Personality and Depression

Relationship Between Five-Factor Personality Traits and Depressive Symptoms

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Tiivistelmä

Johdanto: Masennus on yksi yleisimmistä mielenterveyden häiriöistä, jotka aiheuttavat työkyvyttömyyttä. Sen suhde persoonallisuuteen on ollut kiinnostuksenkohteena sekä historiassa että modernissa tutkimuksessa. Tieto persoonallisuuspiirteiden ja masennuksen välisestä yhteydestä auttaa kehittämään sopivia malleja masennuksen hoitamiseen.

"Viiden suuren" persoonallisuuspiirteen malli (the Five-Factor Personality Model, FFM, ns. Big Five) on yksi vakiintuneimmista persoonallisuusteorioista. Sen mukaan persoonallisuus koostuu viidestä piirteestä – neuroottisuudesta, ekstraversiosta, avoimuudesta, tunnollisuudesta ja myöntyvyydestä. Neuroottisuuden ja ekstraversion yhteys depressioon tunnetaan hyvin nykyisessä tutkimuksessa, mutta muiden piirteiden ja depression yhteydestä ei ole yhdensuuntaisia tuloksia. Korkea neuroottisuus vaikuttaisi olevan masennusjaksojen taustalla oleva riskitekijä, mutta muiden persoonallisuuspiirteiden lieventäviä vaikutuksia tulisi tarkastella syvemmin. Lisäksi on saatu vaihtelevia tuloksia siitä, onko sukupuolella piirteistä riippumatonta vaikutusta masennukseen.

Tavoitteet: Käsillä oleva tutkimus pyrkii vastaamaan seuraaviin kysymyksiin: 1. *Mikä on viiden suuren persoonallisuuspiirteen yhteys depressioon?* 2. *Miten neuroottisuus toimii depression riskitekijänä?* 3. *Millaista persoonallisuuspiirteistä riippumatonta vaikutusta sukupuolella on depressioon?*

Menetelmät: Tutkimusaineisto on tuotettu Lasten Sepelvaltimotautien Riskitekijät (LASERI, The Cardiovascular Risk in Young Finns) -hankkeessa, joka on alkanut vuonna 1980. Hankkeen 27. vuoden seuranta toteutettiin vuonna 2007, jolloin osallistujilta mitattiin persoonallisuuspiirteet sekä masennusaste. Tulokset saatiin 1 714 henkilöltä tutkimuksessa alun perin mukana olleilta 3 596 henkilöltä. Persoonallisuuspiirteet mitattiin NEO-FFM-M-testillä ja masennustason mittaamisessa käytettiin BDI II -testiä. Tutkittavat jaettiin neljään ryhmään neuroottisuuden ja ekstraversion mediaaniarvojen perusteella.

Tulokset ja johtopäätökset: Korkean neuroottisuuden ja masennuksen välillä on vahva yhteys, mutta korkea ekstraversio vaikuttaa maltillisesti toiseen suuntaan. Muiden persoonallisuuspiirteiden ja masennuksen välillä ei löytynyt yhteyttä. Naisten masennusaste on miesten vastaavaa korkeampi, ja sukupuolen vaikutusta välittää naisten korkeampi neuroottisuus. Siitä, onko sukupuolella persoonallisuudesta riippumatonta vaikutusta, tarvitaan lisää tutkimusta.

Väestöaineistoon perustuvat poikkileikkaustutkimukset antavat arvokasta tietoa sukupuolen, persoonallisuuden ja masennuksen välisistä yhteyksistä, mutta ne eivät mahdollista persoonallisuuden mahdollisten muutosten ja kausaalisuhteiden tutkimista. Tämän vuoksi tutkimusta tulee tehdä pitkittäisessä tutkimusasetelmassa.

Avainsanat
Big Five, depressio, masennus, persoonallisuus

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Abstract

Background: Depression is one of the most prevalent disabling mental disorders worldwide. Its relation to the personality of the patient has been a topic of interest both in history and modern research. Understanding the relationship between personality traits and depression will help to develop suitable models of treatment for depression.

The Five-Factor Personality Model (FFM, a.k.a. Big Five) is one of the most established scientific personality models, with its traits, namely neuroticism, extraversion, openness, conscientiousness and agreeableness. Connection between neuroticism and depression as well as between extraversion and depression is well known in modern scholarship, but no unambiguous results of connections between other traits and depression exist. High neuroticism seems to function as a risk factor that has a strong connection with Major Depression Episodes, but the moderating effects of the other personality traits are to be studied more deeply. In addition, there have been diverse results whether sex/gender has or has not a trait-independent role in predicting the severity of depression.

Aims: Thus, the present study strives for answering the following questions: 1. *What is the correlation between individual five-factor personality traits and depression?* 2. *How does neuroticism trait function as a risk factor for depression?* 3. *How does sex/gender covariate with the depression?*

Methods: The data of the present study has been obtained from The Cardiovascular Risk in Young Finns study (Lasten Sepelvaltimotautien Riskitekijät, LASERI). The project has begun in 1980 and its 27-year follow-up was performed in 2007, when five-factor personality traits and depression score were measured as well. Personality traits and the depression score from 1,714 of the original 3,596 subjects were measured with NEO-FFI-M and BDI II. The participants were divided into four groups on the basis of the median values of neuroticism and extraversion traits.

Results and conclusions: High neuroticism has a strong connection with depression, but high extraversion has a moderate opposite influence. No connection between the other traits and depression was found. Women tend to have higher scores of depression than men, but the sex influence is mediated by higher neuroticism among women. Further research is needed on possible trait-independent gender influence.

Cross-sectional studies based on population data bring forth valuable information about links between gender, personality and depression, but they do not permit possible changes in personality or causal relations to be studied. Therefore, more profound research in longitudinal paradigm is needed.

Keywords Big Five, depression, melancholy, personality
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1.   Introduction

1.1.   Aim of the Study

Depression is one of the most prevalent disabling mental disorders, ranked as a fourth leading cause of burden among all diseases (WHO, 2001, 30). According to the latest global data (WHO, 2001), 5,8 % of men and 9,5 % of women worldwide experience a depressive episode in a 12-month period. In Finnish population, total 3.6 % of men and 7.0 % of women had experienced a Major Depressive Episode (MDE) in 2011. The prevalence of the MDEs in a 12-month period has remained the same since 2000. (Suvisaari et al., 2012). As early as in the middle of the 1990s, the World Health Organization estimated that the ranking of the depression with respect to burden would rise to the second place by 2020 (Murray & Lopez, 1996, 38).

The question of the relationship between personality of a human being and depressive symptoms is as old as the history of medicine. The ancient Greek physician Hippocrates, as early as in the fifth century BC, assigned depressive symptoms to one of the four body liquids, which he called humours, namely black bile (*melaina khole*) wherein the former name melancholy for depression. The Roman philosopher Galen, royal physician of Emperor Marcus Aurelian in the second century AD, developed Hippocrates' theory of the four bodily humours to a nine fold temperament matrix, based on the Latin verb *temperare*, "to mix". In his matrix, there were some less ideal types of temperament, in which one bodily liquid dominated the others. Thus, it was the dominance of the black bile in the *melancholic* temperament that was associated with melancholy by Galen. (Solomon, 2002, 385–394)

In the course of time and especially in the twentieth century, the psychological knowledge of personality and depression has rapidly increased as a result of modern psychological and medical research. However, the question on the

relationship between personality characteristics and depressive symptoms has remained essentially the same: Is there a statistically significant correlation between certain personality traits and depressive symptoms? Research on the subject will help physicians and psychologists to develop suitable models of treatment for depression by means of a broader understanding of the significance of a patient's personality.

In the present study, the relationship between personality and depression is analysed in the framework of the five-factor personality theory, also known as the Big Five theory (e.g. Goldberg, 1990; McCrae & Costa, 1987), and modern clinical measurements of depression. The research is done as a transverse study of the Finnish normal population. As a result, we shall have a great amount of new knowledge from a previously unexplored sample of an extraordinary size. The sufficient size of the sample improves the validity of the study.

1.2.   Big Five Personality Theory

The five-factor model of personality was originally presented by McDougall (1932), who suggested that personality consists of "five distinguishable but separate factors", namely intellect, temper, character, disposition, and temperament. His suggestion was followed by a more comprehensive study by Norman (1963), whose results were enough for "an adequate taxonomy for personality attributes", which he named culture, conscientiousness, surgency, agreeableness, and emotional stability, respectively. Since Norman, there has been an immense amount of studies set forth, in which the five-factor model of personality has been statistically tested. According to Digman (1990), those studies show that personality "could be adequately described by five superordinate constructs".

As demonstrated by Digman (1990), the exact nomenclature has not been easy to achieve. Much of the lexical work has been done in order to find eloquent and explicit names for the five personality traits. In the research of recent decades, once the five-factor model was established as a *status quo*, the fundamental traits of human personality have been named as openness to experience (O), conscientiousness (C), extraversion (E), agreeableness (A), and neuroticism (N), sometimes easily remembered as an acronym OCEAN. The factors shall, however, be presented according to McCrae & Costa (1987) in the order N–E–O–A–C, which

can be found in the name of the five-factor personality inventory NEO-PI-R (Costa & McRae, 1985), as well.

Neuroticism, which is sometimes called emotional instability, manifests itself as the experience of negative emotions, such as anger, anxiety, and depressed mood. Neurotic people are apt to react emotionally, interpreting even ordinary situations as threatening. Again, people with low neuroticism tend to be calm and emotionally stable, and have more capability to think clearly and cope effectively with stress (McCrae & Costa, 1987; Goldberg, 1990).

Extraversion is in conjunction with positive emotions, sociability, and engagement with the external world. Extravert people are perceived as full of energy, enjoy social communication, and show their enthusiasm with ease. As opposed to this, introvert people prefer non-social environments, are more quiet, and simply do not need as much social stimulation. This does not mean anxiousness, shyness or depression, however (McCrae & Costa, 1987; Goldberg, 1990).

Openness to experience is regarded as a general appreciation for emotion, imagination, unusual ideas, curiosity, and variety of experience. People with high scores on openness tend to be sensitive to beauty, more creative and more aware of their feelings. In turn, more closed off people are apt to plain, straightforward environments and feel anxious towards ambiguity, for example (McCrae & Costa, 1987; Goldberg, 1990).

Agreeableness, which is sometimes called friendliness, expresses compassion and cooperativeness towards surrounding people. Agreeable people generally have a positive view of humanity and make compromises easily in order to achieve social harmony. Disagreeable people instead have a more negative view of others, tend to be more selfish, and are not concerned with the well-being of their neighbours (McCrae & Costa, 1987; Goldberg, 1990).

Conscientiousness brings forth self-discipline and a sense of duty. Conscientious people often have high aims for achievement and do not hesitate to act dutifully in order to fulfil the expectations towards them. People who scored low on conscientiousness show more preference to spontaneous rather than planned behaviour and have a tendency not to keep an exact order (McCrae & Costa, 1987; Goldberg, 1990).

1.3. Depression

Depressive phenomena are as old as is the humankind. Historically they have some sometimes been seen as a result of instability of body liquids, sometimes as an acedic state caused by a noonday demon (Solomon 2002, 385–400). In modern medicine, however, depression is seen as a bundle of depressive syndromes, which have been most recently defined in the *Diagnostic and Statistical Manual of Mental Disorders IV Text Revision (DSM-IV-TR)* of the American Psychiatric Association in 2000. Along with the Major Depressive Disorder (MDD) with its several subtypes, also Dysthymia and Depressive Disorder Not Otherwise Specified (DD-NOS) were found, containing Minor Depressive Disorder, for example. However, depression as a concept can be regarded more broadly than just as diagnoses, signifying depressed mood, low self-esteem, and loss of pleasure without clinical significance as well.

According to DSM-IV-TR (2000), Major Depressive Disorder is diagnosed when five or more of the six symptoms of the criteria for the Major Depressive Episode are present over a two-week period. Those criteria consist of two main symptoms, (1) depressed mood and (2) anhedony, of which either is required in order to make a diagnosis, and seven other symptoms, namely (3) a change in eating, appetite, or weight, (4) a change in sleep, (5) slow motor activity, (6) fatigue, (7) loss of self-worth, (8) troubles in concentration, and (9) thoughts of death. In addition, these symptoms are to cause clinically important distress, work impairment, or impairments in social or personal functioning in order to a diagnosis to be made.

There is some difficulty assigned with the categorical nature of clinical diagnosis. A certain person either has a diagnosis or not. There is no continuity between major depression and a non-depressive state. As Solomon (2002) has stated, the threshold of five symptoms over a two-week period is somewhat arbitrary. Also, having four of the nine symptoms may be unappealing, even if they do not last for more than 13 days. It might also be less troublesome to have many mild symptoms instead of two extremely intense ones. In addition, when doing research among the normal population, it is especially significant to note that not all the people, who could fit the criteria of Major Depressive Disorder, have a

diagnosis for one reason or another. That is why the present study cannot be based on the diagnoses people may or may not have.

1.4.   Previous Research on Personality and Depression

As presented by Klein, Kotov and Bufferd (2011), there are hundreds of studies concexrning the relationship between personality traits and depression. Thus, as the focus of this study is specifically the Big Five personality theory, we shall go through only those studies, where the question is examined in light of the five-factor model. Some other studies will be used, if they bring forth additional information or suggestions for hypotheses.

Summarised from the studies, which are presented below, there is strong evidence for the relationship between neuroticism and depression; also some studies have found a connection between extraversion and depressive mood (Klein & Kotov & Bufferd, 2011; Kotov, Gamez, Schmidt & Watson, 2010). Some studies have also combined several traits to separate categories and found connections between depression and certain personality profiles (see, for example, Josefsson, Merjonen, Jokela, Pulkki-Råback & Keltikangas-Järvinen, 2011). There are also studies concerning the stableness of personality and the question of change during and after depressive episodes (see, for example, Steunenberg, Braam, Beekman, Deeg & Kerkhof, 2009).

Concerning individual personality traits, neuroticism is the most significant trait connected with depression according to various studies (e.g. Bienvenu et al., 2004; Jylhä, 2008; Klein et al., 2011; Kotov et al., 2010; Steunenberg et al., 2009; Goodwin & Godlib, 2004). Also harm avoidance, a temperament trait in Cloniger's model (see e.g. Elovainio et al., 2004), which can be regarded as essentially the same as neuroticism of Big Five, has been found to be in a significant conjunction with depressive symptoms (e.g. Elovainio et al., 2004; Josefsson, Merjonen, Jokela, Pulkki-Råback & Keltikangas-Järvinen, 2011; Jylhä et al., 2011; Klein et al., 2011; Jylhä, 2008; Kronström, 2011).

There is some research made concerning the facets of neuroticism as well. According to Klein et al. (2011), there is some evidence for the relationship between self-harm and depressive symptoms. According to Bienvenu et al. (2004),

however, a relationship between depression and a single facet of neuroticism was not found. Thus, the study of facets of neuroticism would be a question of interest.

Furthermore, there is a lot of evidence about the connection between extraversion and the Major Depressive Disorder. Generally, depressive symptoms are associated with low extraversion in several studies (e.g. Jylhä, 2008; Carrasco Ortiz & del Barrio Gándara, 2002; Griens, Jonker, Spinhoven & Blom, 2002; Klein et al., 2011; Kotov et al., 2010; Naragon-Gainey et al., 2009; Bienvenu et al., 2004). It has been noted, however, that the relationship between extraversion and depression is not as significant as is the link between depression and neuroticism, still having far less controversial results than openness and conscientiousness, for instance (Klein et al., 2011; Kotov et al., 2010).

The link between extraversion and depression is also studied from the perspective of the facets of extraversion. For example, Bienvenu et al. (2004) have found the relationship between low assertiveness and the Major Depressive Disorder, whereas according to Naragon-Gainey et al. (2009) there is a negative correlation between depression and both sociability and positivity alike. The significance of positivity has been affirmed also by Klein et al. (2011), which is not the case in sociability, however. Concerning other facets of extraversion, namely ascendance and fun-seeking, no link was found between them and depressive symptoms.

In turn, there is only little evidence of the connection between openness and depression. In large-scale meta-analyses by Kotov, Gamez, Schmidt and Watson (2010) and Klein et al. (2011), the correlation between openness and depression was not reported. However, in one study (Bienvenu et al., 2004) on patients with the Major Depression Disorder, a slightly high mean openness to feelings, a facet of openness, was found in depressive patients. In turn, an opposite correlation was reported by Carrasco Ortiz & del Barrio Gándara (2007). Regardless of controversial result, this suggests that a relationship between openness to feelings and the Major Depressive Disorder may be found in a data with a great number of participants.

Like openness, conscientiousness has got only little support considering its conjunction with depression. According to meta-analyses by Kotov et al. (2010) and Klein et al. (2011), there is support for a link between low conscientiousness

and the Major Depressive Disorder. Such a relationship has also been reported by Carrasco Ortiz & del Barrio Gándara (2007). It is interesting, however, that in various studies, the relationship has not been found (see e.g. Bienvenu et al., 2004; Jylhä, 2008; Goodwin & Gotlib, 2004; Kendler & Myers, 2010; Griens et al., 2002). Thus, the present study contributes to this discussion about the significance of conscientiousness to depression.

On agreeableness, no support was found for its significance concerning depressive symptoms in any study or meta-analysis. It seems, therefore, that there is no link between depression and agreeableness.

The relationship between individual personality traits and depression is reviewed below, and the results are summarized in table 1.

Table 1
Correlation Between Five-Factor Personality Traits and Depression

Personality Trait	Correlation with Depression
Neuroticism	Strongly Positive
Extraversion	Negative
Openness	Slightly Positive (?)
Agreeableness	No correlation
Conscientiousness	Slightly Negative (?)

Some research has also been made on the stability of personality traits before, during, and after a depressive state. According to Klein et al. (2011), high neuroticism predicts the onset of depression and a worse recovery. Respectively, it has been found that scores of neuroticism rise during a depressive state. According to Karsten et al. (2012), the state effects were found on neuroticism, extraversion and conscientiousness, but their size was rather small. Similar results on neuroticism and extraversion have been discovered by Griens et al. (2002).

Furthermore, there is some evidence for the reduction of neuroticism during treatment and rehabilitation, but higher neuroticism levels still remain in comparison with the normal population (Jylhä, 2008). In addition, high neuroticism predicts relapses in depression in later life (Steunenberg et al., 2009). Although the personality traits tend to be quite stable, small changes occur in course of life. According to Rantanen, Metsäpelto, Feldt, Pulkkinen and Kokko (2007), the mean level of neuroticism tends to decrease and the mean levels of other traits increase during a 10-year follow-up period.

There has also been some research on the influence of antidepressant medicine to personality traits. According to Lisheng et al. (2002), the level of neuroticism tends to lower when depression is treated with fluoxetine. Similarly, the level of extraversion tends to rise during fluoxetine treatment, but no changes in other personality traits were recorded. The interaction seems not to be two-way, since high neuroticism does not predict poor short-term outcome in fluoxetine treatment (Petersen et al., 2002).

There is also some research about the comorbidity of depression and other disorders in connection with personality traits. Similar personality profiles seem to be linked in several disorders besides depression, especially other mood disorders, anxiety disorders and different kinds of phobias (Trull & Sher, 1994; Jylhä et al., 2011; Nyman et al., 2011). In addition, both depression and alexithymia were linked to high neuroticism, low extraversion and low conscientiousness (Atari & Yaghoubirad, 2016). Even some clues about the connection of high neuroticism, depression, and multiple sclerosis has been found (Khodarahimi & Rasti, 2015). Concerning different disorders of behaviour, depression has been linked to higher suicide levels as well, and interesting enough, to *low* neuroticism levels (McCann, 2010). According to Jianing et al. (2016), depression may also function as a mediator between high neuroticism and non-suicidal self-injury. There is even some correlation between depression and drug abuse (Trull & Sher, 1994).

Many of the previous studies face problems with the quality of their data. Most importance must be put on the size of the sample and data acquisition. There are studies, in which the sample is only several dozens (e.g. Griens et al., 2002; Kronström, 2011) or at the most some hundreds of people (e.g. Trull & Sher, 1994; Atari & Yaghoubirad, 2016). Then, there are studies, in which the sample is somehow skewed – it is based for example on a group of students of psychology and a group of psychiatric outpatients (Naragon-Gainey et al., 2009). There is, however, plenty of recent research, in which a population-based sample of sufficient size has been used (like Carrasco Ortiz & del Barrio Gándara, 2007; Elovainio et al., 2004; Goodwin & Godlib, 2004; Josefsson et al., 2011; Jylhä, 2008; Nyman et al., 2011; Steunenberg et al., 2009).

1.5.   Sex and Gender

A question of interest is the role of sex and gender when considering the relationship between depression and personality traits. According to the APA Dictionary of Psychology, the sex is defined as "the traits that distinguish between males and females, especially physical and biological traits". Gender, in turn, implies the "psychological, behavioural, social, and cultural aspects of being male or female" (VandenBos, 2007).

In most of the studies (e.g. Jylhä, 2008; Kronström, 2011; Josefsson et al., 2011; Griens et al., 2002; Elovainio et al., 2004; Steuenberg et al., 2009; Kotov et al., 2010; Jylhä et al., 2011; Bienvenu et al., 2004), a joint effect of gender that would relate to personality traits and depression was not found. In some studies, the attribute of gender was not controlled at all (e.g. Naragon-Gainey et al., 2009; Cassarco Ortiz & del Barrio Gándara, 2007). Generally, there are significant differences between the two genders concerning personality traits, of which openness has been reported to be higher in males and other traits in females (Goodwin & Gotlib, 2004). In addition, females tend to have higher levels of depression. Goodwin & Gotlib (2004) have therefore suggested that neuroticism could serve as a mediator between the female gender and an increased risk of depression in adulthood. Either way, the issue is still controversial and, as Klein et al. (2011) have pointed out, "there is a need for more systematic research examining these moderators and mediators in a longitudinal framework".

On the grounds of the previous scholarship, no further studies that do not take gender effect into account should be made. There has also been a tendency to take either sex or gender as face value. Thus, the lack of operationalization sex/gender should be fixed as well. This point of view has been taken into account in the present study.

1.6.   Research Questions

The aim of the study is to find out the relationship of the five-factor personality traits and the Major Depressive Disorder. In this regard, the study's task is threefold: First, there is still room to replicate the results of previous studies; especially the significance of neuroticism and extraversion and moreover the insignificance of agreeableness in relation to depressive symptoms. Concerning

openness and conscientiousness, research has found clues of their relevance, so that their contribution will be examined with an interest.

Secondly, since the size of effect of the neuroticism trait is huge compared to the other traits, it is important to investigate the role of high neuroticism as a risk factor. An essential question is whether the other traits, especially extraversion, have a mitigating effect in relation to the MDD. This will be done by performing separate analyses for the subgroup with high neuroticism.

Thirdly, as said, the joint effect of sex or gender has been reported controversially. Either the sex or the gender was not controlled at all in previous studies or they were not operationalized. One of the main focuses of this study is to contribute to the question of the role of sex/gender concerning the relationship between depression and personality traits. Because of the higher prevalence of depression among women, sex/gender can be seen as a risk factor in relation to depression.

From the previous points, three research questions with their hypotheses are construed:

1. *What is the correlation between individual five-factor personality traits and depression?* It is presumable that a strong correlation between neuroticism and depression will be found as well as an average correlation between extraversion and depression. In addition, a slight correlation between openness and conscientiousness on the one hand, and depression on the other may be found. It is also probable that no connection between agreeableness and depression will be discovered.

2. *How does neuroticism trait function as a risk factor for depression?* Since the strong correlation between high neuroticism and depression score is known, a significantly higher risk factor to score high on the depression scale should be found. Furthermore, it is suggested that at least high extraversion would diminish the probability to score high on the depression scale.

3. *How does sex/gender covariate with the depression?* The question, whether sex/gender has an independent role in explaining the variance of the depression score, is an open one. It is presumable that some of the variance of the depression score caused by sex/gender is

explained by sex/gender differences in personality traits but still some independent correlation between sex/gender and depression can be found.

2.   Methods

2.1.   Procedure

The data of the present study has been obtained from the research project called The Cardiovascular Risk in Young Finns (LASERI, later Young Finns) (Åkerblom et al., 1985), in which the risks of cardiovascular diseases are monitored every third year since the project began in 1980. At that time, 3,596 children aged 3, 6, 9, 12, 15, and 18 participated in the study. In the data collection, Finland was divided into five parts according to the location of the university cities with a medical faculty. In order to gather a data that represents living conditions, and socio-economic as well as demographic background, children and adolescents were randomly selected in each area on the basis of their personal social security number from the Social Insurance Institution's popular register, which covers the entire population of Finland. Based on the population density in each area, inhabitants of both urban and rural areas were chosen into study. The ethical committees of all participating universities accepted the research plan, and the study protocol of each study phase corresponded to the proposals of the World Health Organization for a cross-sectional study of atherosclerosis precursors in children (Åkerblom et al., 1985).

The 27-year follow-up of the Young Finns Study was performed in 2007 (see Raitakari et al., 2008). That time, the personality traits according to the Five-Factor Model and the Beck's Depression Inventory II were measured as well. Since all the measures of the present study have been done in 2007, the present study is cross-sectional.

2.2.   Participants

When the 27-year follow-up of the Young Finns Study was performed in 2007, altogether 2,228 of the original 3,596 participants in 1980 responded to the survey. They were now respectively aged 30, 33, 36 39, 42, and 45 years, which was

determined by their birth year that was recorded in the original study. Also the sex of the participant was defined on the basis of the original data gathering in 1980, which means that the individual's subjective definition of their gender was not taken into account. The educational level was classified as low (elementary school), intermediate (high school or vocational school), and high (college or university) and was determined by the respondent in the survey.

Table 2

Characteristics of the Study Group

Background Variables	N	%	Cum %
Sex			
Male	702	41.0	41.0
Female	1,012	59.0	100.0
Birth year			
1962	265	15.5	15.5
1965	320	18.7	34.1
1968	314	18.3	52.5
1971	289	16.9	69.3
1974	272	15.9	85.2
1977	254	14.8	100.0
Educational level			
Low	615	35.9	35.9
Intermediate	789	46.0	81.9
High	310	18.1	100.0
Trait Variables	**Median**	**Mean**	**SD**
Traits			
Neuroticism	2.33	2.38	0.68
Extraversion	3.46	3.43	0.53
Openness	3.17	3.18	0.53
Agreeableness	3.63	3.66	0.49
Conscientiousness	3.75	3.71	0.55
Depression Variable	**N**	**%**	**Cum %**
BDI Score			
No depression (≤13)	1,533	89.4	89.4
Mild depression (14–19)	109	6.4	95.8
Moderate depression (20–28)	54	3.2	98.9
Severe depression (≥29)	18	1.1	100.0
Diagnoses and Medicine	**N**	**%**	
Diagnoses			
Major Depression Disorder	154	9.0	
Other mental disorder	47	2.7	
Medicine			
Uses antidepressants or relaxants	109	6.4	

The data for the present study includes all the age cohorts from the research project, and complete data was available for 1,714 participants, which count for

48 % of the participants in 1980. Of the 2,228 participants, who answered the survey, 514 were left out of the study, because they lacked either over 50 % of the subscores of a certain personality trait or the depression score. Thus, of the 1,714 subjects, 59 % (1,012) were women and 41 % (702) men. The demographics of the sample are listed in table 2.

2.3.   Measures

The personality traits were measured using the NEO-FFI inventory (Neuroticism, Extraversion, Openness, Five-Factor Inventory; see Costa & McCrae 1989), which is a cut-down version of the longer NEO-PI (see Costa & McCrae, 1985). The NEO-FFI consists of 60 of the altogether 180 questions of the NEO-PI. The NEO-PI was originally translated in Finnish and standardized by Pulver, Allik, Pulkkinen and Hämäläinen (1995). In 2007, however, a modified version of the NEO-FFI, developed by Rantanen et al. (2007), was used. In the modified version (NEO-FFI-M), some of the questions were rewritten in order to better correspond to a non-Indo-European Finnish language. From the 1 to 5 Likert scale, five mean value variables were formed, provided that at least half of the questions related to each factor were answered. The median and mean values as well as standard deviations for each factor are presented in table 2.

The depression level was measured using Beck's Depression Inventory version II (Beck, Steer, Ball & Ranieri, 1996), which is a revised version of the original BDI (Beck & Steer, 1987). The BDI is a multiple-choice inventory of 21 statements, which are assessed on a scale from 0 to 3. The BDI score is then a continuous variable – with its values between 0 and 63 – which indicates the intensiveness of depressive symptoms. The scores below 13 are considered "minimal" depression, scores between 14 and 19 "mild", scores from 20 to 28 "moderate" and from 29 onwards "severe" (Beck, Steer & Brown, 1996). In the present population, the prevalence of clinical depression was low – only 72 of the 1,714 participants (3.8 %) had ad least the moderate level of 20 points in the BDI-II scale (see table 2). The skewedness of the BDI-II score can most easily be seen from the chart 1.

Chart 1
The Distribution of the BDI Score
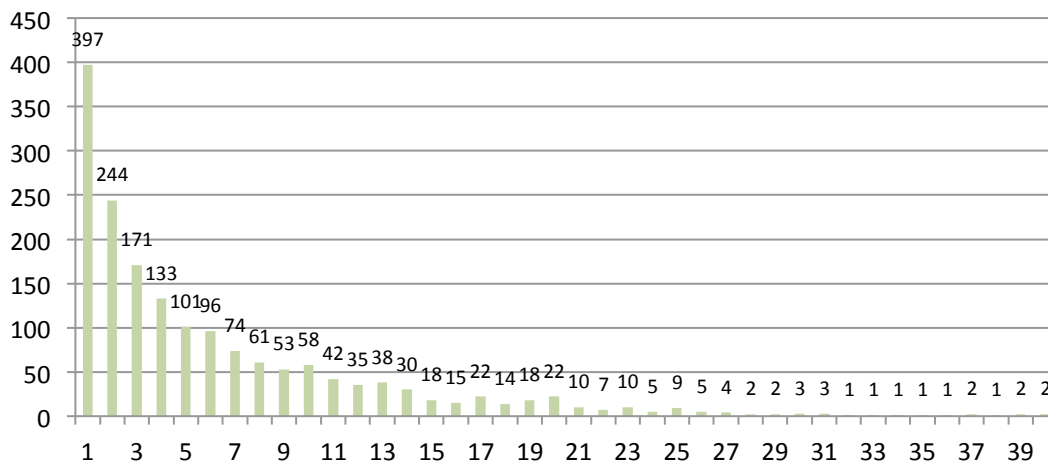
In the survey, there were also three questions related to the mental disorders, namely whether the participant had a Major Depression Disorder diagnosis, whether a diagnosis of some other mental disorder had been made, and whether either antidepressants or relaxants were prescribed to the participant. These characteristics of the study group are presented in table 2.

However, 154 participants (9.0 %) had some depression diagnosis, some of those obviously "mild" one. In addition, as can be seen in table 3, there are, according to the BDI-II score, a significant amount of participants, who do not have a depression diagnosis, but have scored at least 14 points (mild depression) on the BDI-II scale. Actually, more than a half of the participants, who score at least 14 points on the BDI-II scale, do not report to have diagnosis of some kind of depression. In order to deal with the under-diagnosis phenomenon, it is needed to use the BDI-II score, not the diagnosis variable as an indicator of depression in this study.

Table 3
Cross Tabulation of BDI-II Score and Depression Diagnosis

Diagnosis of Depression	Yes	No	Total
BDI Value			
No depression (≤13)	94	1,439	1,533
Mild depression (14–19)	33	76	109
Moderate depression (20–28)	16	38	54
Severe depression (≥29)	11	7	18
Total	154	1,560	1,714

2.4. Analysis

Zero-order correlations were used to examine bivariate relationships between personality traits, depression and the background variables. In order to examine the multivariate relationship of the personality traits to the depression score, a series of linear regression analyses were used with sex, age, and the educational level as fixed covariates.

In order to examine the role of high neuroticism as a risk factor for depression, the subjects were divided into groups according to their level of neuroticism (N) and extraversion (E) by median split. Thus, four groups were formed, namely (1) low neuroticism and extraversion (ne), (2) low neuroticism, high extraversion (nE), (3) high neuroticism, low extraversion (Ne), and (4) high neuroticism and extraversion (NE). In every group, a series of linear regression analyses in the same manner as before, first in the low neuroticism groups together, then in high neuroticism groups together, and finally in each group separately. The characteristics of the groups are shown in table 4.

Table 4
Sizes of the NE-groups

Study Group	Women	Men	Total
Low Neuroticism and Extraversion	98	160	258
Low Neuroticism and High Extraversion	324	249	573
High Neuroticism and Low Extraversion	335	232	567
High Neuroticism and Extraversion	255	61	316

3. Results

3.1. Personality Traits and Depression Related

In the first phase, several analyses were made in undivided study group. The zero-order correlations between the study variables are represented in Appendix I. In the preliminary analysis, based on the zero-order correlations, only a small correlation ($r < .20$, $p < .01$) between sex of the participant and either their personality traits, BDI score or MDD diagnosis was found. The impact of the age and of the educational level to the BDI score was minimal, although there was a slight correlation ($r = .07$, $p < .01$) between the educational level and the BDI score. Generally it can be stated that the correlations of sex, birth year and educational level to the other study variables can be considered weak, except the relationship between the educational level and the openness trait, which do have a moderately positive interconnection ($r = .30$, $p < .01$).

Between the five personality traits there are moderate relations, e.g. between neuroticism and extraversion ($r = -.49$, $p < .01$) one the one hand and con-scientiousness ($r = -.31$, $p < .01$) on the other. The extraversion factor is also moderately intertwined with agreeableness ($r = .30$, $p < .01$) and conscientiousness ($r = .37$, $p < .01$). For this reason we shall examine the relationship between each individual trait and the BDI score separately and finally in a common analysis.

As stated before, there are a notable amount of participants, who score at least 14 points on the BDI scale but who don't either have an MDD or some other mental diagnosis. This point can clearly seen in the correlation matrix (Appendix I), where only a moderate correlation ($r = .34$, $p < .01$) between the BDI score and the MDD diagnosis can be found. The correlations between the BDI score and other mental diagnoses or the use of medicine, are further smaller ($r < .30$) although statistically significant ($p < .01$).

To examine the relationship of the personality traits and BDI score further, a series of multivariate regression analyses were made. Seven different models were constructed for the analysis series, first one with only the background variables (sex, birth year, and educational level) and the BDI score, then one model with each of the individual trait added, and finally a model with background variables, all five personality traits, and the BDI score (see Appendix II). From the seven models, only models 2 (neuroticism) and 7 (all traits) have a moderate coefficient of determination (adjusted $R^2 = .43$ and .44, respectively). They are the only models that include the neuroticism personality trait. Still they are the only models, in which the sex and the educational level have only a slight impact, if any at all. Thus, it seems that the neuroticism trait explains the majority of the variation in the BDI score caused by the sex variable. We will return to this question later.

In addition, there is the model 3 (extraversion) that has some explanatory power in itself (adjusted $R^2 = .17$). This model includes the extraversion trait besides the background variables and the BDI score. Unlike in the models 2 and 7, sex does explain some of the variance of the BDI score, partly because the neuroticism trait was not included in the model.

3.2.   High Neuroticism as a Risk Factor

We have already seen that the neuroticism personality trait explains the vast majority of the variance of the BDI score in the study group. Furthermore, we have seen that the extraversion trait may contribute notably to the BDI score besides the neuroticism factor. For a further analysis of the impact of the extraversion, the study group has been divided into two parts according to the median value (2.33) of the neuroticism trait, as described before in section 2.4. Thus formed high N group contains all but seven cases of clinically significant BDI scores (at least 14 points), total 174. According to an oneway ANOVA, the BDI score is statistically significantly higher ($F = 450.76$; $p < 0.001$) in the high N group (mean 8.16) than in the low N group (mean 2.18).

In the high N group, the extraversion factor has a moderate role in explaining the variance of the BDI score (see Appendix III). The higher the extraversion, the lesser is the probability to score high on the BDI scale. Other personality traits – the openness, agreeableness and conscientiousness – contribute as well, but not as

notably as the extraversion. It is worth noting that sex has greater coefficient of determination in models 2 (extraversion) and 6 (all traits), in which the extraversion factor is included. This suggests that the extraversion mediates the sex impact to the BDI score.

In addition, the study group has been divided to two parts according to the median value (3.46) of the extraversion trait. Most of the participants with BDI score at least 14 were in low E group, but the distribution was not as skewed as it was in N groups. According to an oneway ANOVA, the BDI score was statistically significantly higher (F = 143.99; p < 0.001) in the low E group (mean 7.16) than in the high E group (mean 3.51).

By crosstabulating N and E median groups, we got four groups, namely low N–low E group (ne), low N–high E group (nE), high N–low E group (Ne), and finally high N–high E group (NE) as described before. The frequencies of each group were presented before in table 4. Table 5 summarises the probabilities of having clinically significant depression (at least 14 points on the BDI scale) in each group.

Table 5
Probabilities of Having Clinically Significant Depression (BDI score 14 or more) in NE groups

Group	n	N	p	1 – p	odds
Low N, Low E (ne)	3	258	.01		
Low N, High E (nE)	4	573	.01		
High N, Low E (Ne)	134	567	.24	.76	.31
High N, High E (NE)	40	316	.13	.87	.14

As we see from table 5, we may leave the low N groups without further interest and give focus to the high N groups, where almost every fifth participant (174 of 883) scores at least 14 on the BDI scale! As previously stated, the higher extraversion seems to result lower the BDI scores. Using the probabilities of the high N groups from table 5, we can calculate the odds ratio or *OR* for estimating the risk to have a clinically significant BDI score. The *OR* is then the odds of the Ne group divided by the odds of the NE group, so the *OR* = 2.14, which means that the probability to have a clinically significant BDI score in the high N group is roughly twice as high when having low E instead of having high E.

As can be seen from the chart 2, the 99 % confidence levels between Ne and NE groups do not overlap. Thus, we can conclude, that the high extraversion trait correlates with lower rates of depression in high N groups.

Chart 2
BDI Mean Scores in NE-groups With Their 99 % Confidence Levels

Error bars represent 99 % confindence level.
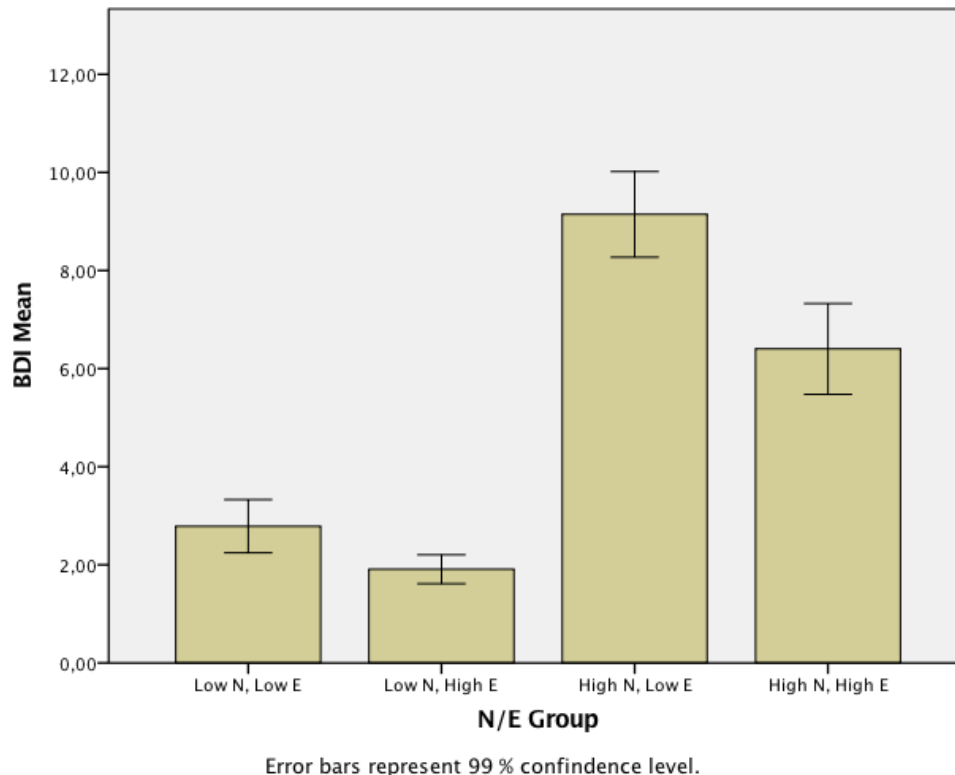
We have to still further examine whether the other personality traits have some correlation with the depression score. Separate regression analyses were made in both Ne and NE groups with five models, one for the background variables only, then one for the background variables plus each of the remaining personality factors (openness, agreeableness, conscientiousness) and finally one for the background variables and all three remaining personality factors. These models and results from the analyses are presented in table 6.

In the high N, low E group, a small correlation between the agreeableness and consciousness personality traits and the BDI score was found. The results in table 6 suggest that the higher the agreeableness or the conscientiousness, the lower should the participant score on the BDI scale. The size of the effect is not very notable, though.

In the high N, high E group, no correlation between other personality traits and the BDI score was found. This suggests that the high extraversion mediates the influence of the other personality traits against the momentum of the neuroticism. It is worth noting, as well, that the sex influence is neutralised in the NE group but

not in the Ne group. However, the explanatory power of the regression model is weak (adjusted R^2 = .05).

Table 6
Multivariate Regression Analyses of Background Variables and Personality Traits in Predicting Beck's Depression Inventory II (BDI-II) Score in High N, Low E Group

Study Variable	Model 1 β	Model 2 β	Model 3 β	Model 4 β	Model 5 β
Background Variables					
Sex[a]	-.14**	-.13**	-.16***	-.17***	-.18***
Birth Year	-.05	-.05	-.05	-.04	-.03
Educational level[b]	-.03	-.04	-.02	-.03	-.03
Personality Traits					
Openness		.06			.05
Agreeableness			-.12**		-.17**
Conscientiousness				-.18***	-.11***
Adjusted R^2	.01	.02	.03	.04	.05

[a] 1 = women, 2 = men; [b] 1 = low, 2 = intermediate, 3 = high
* $p < .05$; ** $p < .01$; *** $p < .001$

3.3. Sex Influence

As noted before in the section 3.1, the sex influence vanishes when the neuroticism factor is combined into the same regression analysis model. It suggests that the variance of the BDI score caused by sex is actually caused by the different distribution of neuroticism between sexes.

In the section 3.2 we found a statistically significant correlation between sex and the depression in the high N, low E group, when the influence of the personality traits was taken into account. Thus, there have already been some clues that sex does have a somewhat independent role in explaining the variance of the BDI score. According to an oneway ANOVA (F = 37.94, $p < .001$), there is a statistically significant difference in the BDI score between sexes (means for men 4.1 and for women 6.1) in the high N, low E group. When executing the same ANOVA in the high N group, however, the difference between sexes does not pass the 95 % confidence level (F = 212.12; $p > .05$). Correspondingly in the low N group, a highly significant difference between sexes was found (F =189.36; $p < .001$).

When examining this further, we find that 30 % of men but 18 % of women score 0 on the BDI scale in the study group. The difference is statistically significant (ANOVA F = 33.70; $p < .001$). The logistic regression analysis with its R^2

value .24 states that men have over twice as high probability to score 0 on the BDI scale (table 7).

Table 7

Multivariate Logistic Regression Analysis of Background Variables and Personality Traits in Predicting the Zero-Point BDI Score

Study Variable	Exp(B)
Background Variables	
Gender[a]	1.74***
Birth Year	1.00
Educational level (1/3)[b]	0.72
Educational level (2/3)[b]	0.80
Personality Traits	
Neuroticism	0.25***
Extraversion	1.29
Openness	0.76
Agreeableness	1.57***
Conscientiousness	1.21
R^2 .24	

[a] 1 = women, 2 = men; [b] 1 = low, 2 = intermediate, 3 = high
* $p < .05$; ** $p < .01$; *** $p < .001$

We found in the section 3.2 above that there was a statistically significant correlation between sex and the BDI score in the high N, low E (Ne) group but not in the high N, high E (NE) group. In the Ne group women tended to have somewhat higher BDI scores, when the variance caused by the personality traits was taken into account. This was confirmed by an oneway ANOVA that shows statistically significant differences in the BDI score between sexes in the Ne group (F = 9.26; $p < .01$) but not in the NE group (F = 31.72; $p > .37$).

In connection with the regression analysis (see Appendix III), this implies that the sex influence appears in low scores of extraversion. This is true in the low N, low E (ne) group (ANOVA, F = 11.96; $p < .01$) but in the low N, high E (nE) group as well (ANOVA, F = 18.82; $p < .001$)! Thus, the results suggest that women usually score higher in the BDI scale, but in the high levels of both neuroticism and extraversion, this imbalance between sexes is neutralised. It should be noted, however, that the coefficient of determination was quite small, so the majority of the sex influence was mediated by the median value group.

4. Discussion

4.1. Personality Traits and Depression in General

In the present study, the connection between personality traits and depression was analysed from three different angles. Firstly, the correlation between individual traits of the five-factor personality model and the depression score was sought. These results will be treated in this section. Secondly, the high neuroticism trait was analysed separately as a risk factor, and thirdly, the covariance of the sex with the depression score was sought. These results will be reflected in the following sections.

In chapter 1.6, some hypotheses about the relationship of the personality traits and the depression score were made. Firstly, it was presumed that the neuroticism would explain most of the variance of the depression score, which was clearly found in the present study. Secondly, it was assumed that the extraversion would have a moderate effect to the depression score. A connection of this strength was likewise found. Thirdly, it was suggested that a slight correlation of low openness and low conscientiousness on the one hand, and the depression score on the other should be found. Fourthly, it was predicted that the agreeableness should not cause variance in the depression score at all. The results of the present study did not confirm such correlations between those traits and the depression score, since the effects of both agreeableness and of conscientiousness – both perceived separately – were vanished when neuroticism and extraversion were considered. Against the expectations, no correlation between openness and depression score was found, not even when tested in isolation from other traits.

The achieved results shall now be reflected in the light of previous studies. The link between high neuroticism and depression that was found in various previous studies (e.g. Bienvenu et al., 2004; Carrasco Ortiz & del Barrio Gándara, 2007; Griens et al., 2002; Jylhä, 2008, 92–97; Karsten et al., 2012; Klein et al., 2011;

Koorevaar et al., 2013; Kotov et al., 2010; Trull & Sher, 1994), was confirmed in the present study as well. A similar, affirmative result on the correlation between low extraversion and depression score has also been found in several studies (Bienvenu et al., 2004; Carrasco Ortiz & del Barrio Gándara, 2007; Griens et al., 2002; Jylhä, 2008, 92–97; Klein et al., 2011; Koorevaar et al., 2013; Kotov et al., 2010; Naragon-Gainey et al., 2009; Trull & Sher, 1994). The present study confirms the understanding based on previous studies that high neuroticism has a strong and low extraversion a moderate correlation with depression.

There was no link found between openness and depression in the present study. Therefore it contradicts on the one hand with Bienvenu et al. (2004), who reported a slight positive correlation between openness and depression, and on the other hand with Carrasco Ortiz & del Barrio Gándara (2007), who reported an opposite correlation. The positive correlation in the study of Bienvenu et al. (2004) was found between depression and openness to feelings, a facet of openness, not the openness sum factor. Since the facets could not be extracted in the present study, it is not possible to compare its results with Bienvenu's et al. The results of Carrasco Ortiz & del Barrio Gándara are not straight comparable with the present study, because their sample consisted of children and the depression score was measured with a different instrument (Children's Depression Inventory, CDI). The age of the subjects might explain this, since also Trull & Sher (1994) found some correlation between high openness and depression, but state that it might be caused by the fact that "subjects were young and sampled from a relatively high functioning non-clinical population". Thus, the present study is in line with the vast majority of studies, where no connection between openness and depression was found (Klein et al., 2011; Kotov et al., 2010).

Like openness, consciousness seems to be unrelated to depression according to the results of the present study. Thus, the present study confirms the findings of various studies (e.g. Bienvenu et al., 2004; Goodwin & Gotlib, 2004; Griens et al., 2002; Jylhä, 2008; Kendeler & Myers, 2010). In turn, meta-analyses by Klein et al. (2011) and Kotov et al. (2010) suggest for the link between low conscientiousness and depression. Klein et al. (2011) note that "[c]onscientiousness is hypothesized to influence depression by increasing exposure to negative life events but mediation and moderation effects have not been tested". From the point of view of

the present study, it seems that the influence of conscientiousness is mediated mostly by neuroticism.

There was not found links between agreeableness and depression in previous research, and it was not found in the present study either. There seems to be found, however, a slight correlation between high agreeableness and depression when leaving out those subjects with low neuroticism. We will turn to this next.

4.2.   High Neuroticism as a Risk Factor

The second research question raised in section 1.6 was how does the neuroticism trait function as a risk factor for depression? It was suggested that a significantly higher risk factor to score high on the depression scale should be found, when scored high in neuroticism scale. It was also presumed that at least high extraversion would diminish the probability to score high on the depression scale.

Both hypotheses seem to be correct in the light of the results of the analyses. Probability to have clinically significant depression score (BDI-II at least 14) was almost 20 % in the group with high neuroticism compared to 1 % in the group with low neuroticism. High extraversion, in turn, mitigates the exposing effect of high neuroticism to depression, since clinically significant depression was found among 13 % of the subjects in the subgroup with high neuroticism and high extraversion but even among 24 % of the subjects in the subgroup with high neuroticism and low extraversion. It was estimated that the probability to have a clinically significant depression with the high neuroticism trait is twice as high when accompanied with low instead of high extraversion.

These findings were likewise in line with previous research on topic. High neuroticism has been linked to the prevalence of depression in a national-level study of McCann (2010). It has been found that high neuroticism predicts the onset of depression and a worse recovery (Klein et al., 2011). In longitudinal studies, high neuroticism is clearly seen as a risk factor for depression (e.g. Jylhä, 2008, 98). In this regard, the findings of the present study are also in the line with the studies that examine the relationship between depression and harm avoidance temperament trait (see, for example, Elovainio et al. 2004; Jylhä, 2008; Jylhä et al., 2011; Kronström, 2011).

Of the rest of the five-factor personality traits, some clues about the mitigating effect of high agreeableness and conscientiousness on the depression score were found – but only when accompanied with low extraversion. It was noted, though, that the size of the effect was quite small. No correlation between agreeableness and depression was found in previous research. Therefore, the possible link between agreeableness and depressions seems to be very weak.

High extraversion seems to mediate the mitigating effects of the other traits. The softening role of high extraversion has been discovered in several studies. Bienvenu et al. (2004), for example, found that low assertiveness, a facet of extraversion, was linked to lower states of depression. Hayward et al. (2011) conclude the same but add that also the facets of activity and positive emotionality mitigate depression as well. Naragon-Gainey et al. (2009), however, did not find links between any specific facet of extraversion on the one hand, and depression on the other.

It remains a bit obscure, though, that what sort is the interaction of high neuroticism and depression. Clearly it has been seen, that the high neuroticism is not essentially the same as depression, although the correlation between them is strong. Some answers may be found from studies, where personality traits were assessed either before or after a Major Depression Episode. Griens et al. (2002) as well as Karsten et al. (2012) have pointed out that there are some state effects on neuroticism. The size of effect is not remarkable, however. Thus, further, longitudinal research on topic would be valuable.

Bienvenu et al. (2004) raise the question about whether depression causes "scars" or lasting changes in personality because of the depressive disorder. According to Jylhä (2008, 88), the scores of neuroticism were observed to decline markedly and scores of extraversion to increase somewhat during recovery period. It is notable, however, that there was left a difference between baseline scores and the scores after recovery both in neuroticism and extraversion. In 12-month follow-up, low extraversion was observed to rise but there was no change in neuroticism (Jylhä, 2008, 94–95). During a 10-year follow-up period, there was recorded decrease in the scores of neuroticism and increase in other traits (Rantanen et al., 2007). Thus, it seems that some "scars" remain for some period after

Major Depression Episode, but they will be mitigated in the course of years (see also Jylhä, 2008, 98).

4.3.   Sex Influence

The third research question postulated in section 1.6 was whether sex or gender has an independent role in explaining the variance of the depression score. It was presumed that some of the variance of the depression score caused by sex/gender would be explained by sex/gender differences in personality traits but still some independent correlation between sex/gender on the one hand, and the depression on the other hand could be found. As stated in section 2.2, the binary sex of the participant was used in this study as such as it was assessed originally in 1980 instead of gender that could have been but was not asked in the survey.

The present study brings forth somewhat divergent results to the research questions. Firstly, there is a connection between the sex of the participant and their depression score: women tend to have higher scores on depression, but the sex influence is vanished when the neuroticism trait, which as well is higher among women, is taken into account. It suggests that sex would not have an independent role in explaining the depression score, but the sex-related variance of the depression score is caused by the different distribution of neuroticism between sexes. Thus, the neuroticism trait seems to mediate the sex influence. These findings are in line with previous research (Bienvenu et al., 2011; Goodwin & Godlib, 2004; Griens et al., 2002; Jylhä, 2008; Jylhä et al., 2011; Kronström, 2011; Kotov et al., 2010; Steunenberg et al., 2009; about the harm avoidance temperament trait, see e.g. Elovainio et al., 2004; Jylhä, 2008), which, however, suffers from ambivalence in operationalization of the sex/gender variable.

The view is somewhat different, when neuroticism and extraversion are controlled by splitting the participants into different groups according to the median value of the traits mentioned. Some independent influence of sex on the depression score was detected in the other groups, but in the group of participants with high neuroticism and high extraversion, the sex difference was vanished. Thus, the results could suggest that women usually score higher in depression, but in the high levels of both neuroticism and extraversion, this imbalance between sexes is

neutralised. The size of effect with sex in other groups was small, though, so it cannot really be stated that depression score was sex-dependent in any group.

Men and women do, however, have a different probability to get zero points from the BDI test. In section 3.3 it was concluded that *ceteris paribus* men have over twice as high probability to score 0 in the BDI test than women do. This could mean, of course, that there are trait-independent differences between sexes in the BDI scores, but in the view of the former result that the sex influence is mediated by the neuroticism trait, this is not plausible. On the contrary, it could be based on the supposition that men have tendency to underrate or women have tendency to overrate their perceived symptoms. It would suggest that there might be some divergence in the answer style between sexes. This is a point that has not been focus of attention in previous research, but should be taken into account in future.

Why do men and women differ in their neuroticism as much as they do? This is a question that could not be answered in the present study. As Goodwin and Godlib (2004) state, "the mechanism underlying this association remains unclear". They suggest that societal influences, like differences in treatment in day care or in schools, lead men and women to develop different ways of coping and of experiencing the world. Holma (2010), in turn, suggests that the family background may have its influence on neuroticism especially among women. Besides social impacts also genetic influence should be taken into account. Jokela (2007) has, for example, suggested that certain genes moderate the association between childhood maternal nurturance and adulthood depressive symptoms, and thus may contribute also distribution of neuroticism between sexes.

4.4.   Limitations of the Study

The present study has several limitations. First, some remarks concerning the study paradigm must be made. Because of its cross-sectionality, the study lacks the longitudinal aspect, which is why the changes within the correlations of the personality traits and of depression could not be studied. The changes in personality traits before, during, and after a Major Depression Episode should be examined in a longitudinal study design. In addition, no causal inferences could be drawn.

The second limitation of the study is related to the ways of data acquisition. As Jylhä (2008, 99) has noted, personality should not be measured only by self-

report questionnaires. The same remark should be made for the depression score as well. Thus, results of this study also rely to the self-assessment of the participants.

Thirdly, the study suffers from the fact that only narrow questionnaires of the personality traits were used. Since the shortened version of the NEO-PI, the NEO-FFI, has got only 60 of the 180 questions of the NEO-PI, the facets of the personality traits could not be analysed. Therefore the present study could not replicate the studies, where the facets, like low assertiveness of extraversion, were treated.

Fourthly, the comorbidity of other mental disorders, like anxiety disorder or different kinds of phobias, was not controlled, as it was in some other studies (see, for example, Bienvenu et al. 2004, Jylhä, 2008, or Trull & Shev, 1994).

And finally, the study was based on the answers of only 1,714 of the original 3,596 participants in 1980. About 38 % of the original participants – 1,368 to be exact – did not participate in the 27-year follow-up in 2007. Of the remaining 2,228 participants, only 1,714 had given sufficient answers to the NEO-FFI and BDI measures. It is possible that the drop-offs differ from the remaining participants, especially when it comes to mental disorders, which may reduce answering surveys.

4.5. Conclusions and Future Implications

The present study has confirmed results of previous research in many ways. Of the personality traits of the five-factor personality model, neuroticism has as a strong and extraversion a moderate link with Major Depressive Disorder. High neuroticism functions as a severe risk factor for depressive symptoms, but high extraversion acts as a mitigating factor. The other traits, openness, conscientiousness, and agreeableness, have only a minimal connection – if any at all – with depression.

Women tend to have higher scores of neuroticism when compared to men, and the connection between sex of the subject and depression was almost entirely mediated by neuroticism trait. Some clues were found that sex may have trait-independent influence on depression, but the topic would need more profound research. Also, the reasons behind the gender-related skewedness of neuroticism distribution should be studied with more care, since the imbalance of depressive

symptoms may imply equality problem between genders, especially if the differences in neuroticism are of societal origin.

It would be highly valuable to study changes in personality traits during depression. That means following a sufficient sample of individuals in a longitudinal study paradigm. There are already some studies on the subject, but more research with population-based data is needed. Cross-sectional studies, like the present study, cannot bring answer to questions about the stability of the personality traits during and after depressive episodes.

There has been a long way from the days of Galen to modern 21st century psychology, and bodily humours have been turned to reasonably stable temperament and personality traits. Depression, though, has not disappeared from the world, and it seems that the humankind shall try to survive with it yet for a long time. Research on the fundamental themes, like personality issues, can, however, increase our understanding of the aetiology of depression, and help us to develop suitable treatment models.

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Appendices

Appendix I
Zero-Order Correlations Between Study Variables

Study variable	1	2	3	4	5	6	7	8	9	10	11	12
1. Sex[a]	—											
2. Birth year	-.00	—										
3. Educational level[b]	-.12**	.08**	—									
4. Neuroticism	-.19**	.00	-.10**	—								
5. Extraversion	-.13**	.06*	.11*	-.49**	—							
6. Openness	-.18**	-.02	.30**	.00	.28**	—						
7. Agreeableness	-.19**	.00	.15**	-.25**	.30**	.17**	—					
8. Conscientiousness	-.13**	.04	.05*	-.31**	.37**	.04	.19**	—				
9. BDI	-.15**	-.02	-.07**	.66**	-.37**	-.01	-.19**	-.22**	—			
10. MDD diagnosis[c]	-.07**	-.04	-.03	.31**	-.17**	.08**	.00	-.08**	.34**	—		
11. Other mental diag.[d]	-.01	-.01	-.01	.17**	-.08**	.11**	.03	-.03	.15**	.26**	—	
12. Use of medicine[e]	-.05	-.05*	-.02	.26**	-.13**	.07**	-.01	-.06*	.29**	.53**	.38**	—

[a] 1 = women, 2 = men; [b] 1 = low, 2 = intermediate, 3 = high; [c] 0 = no, 1 = yes; [d] 0 = no, 1 = yes; [e] 0 = no, 1 = yes

* $p < .05$; ** $p < .01$

Appendix II
Multivariate Regression Analyses of Background Variables and Personality Traits in Predicting Beck's Depression Inventory II (BDI-II) Score

Study Variable	Model 1 β	Model 2 β	Model 3 β	Model 4 β	Model 5 β	Model 6 β	Model 7 β
Background Variables							
Sex[a]	-.16***	-.03	-.20***	-.16***	-.20***	-.19***	-.05*
Birth year	.01	-.02	.01	-.01	-.01	-.00	-.01
Educational level[b]	-.09***	-.01	-.05*	-.08**	-.06*	-.08**	.00
Personality Traits							
Neuroticism		.65***					.61***
Extraversion			-.39***				-.06**
Openness				-.01			.01
Agreeableness					-.22***		-.03
Conscientiousness						-.24***	-.01
Adjusted R^2	.03	.43	.17	.03	.08	.08	.44

[a] 1 = women, 2 = men; [b] 1 = low, 2 = intermediate, 3 = high

* $p < .05$; ** $p < .01$; *** $p < .001$

Model 1: Sex, Birth year, Educational level, and the BDI score
Model 2: Model 1 + Neuroticism
Model 3: Model 1 + Extraversion
Model 4: Model 1 + Openness
Model 5: Model 1 + Agreeableness
Model 6: Model 1 + Conscientiousness
Model 7: Model 1 + all five personality traits

Appendix III

Multivariate Regression Analyses of Background Variables and Personality Traits in Predicting Beck's Depression Inventory II (BDI-II) Score in High N Group

Study Variable	Model 1 β	Model 2 β	Model 3 β	Model 4 β	Model 5 β	Model 6 β
Background Variables						
Sex[a]	-.07*	-.15***	-.07*	-.10***	-.11**	-.16***
Birth year	-.04	-.02	-.03	-.04	-.03	-.01
Educational level[b]	-.03	-.03	-.04	-.03	-.03	-.05
Personality Traits						
Extraversion		-.31***				-.30***
Openness			.02			.11**
Agreeableness				-.14***		-.08*
Conscientiousness					-.19***	-.10**
Adjusted R^2	.01	.10	.00	.02	.04	.12

[a] 1 = women, 2 = men; [b] 1 = low, 2 = intermediate, 3 = high
* $p < .05$; ** $p < .01$; *** $p < .001$

Model 1: Sex, Birth year, Educational level, and the BDI score
Model 2: Model 1 + Extraversion
Model 3: Model 1 + Openness
Model 4: Model 1 + Agreeableness
Model 5: Model 1 + Conscientiousness
Model 6: Model 1 + Extraversion, Openness, Agreeableness, and Conscientiousness