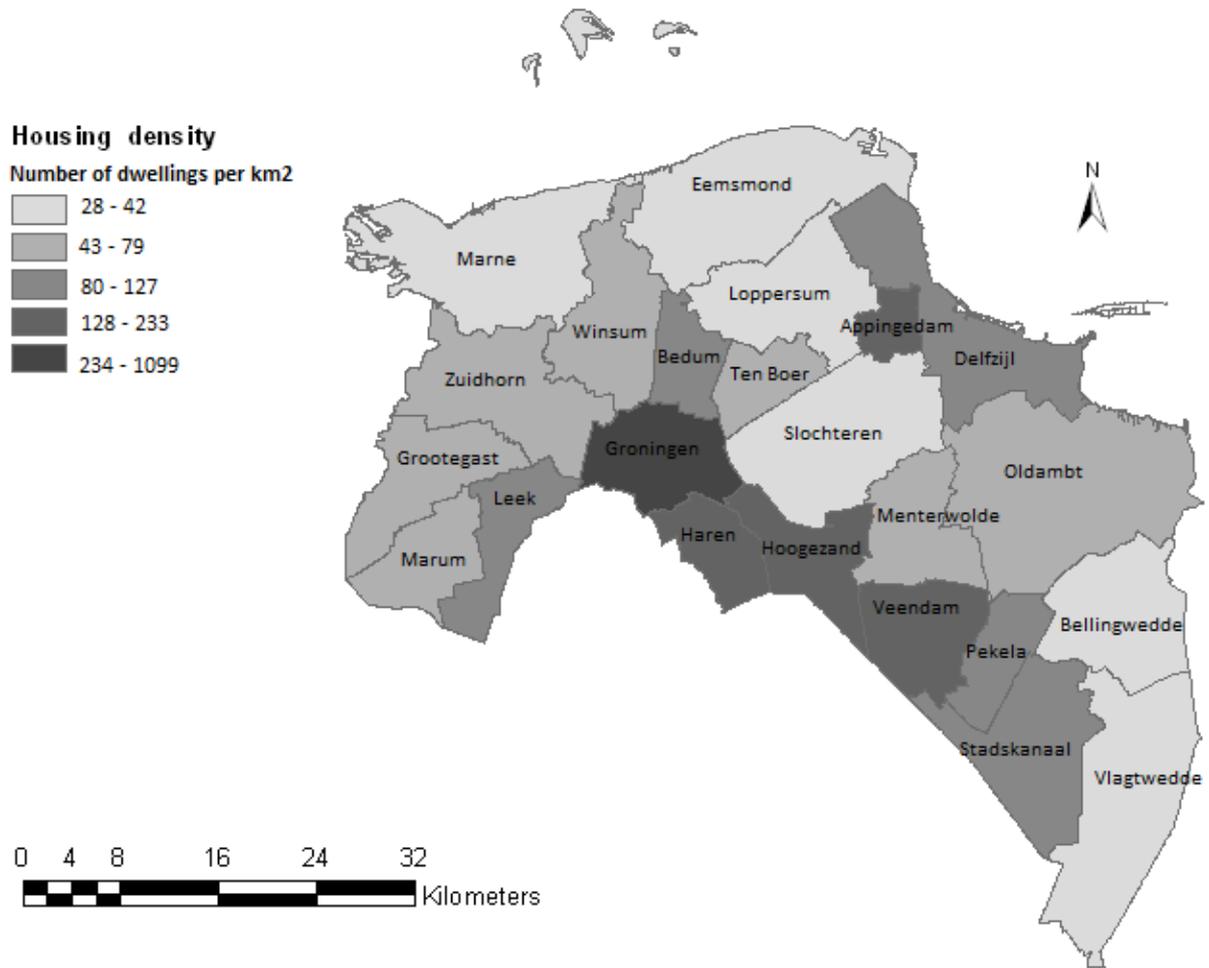
Figure 3 Status scores; municipalities of the province of Groningen, 2010



Data source: SCP, 2012

Urbanity is measured by housing density; the housing density (2011) for the province of Groningen is shown in figure 4. In the Netherlands the average housing density is 214 dwellings per km^2 (RIVM, 2014⁶). The mean housing density in the province of Groningen at municipality level is 421.59 dwellings per km^2 ($SD = 465.34$), with a minimum of 28 dwellings per km^2 in Marne and a maximum of 1,099 dwellings per km^2 in Groningen. The municipalities Appingedam, Groningen and Hogezaand show a housing density above the Dutch national average ($> 214 km^2$). Groningen is an outlier as its housing density is 1,099 km^2 .

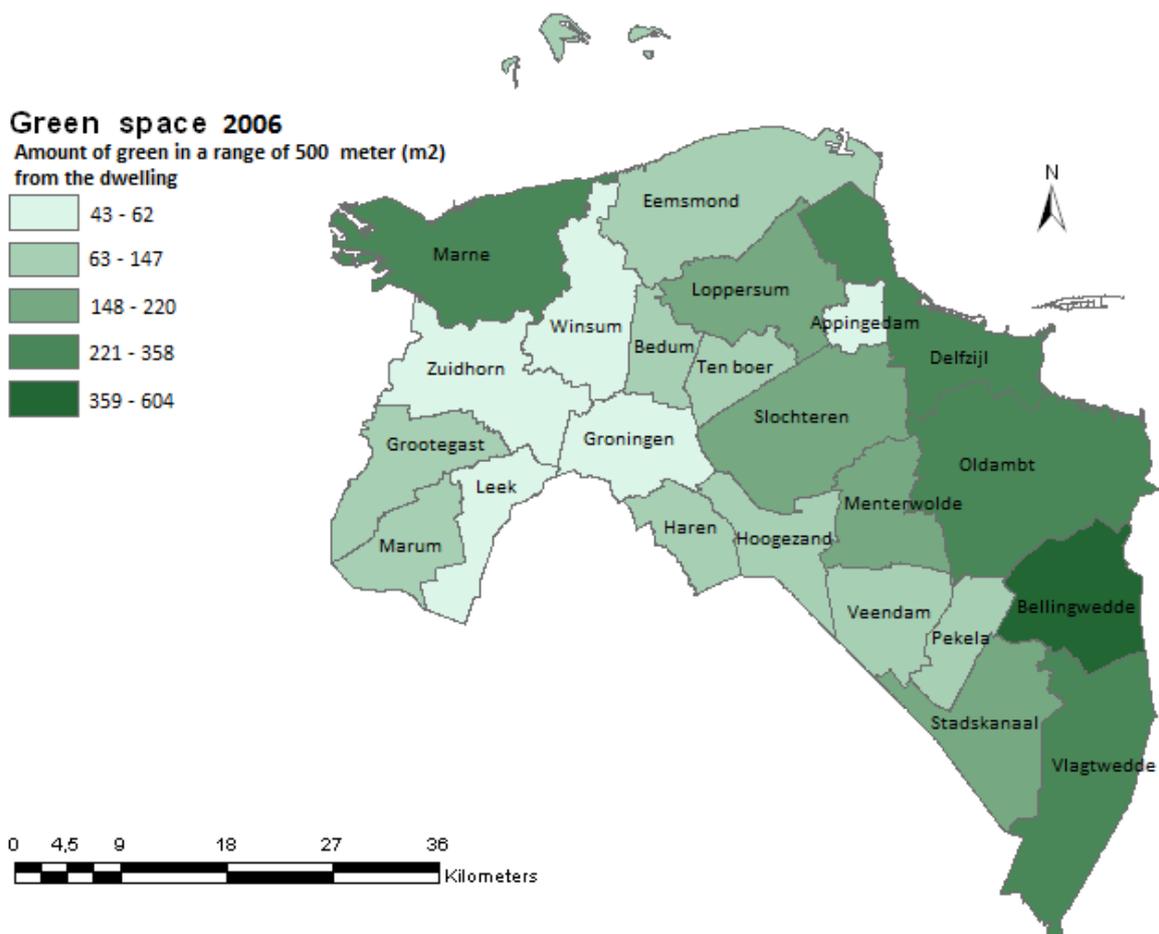
Figure 4 Housing density; municipalities of the province of Groningen, 2011



Data source: RIVM, 2014^c

Green space indicates the public green in a range of 500 meter (m²) from the dwelling at municipality level, agricultural is not included. Agricultural is not included due to the reason that agricultural green is perceived as less natural. The recommended amount of green in the Netherlands is 75m² per dwelling (RIVM, 2011). The mean amount of green in Groningen at municipality level is 134.74 m² ($SD = 105.78$), with a minimum of 34 m² in Zuidhorn and a maximum of 604 m² in Bellingwedde. In the province of Groningen the municipalities of Appingedam, Groningen, Leek, Winsum and Zuidhorn do not meet the recommended standard for green. The distribution of green space is presented in figure 5. The exact scores of the living environment characteristics at municipality level can be found in appendix 3.

Figure 5 Green space; municipalities of the province of Groningen, 2006



Data source: RIVM, 2011

The living environment characteristics expected to have some correlation (Maas, 2008; Maas, 2009). To check whether this coherence is correct a Pearson Correlation test is used. In table 2 the correlations between the living environment characteristics are presented. The table shows a moderate negative correlation for the characteristics urbanity and socio-economic status and green space and urbanity. A low negative correlation was found for green space and socio-economic status.

Table 2 Correlation (Pairwise) living environment characteristics			
Municipality	Socio-economic status	Urbanity	Green space
Socio-economic status	1.00		
Urbanity	-0.485*	1.00	
Green space	-0.059*	-0.524*	1.00

*p<0.05
Data source: SCP, 2012; RIVM, 2014^c; RIVM, 2011

4.2 The effect of individual characteristics on the risk of an anxiety disorder or depression

The results from a multilevel logistic model of the individual characteristics on the risk of an anxiety disorder or depression for female and male can be found in table 3. The diverse individual characteristics has shown the following effects:

For both females and males each increase of age with one unit, decreases the log-odds of the risk of an anxiety disorder or depression. For females the log-odds of the risk of an anxiety disorder or depression decreases with 0.026 log-odds, males with 0.022 ($P < 0.05$). Ethnicity shows no statically significant different effect when comparing the risk of an anxiety disorder or depression of non-western with Dutch respondents.

The difference in qualification level of females and males showed no effect on the risk of an anxiety disorder or depression. On the other hand a different labour force status does affect the risk of an anxiety disorder or depression. When people who receive unemployment benefits are compared with people with a paid job, people with unemployment benefits have a higher log-odds of the risk of an anxiety disorder or depression. For females the log-odds of the risk of an anxiety disorder or depression increases with 0.479 ($P < 0.05$). Males showed an increase of 0.704 log-odds ($P < 0.05$).

Compared to outstanding and very good health, people with good health and people with moderate to poor health have a higher risk of an anxiety disorder or depression. Females with good health showed a higher log-odds of the risk of an anxiety disorder or depression of 0.977, females with moderate to poor health showed a higher log-odds of the risk of an anxiety disorder or depression of 2.670 ($P < 0.05$). Similar results were found for males. A females lifestyle affect the risk of an anxiety disorder or depression; when females have one bad lifestyle compared with females who have no bad lifestyle, the log-odds of the risk of an anxiety disorder or depression are 0.235 lower for females with a bad lifestyle ($P < 0.05$). Differences in lifestyles for males showed no statistically significant effect on the risk of an anxiety disorder or depression.

The log-odds of the risk of an anxiety disorder or depression are 0.691 higher for females who experience no social cohesion compared to females who experience social cohesion. For females who experience more or less social cohesion the log-odds were 0.749 higher ($P < 0.05$). Comparable results were found for males. Males who experience low social capital showed a higher risk of an anxiety disorder or depression than males who experience high social capital. In terms of log-odds the risk of an anxiety disorder or depression was 0.516 higher ($P < 0.05$).

The model with individual characteristics for females showed a statistically significant variance of 0.008 ($P < 0.05$) for the risk of an anxiety disorder or depression at municipality level. In comparison with the model adjusted for demographics (table 4, model 2a), the variance decreased with 0.001. For males, after including the individual characteristics, no statistically significant variance for the risk of an anxiety disorder or depression at municipality level was found. In terms of Log Likelihood both models for female and male with the addition of individual characteristics improved significantly ($P < 0.05$).

Table 3 Multilevel logistic model: the effect of individual characteristics on the risk of an anxiety disorder or depression

Model 1.	Female		Male	
P value	0.000		0.000	
Wald statistic	345.67 (df 23)		285.81 (df 23)	
Log likelihood	-1440.364		-1034.825	
	Coef.	95% CI	Coef.	95% CI
Age	-0.026*	-0.033 to -0.019	-0.022*	-0.031 to -0.012
Ethnicity				
Dutch®	0.00		0.00	
Non-western	0.414	-0.384 to 1.211	0.265	-0.557 to 1.087
Unknown	-0.194	-0.671 to 0.282	0.236	-0.403 to 0.875
Qualification level				
LO	0.378	-0.031 to 0.786	0.457	-0.006 to 0.919
MAVO LBO	-0.014	-0.283 to 0.256	-0.004	-.0302 to 0.294
HAVO, VWO, MBO	0.012	-0.229 to 0.253	-0.141	-0.427 to 0.145
HBO, WO®	0.00		0.00	
Unknown	-0.115	-0.561 to 0.332	0.230	-0.371 to 0.830
Labour force status				
Paid job®	0.00		0.00	
Pension	0.030	-0.311 to 0.371	-0.267	-0.626 to 0.0913
Unemployment benefits	0.479*	0.073 to 0.884	0.704*	0.311 to 1.098
Unknown	0.189	-0.028 to 0.407	0.344	-0.006 to 0.695
Health				
Outstanding/very good health®	0.00		0.00	
Good health	0.977*	0.764 to 1.191	0.929*	0.668 to 1.189
Poor moderate health	2.670*	2.324 to 3.016	2.394*	2.015 to 2.773
Unknown	1.422*	0.546 to 2.298	0.073	-1.145 to 1.291
Lifestyle				
No bad lifestyle®	0.00		0.00	
One bad lifestyle	-0.209*	-0.412 to -0.005	-0.227	-0.488 to 0.035
Two bad lifestyles	-0.224	-0.548 to 0.100	-0.088	-0.412 to 0.237
Three bad lifestyles	-0.115	-1.374 to 1.144	0.022	-0.624 to 0.668
Unknown	-0.067	-0.480 to 0.346	-0.099	-0.654 to 0.457
Social cohesion				
No social cohesion	0.691*	0.368 to 1.014	0.865*	0.524 to 1.207
Less social cohesion	0.749*	0.527 to 0.972	0.548*	0.301 to 0.796
Social cohesion®	0.00		0.00	
Unknown	0.278	-0.793 to 1.349	0.347	-0.637 to 1.330
Social capital				
Low social capital	0.176	-0.118 to 0.470	0.516*	0.142 to 0.891
Medium social capital	0.010	-0.287 to 0.307	0.250	-0.129 to 0.628
High social capital®	0.00		0.00	
Unknown	0.355	-0.491 to 1.201	-0.202	-1.185 to 0.782
Level-2 variance	Variance	95% CI	Variance	CI 95%
Municipality	0.008*	0.000 to 0.369	0.000	- -

*p<0.05 (for individual characteristics in relation to the reference category®).

Data source: GGD, 2010.

4.3 The effect of living environmental characteristics on the risk of an anxiety disorder or depression

Table 4 presents the effects of the living environment characteristics. First, the results of the living environment characteristics separately will be described. Subsequently the effect of the physical environment (urbanity and green space) will be defined. To conclude, the effect of the living environment, which is the living environment characteristics combined, will be presented. Prior the model without any explanatory variables will be described. All models are adjusted for demographic characteristics age and ethnicity.

The empty model, the model without any explanatory variables (table 4, model 2a), showed for females a statistically significant variance of 0.009 in the risk of an anxiety disorder or depression at municipality level ($P < 0.05$). For male the model showed a statistically significant variance of 0.381 in the risk of an anxiety disorder or depression at municipality level ($P < 0.05$).

Model 2b showed how the socio-economic environment at municipality level effects the risk of an anxiety disorder or depression for females and males. The effect for females showed that one increase of status score decreases the log- odds of the risk of an anxiety disorder or depression with 0.129 ($P < 0.05$). By adding the status score to the model no statically significant variance for the risk of an anxiety disorder or depression at municipality level was shown. For males no statically significant effect by status score was shown. By including status score to the model, the model variance in the risk of an anxiety disorder or depression at municipality level compared with the empty model (table 4, model 2a) decreased to 0.215 ($P < 0.05$).

Model 2c presents the effect of urbanity by housing density. For females housing density showed a small effect. When housing density increases with one unit the log-odds of risk of an anxiety disorder or depression for females increases with 0.000 ($P < 0.05$). By the addition of housing density no statistically significant variance for the risk of an anxiety disorder or depression at municipality level was illustrated. For males no statically significant effect of housing density on the risk of an anxiety disorder or depression was presented. However, by adding housing density the variation in the risk of an anxiety disorder or depression at municipality level compared with the empty model (table 4, model 2a) decreased to 0.036 ($P < 0.05$).

The effect of the living environment characteristic green space is presented in model 2d; green space showed the following statically significant effect. For females the risk of an anxiety disorder or depression decreases with 0.001 log-odds when green space increases with one unit ($P < 0.05$). Again no statically significant variance at municipality level was shown ($P > 0.05$). For males no statically significant effect for green space was found, which led to a slightly smaller variance in the risk of an anxiety disorder or depression at municipality level compared with the empty model.

Model 2e shows the effect of the physical environment (urbanity and green space combined). As well for females as for males no statically significant effect for physical environment was found. However, the variance at municipality level changed. For females no statically significant variation at municipality was shown, for males the variation decreased to 0.025 ($P < 0.05$).

In model 2f the effect of the living environment is presented. For females the combined living environmental characteristics showed one statically significant effect. The effect for females shows

that one increase of green space decreases the log-odds of the risk of an anxiety disorder or depression with 0.001 ($P < 0.05$). For status score and housing density no statically significant effect was found. For females the addition of the combined living environment characteristics show no statically significant variation in the risk of an anxiety disorder or depression at municipality level. For males no statically significant effects were found. However the variation in the risk of an anxiety disorder or depression at municipality level decreased to 0.017 ($P < 0.05$).

For females in terms of Log Likelihood only the combined models 2e and 2f showed a statically significant improvement ($P < 0.05$). The models who tested the living environment characteristics separately showed no statistically significant improvement ($P > 0.05$). For males in terms of Log Likelihood all models with the addition of living environment characteristics improved however this improvement was not statically significant ($P > 0.05$).

Table 4 Multilevel logistic model: the effect of living environment characteristics on the risk of an anxiety disorder or depression

Model2.	Female			Male		
	LL	Wald statistic	P value	LL	Wald statistic	P value
2a. Model	-1658.455	11.88 (df 3)	0.008	-1211.648	14.37 (df 3)	0.002
Level-2 variance	Variance		95% CI	Variance		95% CI
Municipality	0.009*		0.001 to 0.114	0.381*		0.006 to 0.262
2b. Model	LL	Wald statistic	P value	LL	Wald statistic	P value
	-1656.975	19.04 (df 4)	0.001	-1210.655	16.76 (df 4)	0.002
Living env. Characteristic:	Coef.		95% CI	Coef.		95% CI
Status score	-0.129*		-0.256 to -0.005	-0.140		-0.324 to 0.045
Level-2 variance	Variance		95% CI	Variance		95% CI
Municipality	0.000		--	0.0215*		0.001 to 0.584
2c. Model	LL	Wald statistic	P value	LL	Wald statistic	P value
	-1656.258	20.54 (df 4)	0.000	-1211.604	14.48 (df 4)	0.006
Living env. Characteristic:	Coef.		95% CI	Coef.		95% CI
Housing density	0.000*		0.000 to 0.000	0.000		-0.000 to 0.000
Level-2 variance	Variance		95% CI	Variance		95% CI
Municipality	0.000		--	0.036*		0.004 to 0.291
2d. Model	LL	Wald statistic	P value	LL	Wald statistic	P value
	-1656.178	20.53 (df 4)	0.000	-1211.443	14.79 (df 4)	0.005
Living env. Characteristic:	Coef.		95% CI	Coef.		95% CI
Green space	-0.001*		-0.002 to -0.000	0.000		-0.001 to 0.002
Level-2 variance	Variance		95% CI	Variance		95% CI
Municipality	0.000		--	0.035*		0.005 to 0.264
2e. Model	LL	Wald statistic	P value	LL	Wald statistic	P value
	-1655.291	22.37 (df 5)	0.000	-1211.241	15.47.48 (df 5)	0.008
Living env. Characteristic:	Coef.		95% CI	Coef.		95% CI
Housing density	0.000		-0.000 to 0.000	0.000		-0.000 to 0.001
Green space	-0.001		-0.002 to 0.000	0.001		-0.001 to 0.002
Level-2 variance	Variance		95% CI	Variance		95% CI
Municipality	0.000		--	0.025*		0.001 to 0.597
2f. Model	LL	Wald statistic	P value	LL	Wald statistic	P value
	-1653.656	25.49 (df 6)	0.000	-1211.604	17.19 (df 6)	0.009
Living env. Characteristic:	Coef.		95% CI	Coef.		95% CI
Status score	-0.142		-0.297 to 0.012	-0.127		-0.341 to 0.087
Housing density	-0.000		-0.000 to 0.000	0.000		-0.000 to 0.000
Green space	-0.001*		-0.002 to -0.000	0.000		-0.001 to 0.002
Level-2 variance	Variance		95% CI	Variance		95% CI
Municipality	0.000		--	0.017*		-0.000 to 1.66

Model adjust for demographics; age and ethnicity.

*p<0.05

Data source: GGD, 2010; SCP, 2012; RIVM, 2014^c; RIVM, 2011.

Table 2 indicates there is some correlation between the living environment characteristics. The table showed a moderate negative correlation for housing density (urbanity) with status scores ($r = -0.485$, $P < 0.05$) and green space ($r = -0.524$, $P < 0.05$), where the correlation between status score and green space was low ($r = -0.059$, $P < 0.05$). In addition, the change in significance for housing density and green space when combining the living environment characteristics ‘housing density’ and ‘green space’, suspects collinearity.

The negative correlation of urbanity and green space was confirmed by the study of Maas (2008) and stated that green space has a stronger relation with perceived general health than it has with urbanity (Maas, 2008). Which led to the non-inclusion of urbanity (housing density) in the final analyse model.

4.4. The effect of living environmental characteristics on the risk of an anxiety disorder or depression in addition to individual characteristics

Table 5 presents the final analysis model, with status score and green space as explanatory variables in addition to the individual characteristics. The final analysis model showed the following effects. The effect for females showed that one increase of green space decreases the log-odds of the risk of an anxiety disorder or depression with 0.001 ($P < 0.05$). No statically significant effect was found for status scores. By adding the living environment characteristics to the model in addition to the individual characteristics, the variance at municipality level changed from 0.008 ($P < 0.05$) variance to no statistically significant variance at municipality level. For males no statically significant effects for the living environment characteristics were found. Furthermore, no statistically significant variation at municipality level was found, as the statistically significant variance at municipality level was already explained by the individual characteristics.

For females in terms of Log Likelihood, the model with the inclusion of the living environment characteristics in addition to the individual characteristics showed a statistically significant improvement ($P < 0.05$). The model for males showed no statically significant improvement in terms of the Log Likelihood ($P > 0.05$).

Table 5 Multilevel logistic model: the effect of the living environment on the risk of an anxiety disorder or depression, in addition to individual characteristics

Model3.	Female			Male		
	LL	Wald statistic	P value	LL	Wald statistic	P value
Model	-1436.245	352.42 9(df 25)	0.000	-1034.551	286.05 (df 25)	0.000
Living env. Characteristic:	Coef.		95% CI	Coef.		95% CI
Status score	-0.079		-0.217 to 0.058	-0.048		-0.217 to 0.122
Green space	-0.001*		-0.002 to -0.000	-0.000		-0.001 to 0.001
Level-2 variance	Variance		95% CI	Variance		95% CI
Municipality	0.000		--	0.00		--

Model adjust for individual characteristics.

*p<0.05

Data source: GGD, 2010; SCP, 2012; RIVM, 2014^c; RIVM, 2011

5. CONCLUSION & DISCUSSION

5.1. Conclusion

The objective of this study was to assess whether the living environment affects the risk of an anxiety disorder or depression of people in the province of Groningen, as well as ascertaining the role of individual characteristics to this relationship. This study found a statistically significant variation in the risk of an anxiety disorder or depression across municipalities in Groningen for both males and females. For females, a small variation was shown. Little variation was explained by individual characteristics whereas residual variation was explained by the living environment characteristics. After controlling for individual characteristics, the living environment characteristic 'green space' showed a small statistically significant effect on the risk of an anxiety disorder or depression for females, where a higher amount of green space decreases the risk of an anxiety disorder or depression. For males, the variation was explained by individual characteristics. In addition to the individual characteristics, the living environment characteristics showed no statistically significant effect.

Although not definite, the results suggest that the risk of an anxiety disorder or depression is hardly or not associated with the living environment. However, the risk of an anxiety disorder or depression for females showed a small effect of the living environment characteristic 'green space', after controlling for individual characteristics. For males, no effect of living environment characteristics was found. These results may suggest that females are more susceptible to the living environment in terms of green space.

5.2. Discussion

These study findings are the result of three different study components which give insight into the roles of individual and living environment characteristics.

The effect of individual characteristics

The individual characteristics have shown a statistically significant effect on the risk of an anxiety disorder or depression. For both males and females, the risk of an anxiety disorder or depression was higher when they received unemployment benefits when compared to people with a paid job. People having poor/moderate health and good health compared with people with outstanding/very good health showed a higher risk of an anxiety disorder or depression. Moreover, people showed a higher risk of an anxiety disorder or depression when they experienced no or less social cohesion when compared to people with social cohesion. In addition, men showed a higher risk of an anxiety disorder or depression when they experienced low social capital compared to men who experienced high social capital. For both men and woman, the increase in age showed a decrease of the risk of an anxiety disorder or depression. However, this effect was rather small. Females who have one bad lifestyle have a lower risk of an anxiety disorder or depression compared to females who have no bad lifestyle. For both men and woman, the addition of individual characteristics helped explain the variance in the risk of an anxiety disorder or depression at the municipality level significantly. For males, all the variance at the municipality level was explained by the individual characteristics; for females little variance at municipality was explained by the individual characteristics. Study findings concerning the

effect of individual characteristics confirm the study expectation and previous research where the effect of individual characteristics on mental health was presented. Moreover, the negative effect of being unemployed, having poor health and low social cohesion on mental health also corresponds with previous study results (Stafford et al., 2007; Fone et al., 2007; Haomiao et al., 2009; Ivory et al., 2011).

The effect of living environment characteristics

The living environment characteristics have shown only statically significant effects for females. For females, the higher the socio-economic status and the higher the amount of green space in their municipality, the lower the risk of an anxiety disorder or depression. On the other hand: the higher the urbanity at municipality level, the higher the risk of an anxiety disorder or depression. The living environment characteristics independently explained the variance in the risk of an anxiety disorder or depression at municipality level. The combined living environment characteristics also explain the variance in the risk of an anxiety disorder or depression at municipality level, however the effect of the characteristics changed. The effect of green space was the only living environment characteristic that had a small significant effect. For males, no statically significant effect was found. However, the variation in the risk of an anxiety disorder or depression at municipality level was partially explained by the living environment characteristics.

On account of previous studies, the relation between living environment characteristics and mental health were expected for males as well as for females, where Haomiao et al. (2009) showed that socio-economic environmental characteristics were associated with the perceived low physical and mental health (Haomiao et al., 2009). Besides, higher levels of urbanity at environmental level showed an increased risk of mental ill health (Harpham, 1994; Sundquist, 2004; Maas, 2008;). Moreover, the previous research of Maas (2008) has shown that the amount of green space in people's living environment is positively associated with perceived general health (Maas, 2008). However, the majority of these studies made no specific distinction of the extent of the effect of the living environment characteristics for males and females.

The effect of living environment characteristics in addition to individual characteristics

On grounds of presumed collinearity, the living environment is represented by socio-economic status and green space at the municipality level. In addition to the individual characteristics, the living environment for males showed no effect on the risk of an anxiety disorder or depression. Moreover, the variance in the risk of an anxiety disorder or depression for males at municipality level was already explained by the individual characteristics. However, for females, some variation in the risk of an anxiety disorder or depression at municipality level was explained by the living environment characteristics. The living environment characteristic 'green space' showed a small statically significant effect on the risk of an anxiety disorder or depression, where a higher amount of green space decreased the risk of an anxiety disorder or depression. No statically significant effect was found for the living environment characteristic 'socio-economic status'. Nevertheless, it must be taken into account that the variation in the risk of an anxiety disorder or depression at municipality level, as well as the explanation and effect by green space for females was very small.

Again the effect of living environment characteristics was expected, however, this effect was expected to be lower than the effect without individual characteristics (Truong & Ma, 2006; Mair, Diez Roux & Galea, 2008). This is in contrast with what has been shown in this study, where the small effect of

green space on the risk of an anxiety disorder or depression is similar to the effect without the individual characteristics. Moreover, the expected effect of socio-economic status at municipality level, in addition to individual characteristics has not been confirmed by this study. Nevertheless, the no effect of socio-economic status at the environment level was shown by Henderson et al. (2005), where neither socio-economic characteristics, as well as ethnic density at neighbourhood level were associated with depressive symptoms after including individual socio-economic characteristics. Once more, the majority of previous studies did not make a distinction of the effect of living environment characteristics between males and females. However, Ivory et al. (2011) did show that increasing neighbourhood social fragmentation was associated with lower mental health, especially for unemployed women (Ivory et al., 2011).

The living environment characteristic green space showed a small effect on the risk of an anxiety disorder or depression for females in the province of Groningen in addition to the individual characteristics. For males no effect of living environment characteristics on this risk was found, which suggests that women are probably more susceptible to the living environment than men. Moreover, the results suggest that the extent of the effect from individual characteristics on the risk of an anxiety disorder or depression differs for males and females.

5.3. Strengths and limitations

The theoretical framework of the ‘drift and breeder hypotheses’ and ‘composition and context’ gave an overview about how individual and environmental characteristics may manifest and affect health, where the Dynamic Stress-Vulnerability Model has done so specifically for mental health. Besides, the theories and previous studies have provided insight into the strengths and limitations of this study.

Strengths

The secondary data of the “health survey 2010” of the GGD gave this study the opportunity to investigate a large and diverse set of individual characteristics. This has led to the understanding of the extent of the effect of these diverse individual characteristics on the risk of an anxiety disorder or depression. Besides, this study used living environment secondary data independent of the individual data. Because of the hierarchical structure of the data, a multilevel model was used. The multilevel model was important in order to specify clearly which variables belonged to which level and which direct and variation effect can be expected (Hox, 2002). By the use of a multilevel analysis, the unexplained variance in the risk of an anxiety disorder or depression at municipality level was shown, which led to an indication of how the living environment and individual characteristics affect the risk of an anxiety disorder or depression. The analyses have been carried out for females and males separately which gave this study better understanding of their difference in the effect of individual and living environment characteristics.

Limitations

The individual data of the “health survey 2010” of the GGD has been used. However, in March 2014 the health report from 2012 of the province of Groningen was publicly published (GGD, 2013). However, this study used the data of the “health survey 2010” for the individual data on grounds that most recent data on the living environment characteristics were only available for 2006 (green space), 2010 (status scores) and 2011 (housing density).

The living environment characteristics are derived from different years (RIVM, 2014; RIVM, 2011; SCP 2012). This is due to the fact that scores for housing density and green space at municipality level

were not available for the year 2010. Housing density (2011) and Green space (2006) are the most recent scores available. Changes in housing density and green space are probably minimal, yet they may have had an effect. For this reason it would be better to use area data from the same year.

Although the “health survey 2010” of the GGD provided a large and diverse set of individual characteristics, life events, traits and genetic factors were not included. These three individual characteristics, which are emphasized by the Dynamic Stress-Vulnerability model are expected to affect the risk of mental ill health (Ormel et al, 2001). This is confirmed by research conducted in Groningen, where the effect of life events, traits and genetic factors on depression was shown (Ormel, 2000).

The conceptual model of this current study showed the expected and studied relationships based on previous research on the Dynamic Stress-Vulnerability model. The model presented the effect of individual and environmental characteristics on the risk of an anxiety disorder or depression. Moreover, the model presented the effect of individual characteristics on the relationship between living environment characteristics and the risk of an anxiety disorder or depression. However, the interaction effects of these relationships were not taken into account. Although the interaction effects were clearly indicated by the Dynamic Stress-Vulnerability model.

The living environment has been measured at municipality level. The geographical scale of the living environment characteristics by municipalities might be too large. The majority of previous studies have chosen a smaller indication of the living environment, such as neighbourhood level (Weich et al., 2002; Evans, 2003; Sundquist, 2004; Kubzansky et al., 2005; Galea et al., 2007). For this reason a smaller area level might be more appropriate for representing the living environment.

The presumed collinearity between the living environment characteristics has led to the non-inclusion of the living environment characteristic ‘urbanity’ (housing density) in the final analysis model. In order to include an effect of built environment, housing density could be replaced by the quality of housing in the area, which also showed its effect on mental health (Weich et al., 2002; Evans, 2003; Araya, 2007). Quality of housing in the area may have less correlation with status score and green space. In this study the quality of housing could not be included since data on quality of housing was not available.

The observed relation of green space and the risk of anxiety disorder or depression for females could be influenced by interaction effects. Where people who have less risk of an anxiety disorder or depression move to more greener environments, people who have higher risk of an anxiety disorder or depression move to less greener environment (Maas, 2008). However, this study controlled for selection effects by demographic and socio-economic characteristics, which should rule out geographical differences (Verheij, 1996). Nevertheless, given the correlations between the living environment characteristics in the data, effects of selection cannot be ruled out completely (Maas, 2008).

5.4. Future directions and recommendations

In order to give a better indication of the effect of the living environment on the risk of an anxiety disorder or depression, the following directions should be taken into account.

First, most recent data should be used. Moreover, individual data and living environment data should be retrieved in the same year. Changes in living environment characteristics during the years are small, yet they may have an effect. For the most complete indication of the individual characteristics, life events, traits and genetic factors should be taken into account, which are factors emphasized by the Dynamic Stress-Vulnerability model and are expected to affect the risk of mental ill health (Ormel et al, 2000). Furthermore, for the most complete indication of the living environment, urbanity (housing density) could better be replaced by the quality of housing in the area. Since the quality of housing has an effect on mental health and is expected to correlate less with socio-economic environment and green space (Weich et al., 2002; Evans, 2003; Araya, 2007). The geographical scale of the living environment area should be considered properly. Smaller area levels are recommended, such as neighbourhood level. Besides, taken into account a time component ‘the time people spent in a certain area’ might improve the indication of the living environment. This time component may lead to a better understanding of the living environment effect. Finally, taking into account the interaction effects of individual and living environment characteristics might give a better understanding of their effect on mental health. Overall, this study suggests further research and taking into account these future directions.

Even though the effects of the living environment characteristics did not show the expected effect, this study showed an effect of green space on the risk of an anxiety disorder or depression for females. This is why this study recommend policy makers to consider the development of the amount of green space in specific areas with less green in the province of Groningen.

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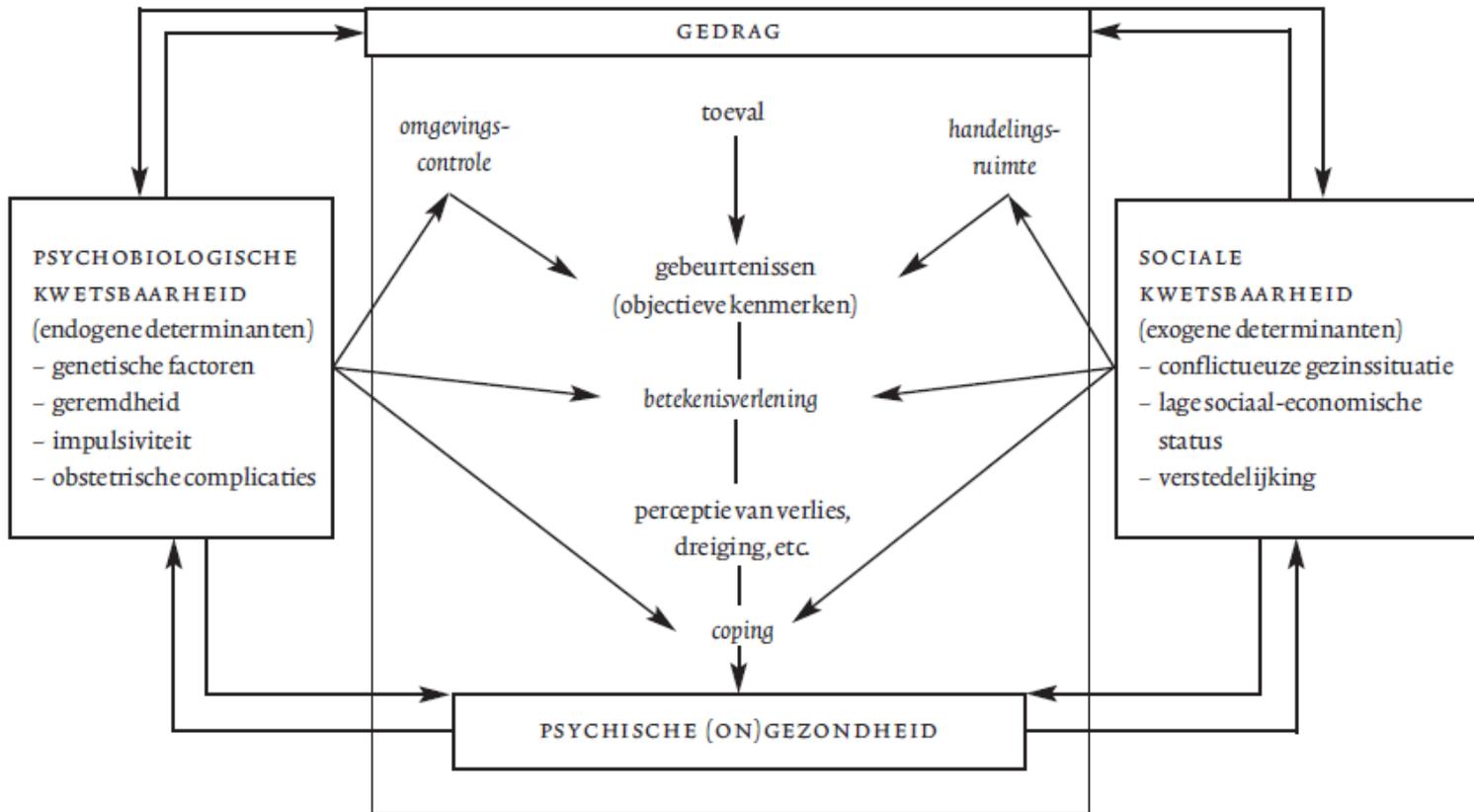
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Appendix 1. The Dynamic Stress-Vulnerability model



Source: (Ormel et al, 2001).

Appendix 2. "Health survey 2010" questions

Question 1. Wat is uw geboortejaar?

Question 2. Wat is uw geslacht? 1 Man 2 Vrouw

Question 7. Hoe zou u over het algemeen uw gezondheid noemen?

- [1] Uitstekend
- [2] Zeer goed
- [3] Goed
- [4] Matig
- [5] Slecht [9 = Missing]

Question 9. Hoeveel kilo weegt u zonder kleren? (afroonden op hele kilo's)
Indien u zwanger bent, hier graag uw gewicht van vóór de zwangerschap invullen.

| kilogram

Question 10. Hoe lang bent u (zonder schoenen)?

| centimeter

Question 29. Rookt u (wel eens)?

- 1 Ja
- 2 Nee, maar vroeger wel Ga naar vraag 31
- 3 Nee, ik heb nooit gerookt Ga naar vraag 31

Question 30. Wat rookt u en hoeveel?

(F2.0) ± ____ Sigaretten (uit een pakje of zelf gerold) per dag

(F2.0) ± ____ Sigaren per week

(F2.0) ± ____ Pakje(s) pijptabak (van 50 gram) per week

Question 31. Wilt u aangeven welke soorten alcoholhoudende drank u in de afgelopen 12 maanden wel eens heeft gedronken?

Er zijn meerdere antwoorden mogelijk.

[1 - Ja | 2 - Nee | 9 - Onbekend

(fl.0) Bier (geen alcoholarm of alcoholvrij/malt bier)

(fl.0) Wijn, sherry, port, vermouth

(fl.0) Likeur, advocaat, bessenjenever, citroenjenever

(fl.0) Jenever, brandewijn, vieux, rum, cognac, whisky, wodka of ander gedestilleerd

(f1.0) Alcoholhoudende drank gemengd frisdrank of vruchtensap (b.v. breezers, shooters)

(f1.0) Ik dronk vroeger wel, maar ik heb de afgelopen 12 maanden geen alcoholhoudende dranken gedronken **Ga naar vraag 38**

(f1.0)] Ik heb nooit alcoholhoudende dranken gedronken **Ga naar vraag 38**

Question 32. Op hoeveel van de 4 door-de-weekse dagen (hiermee wordt bedoeld maandag t/m donderdag) drinkt u gemiddeld genomen alcoholhoudende drank?

1 4 dagen

2 3 dagen

3 2 dagen

4 1 dag

5 Minder dan 1 dag

6 Ik drink nooit op door-de-weekse dagen **Ga naar vraag 34**

Question 33. Als u op zo'n door-de-weekse dag alcoholhoudende drank gebruikt, hoeveel glazen drinkt u dan gemiddeld? (het gaat hierbij nog steeds om maandag t/m donderdag). Met een glas wordt bedoeld een glas dat voor die drank gebruikelijk is. Reken voor een blikje of flesje bier 1,5 glas. Dus twee flesjes bier is 3 glazen (halve glazen naar boven afronden).

Ik drink op zo'n door-de-weekse dag gemiddeld

--	--

 glas/glazen
(F2.0)

Question 34. Op hoeveel van de 3 weekenddagen (hiermee wordt bedoeld vrijdag t/m zondag) drinkt u gemiddeld genomen alcoholhoudende drank?

8 = Missing 9 = Missing

1 3 dagen

3 1 dag

2 2 dagen

4 Minder dan 1 dag

5 Ik drink nooit in het weekend **Ga naar vraag 36**

Question 35. Als u op zo'n dag in het weekend alcoholhoudende drank gebruikt, hoeveel glazen drinkt u dan gemiddeld? (het gaat hierbij nog steeds om vrijdag t/m zondag). Met een glas wordt bedoeld een glas dat voor die drank gebruikelijk is. Reken voor een blikje of flesje bier 1,5 glas. Dus twee flesjes bier is 3 glazen (halve glazen naar boven afronden).

Ik drink op zo'n weekenddag

--	--

 gemiddeld glas/glazen

Question 36. Hoe vaak heeft u de afgelopen zes maanden 4 of meer glazen alcoholhoudende drank op één dag gedronken?

98 = Missing

99 = Missing

1 Elke dag

5 1-3 keer per maand

2 5-6 keer per week

6 3-5 keer per half jaar

3 3-4 keer per week

7 1-2 keer per half jaar

4 1-2 keer per week

8 Nooit

Question 37. Hoe vaak heeft u de afgelopen zes maanden 6 of meer glazen alcoholhoudende drank op één dag gedronken?

98 = Missing

99 = Missing

1 Elke dag

2 5-6 keer per week

3 3-4 keer per week

4 1-2 keer per week

5 1-3 keer per maand

6 3-5 keer per half jaar

7 1-2 keer per half jaar

8 Nooit

Question 39. Kessler psychological distress scale (K10)

De volgende vragen gaan over hoe u zich voelde in de afgelopen 4 weken. Kruis op iedere regel het antwoord aan dat het beste omschrijft hoe vaak u dit gevoel hebt.

[1]
Altijd

[2]
Meestal

[3]
Soms

[4]
Af en toe

[5]
Nooit

[9]
missing

GGADB201 (F1.0) Hoe vaak voelde u zich erg vermoeid zonder duidelijke reden?

GGADB202 (F1.0) Hoe vaak voelde u zich zenuwachtig?

GGADB203 (F1.0) Hoe vaak was u zo zenuwachtig dat u niet tot rust kon komen?

GGADB204 (F1.0) Hoe vaak voelde u zich hopeloos?

GGADB205 (F1.0) Hoe vaak voelde u zich rusteloos of ongedurig?

GGADB206 (F1.0) Hoe vaak voelde u zich zo rusteloos dat u niet meer stil kon zitten?

GGADB207 (F1.0) Hoe vaak voelde u zich somber of depressief?

GGADB208 (F1.0) Hoe vaak had u het gevoel dat alles veel moeite kostte?

GGADB209 (F1.0) Hoe vaak voelde u zich zo somber dat niets hielp om u op te vrolijken?

GGADB210 (F1.0) Hoe vaak vond u zichzelf afkeurenswaardig, minderwaardig of waardeloos?

Question 50. Er volgen nu enkele uitspraken. Wilt u van elk van de volgende uitspraken aangeven in hoeverre die op u, zoals u de laatste tijd bent, van toepassing is?

<i>Geef op iedere regel uw antwoord.</i>	Ja	Min of meer	Nee	missing
(F1.0) Er is altijd wel iemand in mijn omgeving bij wie ik met mijn dagelijkse probleempjes terecht kan.	1	2	3	99
(F1.0) Ik mis een echt goede vriend of vriendin.	1	2	3	99
(F1.0) Ik ervaar een leegte om mij heen.	1	2	3	99
(F1.0) Er zijn genoeg mensen op wie ik in geval van narigheid kan terugvallen.	1	2	3	99
(F1.0) Ik mis gezelligheid om mij heen.	1	2	3	99
(F1.0) Ik vind mijn kring van kennissen te beperkt.	1	2	3	99
(F1.0) Ik heb veel mensen op wie ik volledig kan vertrouwen.	1	2	3	99
(F1.0) Er zijn voldoende mensen met wie ik me nauw verbonden voel.	1	2	3	99
(F1.0) Ik mis mensen om mij heen.	1	2	3	99
(F1.0) Vaak voel ik me in de steek gelaten.	1	2	3	99
(F1.0) Wanneer ik daar behoefte aan heb, kan ik altijd bij mijn vrienden terecht.	1	2	3	99

Question 51. Er volgen nu enkele uitspraken. Wilt u van elk van de volgende uitspraken aangeven in hoeverre die op u, zoals u de laatste tijd bent, van toepassing is? *Geef op iedere regel uw antwoord.*

	Helemaal eens	Beetje Eens	Niet eens, niet oneens	Beetje oneens	Helemaal oneens
De mensen in mijn buurt helpen elkaar	1	2	3	4	5
De mensen in mijn buurt voelen zich verbonden met elkaar	1	2	3	4	5
De mensen in mijn buurt zijn te vertrouwen	1	2	3	4	5
kunnen in het algemeen slecht met elkaar opschieten	1	2	3	4	5
Ik ga liever niet om met de mensen die in mijn buurt wonen	1	2	3	4	5

Question 65. Wat is uw hoogst voltooide opleiding? (F2.0) 99=missing

Geen opleiding afgerond met diploma of voldoende getuigschrift)

- 1 Geen opleiding (lager onderwijs niet afgemaakt)
- 2 Lager onderwijs (basisschool, speciaal basisonderwijs)
- 3 Lager of voorbereidend beroepsonderwijs (zoals LTS, LEAO, LHNO, VMBO)
- 4 Middelbaar algemeen voortgezet onderwijs (zoals MAVO, (M)ULO, MBO-kort, VMBO-t)
- 5 Middelbaar beroepsonderwijs en beroepsbegeleidend onderwijs (zoals MBO-lang, MTS, MEAO, BOL, BBL, INAS)
- 6 Hoger algemeen en voorbereidend wetenschappelijk onderwijs (zoals HAVO, VWO, Atheneum, Gymnasium, HBS, MMS)
- 7 Hoger beroepsonderwijs (HBO, HTS, HEAO, HBO-V, kandidaats WO)
- 8 Wetenschappelijk onderwijs (universiteit)
- 9 Anders namelijk

Question 66. Welke situatie is het meest op u van toepassing? (F2.0) 99=missing

- 1 Ik werk, betaald, 32 uur of meer per week
- 2 Ik werk, betaald, 20 of meer maar minder dan 32 uur per week
- 3 Ik werk, betaald, 12 of meer maar minder dan 20 uur per week
- 4 Ik werk, betaald, minder dan 12 uur per week
- 5 Ik ben (vervroegd) met pensioen (AOW, VUT, FPU)
- 6 Ik ben werkloos/ werkzoekend (geregistreerd bij het arbeidsbureau)
- 7 Ik ben arbeidsongeschikt (WAO, AAW, WAZ, WAJONG)
- 8 Ik heb een bijstandsuitkering
- 9 Ik ben fulltime huisvrouw / huisman
- 10 Ik volg onderwijs / ik studeer

Vraag 68. Wat is uw geboorteland?

- 1 Nederland
- 2 Suriname
- 3 Nederlandse Antillen
- 4 Aruba
- 5 Turkije
- 6 Marokko
- 7 Overig, namelijk

van uw moeder?

- 1 Nederland
- 2 Nederland
- 3 Nederlandse Antillen
- 4 Aruba
- 5 Turkije
- 6 Marokko
- 7 Overig, namelijk

van uw vader?

- 1 Nederland
- 2 Nederland
- 3 Nederl. Antillen
- 4 Aruba
- 5 Turkije
- 6 Marokko
- 7 Overig, namelijk

Appendix 3. Description of living environment characteristics at municipality level.

Municipality	Statusscore	Housing density	Green space
Appingedam	-1.1317	232	62
Bedum	0.0020	98	102
Bellingwedde	-1.2308	38	604
Ten Boer	-0.2884	66	122
Delfzijl	-0.9357	89	259
Groningen	-1.5143	1099	59
Grootegast	-0.5060	54	89
Haren	0.9646	185	103
Hoogezand	-1.4175	233	113
Leek	-0.3836	124	50
Loppersum	-0.6076	40	220
Marum	-0.4384	64	97
Stadskanaal	-1.7231	127	163
Slochteren	0.0510	42	216
Veendam	-0.8220	166	138
Vlagtwedde	-1.8234	42	358
Winsum	-0.1738	58	48
Zuidhorn	0.0515	59	43
Pekela	-1.6735	112	147
Eemsmond	-1.2070	38	83
Marne	-0.8057	28	254
Oldambt	-1.2977	79	275
Menterwolde	-0.6299	66	193

Housing density: number of dwellings per km²; Green space: amount of green in a range of 500 meter (m²).

Data sources: SCP, 2012; RIVM, 2014^c; RIVM, 2011