



Personality traits and association with depression in the elderly

The AGES-Reykjavik Study

Elísabet Þórðardóttir

**Final paper in MA-degree
in Nordic Master Programme in Gerontology
University of Iceland
School of Social Sciences**



HÁSKÓLI ÍSLANDS

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Ritgerð þessi er lokaverkefni til MA gráðu í norrænu námi í öldrunarfræði (NordMaG) og er óheimilt að afrita ritgerðina á nokkurn hátt nema með leyfi rétthafa.

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Formáli

Fyrir allmörgum árum bjó ég erlendis og hóf nám sem kallast EuMaG, European Master of Gerontology og fór námið fram í háskólum víðsvegar um Evrópu. Ég lauk ekki því námi þar sem ég fluttist fyrr heim til Íslands en áætlað var. Ég greip hinsvegar tækifærið haustið 2008 þegar að Félagsráðgjafardeild Háskóla Íslands hóf að bjóða uppá samnorraent meistaranám í öldrunarfræðum (NordMaG) í samvinnu við háskólann í Lundi og háskólann í Jyväskylä. Í náminu er lögð áhersla á að kynna nemendum norræna öldrunarþjónustu, velferðarmál, stefnumótun, löggjöf og framkvæmd á sviðum félags- og heilbrigðisþjónustu. Þetta kennslumódel höfðar mjög til mín, nemendur öðlast betri innsýn inn í öldrunarmál því snertifletir eru fleiri en í hefðbundnu námi. Einnig gefst tækifæri til að kynna sér erlenda háskóla og mynda tengsl við samnemendur og kennara sem mögulega opnar dyr fyrir frekari nám eða samstarf í komandi framtíð.

Nú er árið 2015 og enn og aftur er ég flutt erlendis en að þessu sinni var ég með 60 eininga meistaraverkefni í farteskinu. Ég tók góðan tíma í að klára þetta nám, en þökk sé sveigjanleika og hvatningu frá Dr. Sigurveigu H. Sigurðardóttur, dósents í félagsráðgjöf við Félagsráðgjafardeild HÍ og góðum ábendingum og kennslu frá Dr. Jóni Gunnari Bernburg, prófessori í félagsfræði við Félags- og mannvísindadeild HÍ þá sé ég fram á það að ljúka þessum kafla í lífi mínu og fá mína fyrstu fræðigreini birta í ritrýndu erlendu tímariti. Rannsóknin snýr að fræðigreini minni sálfræðinni og fékk ég gögn frá Hjartavernd þar sem ég skoða áhrif persónuleika á þunglyndi hjá öldruðum. Það var áhugavert að sjá hve yfirgripsmiklar rannsóknir Hjartaverndar eru og ánægjulegt að fá tækifæri til að vinna með slíkt gagnasafn. Ég þakka Vilmundi Guðnasyni, forstöðulækni Hjartaverndar og Guðnýju Eiríksdóttur, framkvæmdarstjóra rannsókna fyrir aðgang að AGES-Reykjavík rannsóknargögnum.

Ég þakka Andreu Einarsdóttur, frumburðinum, fyrir yfirlesturinn á ritgerðinni og góðar ábendingar um skrif á enskri tungu.

Ég þakka einnig fyrir styrk frá rannsóknarsjóði Öldrunarráðs Íslands og verkefnastyrk Félagsstofnunar stúdenta.

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Research paper to be published

Abstract

Background: Personality is associated with various mental disorders. Few studies have looked at the elderly in relation to personality and depression. The aim of this study was to examine the association between personality traits and depression of the elderly. An additional aim was to investigate what differentiates responders from non-responders in Postal Survey Research.

Method: A random sample of 1,000 participants from the AGES-Reykjavik Study received the NEO-Five Factor Inventory by mail. The Geriatric Depression scale and the Mini-International Neuropsychiatric Interview were used. Response rate was 41% and usable data came from 38%. Descriptive statistics, t-test, chi-square test, correlation, multiple and logistic regression were applied.

Results: Neuroticism and subjective health had the biggest impact on depressive symptoms; extraversion and gender also contributed to the model. Those who considered themselves with poor health were 3.12 times likelier to experience depression, than those in good health. Higher neuroticism was related to greater odds of experiencing a depressive episode while higher extroversion and being older decreased the odds. Non-responders had less education, reported worse health, were likelier to use anti-depressants and were older than responders.

Limitations: Because of the cross-sectional design no causal inferences can be drawn. Only 5.6% fulfilled the criteria for depression.

Conclusion: This study adds to the knowledge that the personality factors of neuroticism and extroversion are associated with depression in the elderly. Frailer elderly persons with less education are likelier to refuse or drop out of research, which introduces bias into research of how health of elderly is perceived.

Keywords: Elderly, Depression, Personality, Big Five, Neuroticism and Attrition.

1 Introduction

The proportion of people over 60 years of age is growing fast in most countries. Globally people over 60 were around 739 million in 2009 and it is forecasted that by 2050 this number will have reached two billion (UN, 2009). One of the concerns nations face is the economical consequence of a steadily growing group of vulnerable elderly people due to chronic diseases and long-term care. The proportion of total disease burden in high-income countries was 35% for the age group 60 years and older, compared with 13% in low and middle-income countries (WHO, 2008). Overall, the top leading cause of burden of disease in middle- and high-income countries is unipolar depressive disorders followed by ischemic heart disease and cerebrovascular disease. Unipolar depressive disorder is also in the top leading causes of years lost due to disability (YLD) both in high-income and low- and middle-income countries (WHO, 2008).

Prevalence estimates for major depression for the last 12 months lie between 1 and 10% (Ayuso-Mateos et al., 2001; Kessler, Birnbaum, Bromet, et al., 2010; Kessler, Birnbaum, Shahly, et al., 2010; Lindeman et al., 2000; Steunenbergh, Beekman, Deeg, & Kerkhof, 2010; Wittchen & Jacobi, 2005; Wittchen et al., 2011). The prevalence is lower or between 2.6 and 4.8% in the elderly age groups of 65 and older (Kessler, Birnbaum, Shahly, et al., 2010; Sandanger, Nygård, Sørensen, & Dalgard, 2007; Wittchen et al., 2011) with the exception of prevalence rate of 6.7% in Finland (Lindeman et al., 2000) and 13% in Ukraine (Kessler, Birnbaum, Shahly, et al., 2010) while the prevalence rate in groups under 65 years of age tends to cluster around 7% (Ayuso-Mateos et al., 2001; Kessler, Birnbaum, Shahly, et al., 2010; Kringlen, Torgersen, & Cramer, 2001; Wittchen et al., 2011). Although depression is less common in the elderly and they report less role impairments (Kessler, Birnbaum, Bromet, et al., 2010) it is still a serious disabling condition that is important to diagnose and treat and it increases disability and mortality (Kohn & Epstein-Lubow, 2006). Factors that have been associated with increased risk of depression among elderly people is poor cognition, poor physical functions, greater disability, number of

medications, greater neuroticism (Gale et al., 2011), being female, poor subjective health, stroke, excessive alcohol consumption, poor social network and functional impairment (Luppa, Luck, König, Angermeyer, & Riedel-Heller, 2012). Studies show that personality is associated with various mental disorders (Malouff, Thorsteinsson, & Schutte, 2005; Rector, Bagby, Huta, & Ayeart, 2012), and treatment outcome (Ogrodniczuk, Piper, Joyce, McCallum, & Rosie, 2003; Weber, Giannakopoulos, & Canuto, 2011). A review of risk factors for depression in the elderly show that personality traits can be both protective as well as risk factors (Vink, Aartsen, & Schoevers, 2008).

Personality traits have an impact on how we behave, feel, experience, interpret and interact with the world around us. In the mid-1980s scientists who studied personality achieved an initial consensus that almost all traits could be categorized into five broad dimensions of; extraversion, agreeableness, conscientiousness, neuroticism and openness to experience; that has become known as the 'Big Five' (John, Naumann, & Soto, 2008). Evidence from longitudinal studies shows that personality is stable after the age of thirty (Costa, Metter, & McCrae, 1994; Soldz & Vaillant, 1999) and into old age, although old-old (85-100) score somewhat lower on extraversion compared to middle-age/young-old (50-84) (Roepke, McAdams, Lindamer, Patterson, & Jeste, 2001). Researchers have shown that personality traits are most likely endogenous and therefore likelier to be a cause rather than the effect of life experience (Costa Jr., Yang, & McCrae, 1998) although it is known that traumatic brain injury and diseases like Alzheimer's and Parkinson's can alter persons personality which underpins the biological base of personality traits (Costa Jr, Bagby, Herbst, & McCrae, 2005).

The personality factors that are influential regarding being depressed or developing depression is having high level of neuroticism (Kendler, Gatz, Gardner, & Pedersen, 2006), low levels of conscientiousness and in some instance being low on the extroversion scale (Hayward, Taylor, Smoski, Steffens, & Payne, 2013; Koorevaar et al., 2013; Malouff et al., 2005). Gale et al. (2011) found that a standard deviation increase on the neuroticism factor was associated with more than a two-fold increase in the odds of having depression.

The personality factors of agreeableness and openness are to a much lesser degree connected to depression, (Gale et al., 2011; Goodwin & Gotlib, 2004; Hayward et al., 2013; Rector et al., 2012).

Few studies have investigated personality and depression in elderly persons. A prospective study of 512 persons between 65-100 years of age with disability and a history of significant health care utilization showed that participants high on neuroticism and low on conscientiousness were at risk of developing either major or minor depression (Weiss et al., 2009). Recurrence of depression in later life has also been linked to neuroticism, although in the same study when authors' used multivariable analysis, only mastery and remnants of depressive symptoms predicted recurrence of depression (Steunenbergh et al., 2010). Personality has also been associated with psychiatric treatment outcome in those over 60 years of age. Personality was unrelated to depression severity at the beginning of treatment, but improvement after three months and twelve months was related to lower neuroticism (Hayward et al., 2013).

The aim of the present study is to investigate the influence of personality on depression among elderly persons. Based on previous research it is hypothesized that a higher score on the neuroticism scale and lower scores of extroversion and conscientiousness lead to higher score on the Geriatric Depression Scale (GDS) and higher incident of depression.

An additional aim is to investigate what differentiates responders from non-responders in answering and returning back the personality questionnaire. Studies have shown that various factors, including age, gender, education and health (Lundberg, Damström Thakker, Hällström, & Forsell, 2005; Rönmark, Lundqvist, Lundbäck, & Nyström, 1999) influence response rate in postal surveys. It is hypothesized that non-responders are: males; older; living alone; with lower education; worse sight; more symptoms of depression; are likelier to use anti-depressive medication; have experienced depressive episode; and evaluate their subjective health worse than responders.

2 Methods

2.1 Study design

This was a cross-sectional study of a subsample of elderly persons born 1907-1935 taken from the Age, Gene/Environment Susceptibility-Reykjavik Study (AGES-Reykjavik); an ongoing multidisciplinary longitudinal study on risk factors in relation to disease and disability in old age. The AGES-Reykjavik originates from the Reykjavik Study established in 1967. The AGES-Reykjavik sample was extracted from the 11,549 (41.6% men) surviving participants of the Reykjavik study. The original sample consisted of homogenous group of 19,381 persons, born between 1907 and 1935, living in Reykjavik, the capital of Iceland, in the year 1967 (Harris et al., 2007). The AGES-Reykjavik examination was completed in three clinic visits over four to six weeks. Participants (N = 5,764) had broad physical and psychological assessments and answered various questionnaires. For more detailed information about AGES-Reykjavik study procedure see Harris et al. (2007). The study was approved by the Icelandic National Bioethics Committee (00-063-V18 and VSN-00-063) and by the National Institute on Aging Intramural Institutional Review Board. Written informed consent was obtained from all participants.

2.2 Participants and procedure

A random sample of 1,000 participants (425 men and 575 women) was selected out of the 5,764 participants from the AGES-Reykjavik examination conducted between January 2002 and February 2006. Response rate was 41%. Early in the year 2006 a NEO-FFI personality test was mailed to the sample and they invited to join the study. Of those 414 that responded, usable questionnaires came from 380 (38%) participants.

2.2.1 Screening for dementia

In the AGES-Reykjavik study everyone was screened for possible dementia with The Mini-Mental State Examination (MMSE) (Folstein, Folstein, & McHugh, 1975) and the Digit symbol substitution test (Wechsler, 1981). Those with positive screened results for cognitive impairment were administered a

diagnostic battery of neuropsychological tests. A panel consisting of a geriatrician, a neurologist, a neuropsychologist and a neuroradiologist made a consensus diagnosis of dementia according to international guidelines from the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (American Psychiatric Association, 1994)

In this sample of 1,000 subjects, 53 persons, thereof 16 responders, were considered to have cognitive impairment (consensus rated as probable and possible), and excluded from any statistical analysis. In addition to that seven responders were excluded from statistical analysis as they failed to answer 10 or more questions on the NEO-FFI questionnaire, thus leaving 940 people for the comparison analysis.

2.2.2 Responders vs. non-responders

The information from AGES-Reykjavik study gave opportunities to compare responders with non-responders in regards to: gender, age, vision, education, marital status, subjective health, use of anti-depressant medication, depressive score on GDS and depressive episodes.

2.3 Measures

2.3.1 Depressive symptoms and episodes

Depressive symptoms were assessed with the short version of the Geriatric Depression Scale (GDS) (Sheikh & Yesavage, 1986) with 15 yes and no questions. Most researchers have reported internal consistency of the GDS-15 with Alfa coefficients around .80 (Almeida & Almeida, 1999). In this study missing values were computed according to Yesavage (2004) which recommends to invalidate the scale if there are more than five missing answers. If missing answers are five or less, the recommendation is to divide the total score with answered questions and put that value instead of the missing value, then round total GDS score up to next whole number. The reliability of the 15-item GDS scale ($N = 915$) showed that the Alfa coefficient was adequate .73.

Depressive episodes were assessed according to DSM-IV criteria (American Psychiatric Association, 1994). The screening criteria, to identify participants in the AGES-Reykjavik study who may have had past or current episodes of depression have been described previously (Geerlings et al., 2013). The Mini-International Neuropsychiatric Interview (M.I.N.I.) (Sheehan et al., 1998) was administered if the participants: had a score ≥ 6 on the GDS; scored 4 or 5 on the GDS and answered three of four anxiety questions with a yes: “In the past month, have you felt anxious or frightened?”; “Were there times lately that you felt anxious?”; “Are there special situations that make you anxious?”; “Have you ever had attacks of fear or panic?”; currently used medication for depression; reported ever having a physician diagnosis of depression. Only participants with no diagnosis of dementia and an MMSE (Folstein et al., 1975) score higher or equal to 21 were qualified to be interviewed with the M.I.N.I.. The M.I.N.I. (Sheehan et al., 1998) is a short diagnostic structured interview, designed both to standardize data collection in epidemiology studies and to adopt diagnostic criteria according to international classification systems as ICD (WHO, 1992) and DSM-IV (American Psychiatric Association, 1994). In this study the module A for diagnosing depression was used and five health professionals, who went through training and standardization, interviewed participants. For current major depression the sensitivity was 100% and specificity 64% and for past major depression the sensitivity was 93% and specificity 66% (Geerlings et al., 2013). Depression was dichotomized as 0 = no depressive episode and 1 = having had depressive episode; combining major depression, current major depression, mood disorder due to a general medical condition and mild depressive episode.

2.3.2 Personality

Personality characteristics were assessed with the NEO-Five Factor Inventory (NEO-FFI) (Costa and McCrae 1992), an abbreviate version of NEO Personality Inventory (NEO-PI), which has been standardized in Icelandic. Factor structure was replicated and Alfa coefficient were adequate and were between .82-.91: Agreeableness .82, openness .87, conscientiousness .88, extraversion .88 and

neuroticism .91 (Jónsson & Bergþórsson, 2004). NEO-FFI comprises 60 self-descriptive statements in which participants rate the extent to which each statement describes them. Item-scores are rated on a 5-point Likert scale ranging from '*strongly disagree*' to '*strongly agree*'. The NEO-FFI has demonstrated good internal consistency with Alfa coefficient between .75 to .83 and test-retest reliability, and has been validated against other personality inventories (Costa Jr & McCrae, 1992). NEO-FFI was revised in 2004 and 14 items were replaced (McCrae & Costa Jr, 2004) after few researchers criticized its psychometric properties (Becker, 2006; Egan, Deary, & Austin, 2000).

In this study, each of the five factors summed score from the 12 items was computed. The sum of score could range from 0-48 for each factor. Questionnaires that had ten or more missing answers were not used in the statistical analysis. If five or more answers were missing from a single factor, it was dropped for analysis. Otherwise missing answers were handled by taking the mean from other participants for that question. For this study the reliability of the NEO-FFI scale ($N = 356$) and Alfa coefficient were adequate for neuroticism .80, extraversion .80 and conscientiousness .80, in the lower range for agreeableness .68 but inadequate for openness .55. The last two factors were therefore dropped from statistical analysis.

2.3.3 Sociodemographic and health variables

Gender was dichotomized in: 0 = male and 1 = female.

Marital status was dichotomized in: 0 = married/living together and 1 = not married (widowed, divorced and single).

Education was dichotomized in: 0 = low education (primary school or less and secondary education) and 1 = middle to high education (college education and university education).

Subjective health was measured with the question "In general, how would you say your health is"? Answers were given on a 5-point categorical scale, ranging from *poor* to *excellent*. For the regression analysis it was dichotomized in: 0 = good health (good, very good and excellent) and 1 = poor health (fair and poor).

Anti-depressant medication was categorized as N06 A (antidepressants) or N05 AN01 (lithium), and dichotomized in: 0 = not using depressant medication and 1 = currently using antidepressant. Participants were asked to bring all types of medication they were using, both over the counter drugs and prescriptive medication, for registration (Guðnason, 2003).

2.4 Statistical analysis

Statistical analysis was performed using SPSS 22. Descriptive statistics were used to describe the sample. To compare responders with non-responders *t*-test was used for continuous variables and chi-square test for categorical variables.

Bivariate analysis using the Pearson and Spearman correlation coefficient was carried out to assess the strength of association between the independent variables and with the dependent variable of symptoms of depression (GDS).

To explore the association between personality traits and depression variables in the bivariate analysis that had significant association with the outcome variable of symptoms of depression (GDS) were entered into a hierarchical regression model with the exception of anti-depressive medication as such medication is a treatment to alleviate symptoms of depression. The same predictive variables were also used for logistic regression analysis with depressive episodes, current or ever, as the outcome variable. The critical value for significance was set at $p < 0.05$ for all analyses.

3 Results

3.1 Demographic and clinical data

Information on sample characteristics and difference between responders ($n=356$, 37.9%) and non-responders ($n=584$, 62.1%) can be seen in table 1.

The mean age of the respondents was 75 (5.3) years (range 66-91), 53.9% were female, 65.5% were married/living together, 65.1% had secondary schooling or less, majority had good vision (82.5%) and did not use anti-depressive medication (91%) and less than a quarter (23.9%) reported poor or fair health. The mean score on the Geriatric Depression Scale was 2.25 and most persons (94%) had never experienced a depressive episode according to the M.I.N.I. interview.

Table 1. Characteristics of the total sample of responders and non-responders (N=940)

	Sample	Responders	Non-resp.	Statistic: (t-test or χ^2)
Sample N (%)	940 (100)	356 (37.9)	584 (62.1)	
Gender N (%)	940 (100)	356 (37.9)	584 (62.1)	χ^2 (1 N = 940) = 3.08, p = .080
Male	399 (42.4)	164 (46.1)	235 (40.2)	
Female	541 (57.6)	192 (53.9)	349 (59.8)	
Mean age (SD)	75.6 (66-93)	74.97 (5.33)	76.19 (5.64)	t (938) = 3.27, p = .001
Marital status N (%)	932 (100)	355 (38.1)	577 (61.9)	χ^2 (3 N = 932) = 6.105, p = .107
Marr./living together	573 (61.5)	232 (65.4)	341 (59.1)	
Widowed	251 (26.9)	80 (22.5)	171 (29.6)	
Divorced	56 (6.0)	24 (6.8)	32 (5.5)	
Single	52 (5.6)	19 (5.4)	33 (5.7)	
Education N (%)	932 (100)	355 (38.1)	577 (61.9)	χ^2 (3 N = 932) = 14.71, p = .002
Primary school	207 (22.2)	66 (18.6)	141 (24.4)	Cramer's V .126
Secondary school	456 (48.9)	165 (46.5)	291 (50.4)	
College	165 (17.7)	69 (19.4)	96 (16.6)	
University	104 (11.2)	55 (15.5)	49 (8.5)	
Vision (%)	790 (100)	297 (37.6)	493 (62.4)	χ^2 (2 N = 790) = 4.20, p = .123
Good (1-3)	622 (78.7)	245 (82.5)	377 (76.5)	
Medium (4-6)	138 (17.6)	42 (14.1)	97 (19.7)	
Poor (7-9)	29 (3.7)	10 (3.4)	19 (3.9)	
Anti-depressant use (%)	940 (100)	356 (37.9)	584 (62.1)	χ^2 (1 N = 940) = 9.23, p = .002
Yes	125 (13.3)	32 (9.0)	93 (15.9)	Phi = -.10
No	815 (86.7)	324 (91.0)	491 (84.1)	
Subjective health	939 (100)	356 (37.9)	583 (62.1)	χ^2 (4 N = 939) = 14.87, p = .005
Excellent	186 (19.8)	77 (21.6)	109 (18.7)	V = .126
Very good	150 (16.0)	62 (17.4)	88 (15.1)	
Good	305 (32.9)	132 (37.1)	177 (30.4)	
Fair	241 (25.7)	70 (19.7)	171 (29.3)	
Poor	53 (5.6)	15 (4.2)	38 (6.5)	
Mean GDS score (SD)	2.38 (2,20)	2.25 (2.19)	2.46 (2.21)	t (860) = 1.37, p = .172
Depressive episode (%)	940 (100)	356 (37.9)	584 (62.1)	χ^2 (1 N = 940) = 0.45, p = .502
Yes	62 (6.6)	21 (5.9)	41 (7.0)	
No	878 (93.4)	335 (94.1)	543 (93.0)	

Non-responders had less education ($p = .002$), reported worse health ($p = .005$), were likelier to use anti-depressants ($p = .002$) and were older than responders ($p = .001$) (table 1). They did not differ regarding gender, marital status, vision, GDS score or depressive episodes. Although not significant, non-responders had somewhat higher GDS score and more persons had experienced depressed episodes than those who responded.

3.2 Correlation with depression and GDS score

The bivariate correlations (Pearson's r and Spearman's) between study variables and score on Geriatric Depression Scale that reached significance varied from small, $r = .10$ and explaining 1% of total variance, to large, $r = .50$ and explaining 25% of the total variance of GDS score (table 2). The personality trait of neuroticism had the highest correlation with symptoms of depression (GDS score), as people score higher on the neuroticism factor the more symptoms of depression they report which explains 22.5% of the total variance of GDS score. Higher score on the GDS was positively associated with the personality trait of neuroticism but negatively associated with the personality traits of extroversion and conscientiousness. Participants reporting worse subjective health and those who used anti-depressants also scored higher on the GDS. Earlier or current depressive episodes were positively correlated with higher score on GDS. There was a weak association with age and gender; as participants got older they scored somewhat higher on GDS and males also scored somewhat higher than females. Length of education and marital status showed no correlation with score on GDS.

Table 2. Bivariate correlation between variables used in the study (N=356)

Variable	Mean	S.D.	1	2	3	4	5	6	7	8	9	10
1. GDS	2.25	2.19	-									
2. Neuroticism	15.7730	6.90	.475**	-								
3. Extraversion	26.5385	5.98	-.334**	-.348**	-							
4. Conscientiousness	32.6652	6.10	-.307**	-.332**	.412**	-						
5. Age	74.97	5.33	.118*	-.072	.007	-.060	-					
6. Subjective health	.24	.43	.432**	.126*	-.060	-.138**	.168**	-				
7. Depressive episodes	.06	.23	.318**	.245**	-.169**	-.083	-.119*	.149**	-			
8. Marital status	.35	.45	.002	-.013	-.011	.021	.346**	.105*	-.050	-		
9. Education	.35	.48	-.046	.027	-.021	-.055	.059	.004	-.025	-.049	-	
10. Gender	.54	.50	-.109*	.112*	.115*	.031	.013	.029	.005	.303**	-.036	-
11. Antidepressants	.09	.29	.212**	.221**	-.083	-.098	-.017	.146**	.265**	.019	.017	.054

** Correlation is significant at the 0.01 level (2-tailed) and * at the 0.05 level (2-tailed).

Notes. Pearson's correlation coefficient was used for variables 1-5 and Spearman's rho coefficient of correlation for variables 6-11.

S.D.= standard deviation; GDS=Geriatric Depression Scale

N = 356 for all variables except GDS for which N = 330 and Education, and Married for which N = 355 and N = 329 for GDS x Education and GDS x Marital status.

Earlier or current depressive episodes were positively correlated with the personality trait of neuroticism and negatively correlated with extroversion. No correlation was found with conscientiousness. Using antidepressants and reporting worse subjective health was positively correlated with depressive episode. There was weak association with depressive episodes and being younger.

3.3 Depressive symptoms

The third model in the regression analysis explained 39% of the variance in GDS score (table 3). Neuroticism ($t(323) = 7.50, p < .001$) and subjective health ($t(323) = 7.22, p < .001$), had the biggest impact on GDS score and their effects was medium strong. Extraversion ($t(323) = -2.66, p < .01$) and gender ($t(323) = -2.34, p < .05$) also contributed significantly to the third model, but their effects were weak. In the second model, age and conscientiousness had an effect on GDS score but by controlling for subjective health in the third model both variables lost their significance.

Table 3. Multiple regression analysis on depressive symptoms (GDS score) (N=330).

	<i>B</i>	<i>SE B</i>	β
Model 1			
Constant	-1.32	1.74	
Gender	-0.30	0.24	-.07
Age	0.50	0.02	.12*
Model 2			
Constant	-1.26	1.76	
Gender	-0.41	0.21	-.09*
Age	0.06	0.02	.13**
Neuroticism	0.13	0.02	.41***
Extroversion	-0.05	0.02	-.13*
Conscientiousness	-0.04	0.02	-.11*
Model 3			
Constant	0.007	1.64	
Gender	-0.46	0.19	-.10*
Age	0.03	0.02	.08
Neuroticism	0.11	0.02	.36***
Extroversion	-0.05	0.02	-.13**
Conscientiousness	-0.03	0.02	-.07
Subjective health	1.64	0.23	.33***

Note: * $p < .05$, ** $p < .01$, *** $p < .001$
 $R^2 = .02$ for step 1 ($p < .05$), $\Delta R^2 = .275$ for step 2 ($p < .001$), $\Delta R^2 = .098$ for step 3 ($p < .001$).

3.4 Depressive episodes

In total there were 356 persons in the regression analysis; 5.6% of them had experienced a depressive episode according to the M.I.N.I. interview. Table 4 shows the results of hierarchical multivariate logistic regression analysis examining the predictors of depressive episode.

In the final model subjective health had the strongest influence in the model; those who consider themselves with poor health had higher odds of experience depression than those who consider themselves in a good health. Higher score on the neuroticism factor was related to greater odds of experiencing a depressive episode. Higher extroversion decreased the odds of a depressive episode, as did being older. Gender and the personality factor of conscientiousness had no significant impact on depressive episodes.

Table 4. Binary logistic regression analysis on current and ever depressive episodes ($N=356$).

	Depressive episode				
	Wald	B (SE)	OR	95% CI	P^a
Model 1					
Constant	2.33	5.75 (3.77)	333.35		0.127
Age	5.08	-0.12 (.05)	0.89	0.80-0.99	0.024
Gender	0.02	0.06 (.47)	1.06	0.43-2.65	0.896
Model 2					
Constant	0.56	3.39 (4.56)	29.67		0.456
Age	3.09	-0.10 (.06)	0.91	0.81-1.01	0.079
Gender	0.00	0.00 (.52)	1.00	0.36-2.74	1.000
Neuroticism (N)	13.57	0.13 (.03)	1.14	1.06-1.21	0.000
Extraversion (E)	4.23	-0.10 (.05)	0.90	0.82-0.99	0.040
Conscientiousness (C)	0.61	0.03 (.04)	1.03	0.95-1.13	0.433
Model 3					
Constant	1.03	5.82 (4.84)	337.68		0.229
Age	4.14	-0.12 (.06)	0.89	0.79-0.99	0.042
Gender	0.02	-0.07 (.53)	0.93	0.33-2.60	0.888
Neuroticism (N)	10.41	0.12 (.04)	1.12	1.05-1.20	0.001
Extraversion (E)	4.27	-0.11 (.05)	0.90	0.81-0.99	0.039
Conscientiousness (C)	0.85	0.04 (.04)	1.04	0.96-1.14	0.357
Subjective health	4.32	1.14 (.55)	3.13	1.07-9.16	0.038

Notes: B: coefficient; OR: odds ratio; CI: confidence interval

^a p values for Wald chi-square test with $df = 1$.

Model 1: $\chi^2(8) = 7.79$, $P = .45$ (Hosmer & Lemeshow), .02 (Cox & Snell), .05 (Nagelkerke).

Model 2: $\chi^2(8) = 9.48$, $P = .30$ (Hosmer & Lemeshow), .09 (Cox & Snell), .26 (Nagelkerke).

Model 3: $\chi^2(8) = 4.57$, $P = .80$ (Hosmer & Lemeshow), .10 (Cox & Snell), .29 (Nagelkerke).

These odds ratios indicate that each one-point increase in neuroticism is equal to 12% increase in the likelihood of depressive episodes and that each point decrease in extroversion is equal to 10% increase in the likelihood of depressive episodes. By raising odds ratios to a power (e) equal to ten-point change, one can determine that a ten-point increase in neuroticism is related to a 3.32 increase in the likelihood of depressive episodes. Likewise, every ten-point decrease in extroversion is related to a 3.0 increase in the likelihood of depressive episodes. The odds of a person with poor health for developing depression is 3.12 times greater than the odds for a person who considers themselves with good health.

4 Discussion

4.1 Personality and depressive symptoms and episodes

The association between personality and depression in this study points in the same direction as many other studies (Hayward et al., 2013; Koorevaar et al., 2013; Malouff et al., 2005; Weiss et al., 2009). The hypothesis that elderly people with a high score of neuroticism and low scores of extroversion and conscientiousness have a higher GDS scores and have higher odds of experiencing depressive episodes was partly confirmed.

The result from the multiple regression analysis showed that persons high in neuroticism and low on extroversion had more symptoms of depression (higher GDS score). Conscientiousness correlated only with a score on the GDS in the bivariate correlation analysis, but not in the regression analysis when confounding variables were taken into account. Similar results can be seen in a large online twin research where two traits had a genetic correlation with major depression .43 for neuroticism and -.36 for conscientiousness, but when the researcher controlled for neuroticism it reduced the genetic correlation between conscientiousness and major depression (Kendler & Myers, 2010).

The logistic regression analysis showed that higher neuroticism was related to greater odds of having experienced a depressive episode. This is similar to other studies where personality domain and facets (Hayward et al., 2013) of neuroticism have consistently been found to be related with major depression (Bienvenu et al., 2004; Koorevaar et al., 2013; Weiss et al., 2009), symptoms of depression (Gale et al., 2011) and with depressive symptoms severity several months after treatment (Hayward et al., 2013). Additionally, in this study higher scores on the extroversion factor decreased the probability of developing depression. This is in line with results from Hayward et al. (2013) as a higher extroversion score was related to less odds of having depression. Finally, the personality factor of conscientiousness had no effect on depressive episodes.

Findings from this study add to the knowledge that the personality trait of neuroticism and extroversion remain important factors in depression, not only in young and middle age (Malouff et al., 2005) but also into late life. In studies of geriatric depression, lower neuroticism is linked to improvement of depressive symptoms three and twelve months after initiation of treatment (Hayward et al., 2013). Higher neuroticism is linked with worse symptom severity (Lockenhoff, Terracciano, Patriciu, Eaton, & Costa, 2009) and worse mood outcomes when treated with antidepressant medication (Steffens, McQuoid, Smoski, & Potter, 2013). Combinations of personality traits can also be critical when identifying those who are most at-risk for geriatric depression (Weiss et al., 2009). The negative association of extroversion and conscientiousness has not been as consistent in relationship with depression and it has been suggested that one reason is that only subsets of the facets of extroversion and conscientiousness are related to depression and therefore more variation in study results (Hayward et al., 2013). This may become even more prominent when the short version of the personality questionnaire is used, as in this study.

4.2 Other confounding variables and depressive symptoms and episodes

Subjective health explained part of the variance of total GDS scores and had the strongest influence in the model for depressive episodes. Those who reported poor subjective health had more symptoms of depression and they had over triple the odds of experiencing a depressive episode than those considering themselves in good health. Other studies have shown poor subjective health and poor physical function to increase the risk of depression (Gale et al., 2011; Luppia et al., 2012). The nature of this relationship is complex as bad health can lead to depression, but being depressed also affects how one perceives health and experiences life.

Being male had a weak effect on depressive symptoms but gender had no effect in relation with depressive episodes, and this is in line with an Italian population-based study of people over 74 years of age where the authors found no gender difference in the prevalence of depression in the elderly, except

when participants had severely disabling conditions like a stroke, where men were then likelier than women to have depression (Forlani et al., 2014). However, most studies show a higher prevalence of depression amongst women also in the elderly group as a study of 8,175 older adults between 50 - 99 years of age shows. In that study women in all age groups had higher prevalence of depression (Regan, Kearney, Savva, Cronin, & Kenny, 2013).

Being older reduced the likelihood of having experienced depressive episodes as other studies have shown (Kessler, Birnbaum, Shahly, et al., 2010; Regan et al., 2013). It has been suggested that the most vulnerable elderly who have a history of depression selectively leave the population (Vink et al., 2008) and may be one of the explanations that the prevalence for depression is lower in older age groups compared with younger ones.

4.3 Responders vs. non-responders

The hypothesis that non-responders are; males; older; living alone; with less education; worse sight; more symptoms of depression; are likelier to use anti-depressive medication; have experienced depressive episode; and evaluate their subjective health worse than responders was partly supported.

In this study the factors that differentiated between those who responded, and answered lengthy questionnaires, from non-responders was that the latter group reported worse subjective health, used more anti-depressant medication, were older and had less education. This is in line with other studies of non-responding to postal surveys as those who do not participate tend to be older (Chatfield, Brayne, & Matthews, 2005), have less education (Jacomb, Jorm, Korten, Christensen, & Henderson, 2002; von Strauss, Fratiglioni, Jorm, Viitanen, & Winblad, 1998), be frailer and regard themselves in worse health than respondents (de Souto Barreto, 2012) and use more antipsychotic drugs (Vercambre & Gilbert, 2012). Gender, living arrangement and sight did not matter. Surprisingly there was no difference between responders and non-responders regarding depressive episodes and depressive symptoms as seen in some other studies (Chang, Yang, Tang, & Ganguli, 2009; Lundberg et al., 2005). It was surprising; especially in light of that non-responders used more anti-depressants than responders. There

could be different reasons for the fact that more participants in the AGES study were using anti-depressants than fulfilled the criteria for depression, according to the M.I.N.I. interview. One reason can be recall bias in the interview, so the participant does not recall depressive symptoms from the past. Heliövaara et al. (1993) found that the prevalence of mental disorders was underestimated in an interview with the participants compared with health examination that followed shortly after. Other reasons could be that elderly people are prescribed anti-depressants for symptoms other than depression (Maust et al., 2014; Mercier et al., 2013; Samúelsson, Zoëga, Guðmundsson, & Halldórsson, 2009) or the criteria according to the M.I.N.I. interview is not reached, but the doctor prescribes antidepressants because of the self-report of low mood and/or lack of interest in daily activities from the client (Maust et al., 2014). Additionally once depressed people are on anti-depressant medication they may tend to stay on it for the years to come and this is especially true for elderly people (Helgason, Tómasson, & Zoega, 2003). In this study no attempt was made to differentiate between current or former depressive episodes, so there is a possibility that those who are currently depressed have higher odds of not responding. One can see there is a tendency, although it does not reach significance, that more non-responders have experienced depressive episodes sometime in their life. All in all this study confirms that elderly non-responders tend to be frailer and with less education than those who respond.

4.4 Strengths and Limitations

There are some strengths and limitations to this study. The obvious limitation was that the personality questionnaire was added later to the study and sent by mail to participants. This had an effect on the response rate, which was 41% and usable data came from 38% of the participants. It is known that having to answer and mail a lengthy questionnaire affects response rate (Ayuso-Mateos et al., 2001).

This was a cross-sectional study and the results can only be viewed as how and if personality and depressive symptoms or depressive episodes are related but cannot establish causality.

Although it is a strength having the diagnosis of depressive episodes done according to clinical diagnostic criteria the weakness is that only 20 persons (5.6%) fulfilled the depression criteria in the M.I.N.I. interview. Having so few cases with a depressive episode increases the risk for type II error – that is the probability of missing significant effects that truly exist. It is also likely that our analysis may have lacked statistical power because of low numbers, both with depression and depressive symptoms.

The reason there are so few participants in the study with depressive symptoms or depressive episodes, can possibly be explained with responder bias. Although there was no difference among responders and non-responders regarding depression and score on the GDS scale, the selective participation could have happened when the AGES-Reykjavik sample was drawn in 2002. The non-responders at that time had in their midlife profile higher blood pressure and higher glucose, both major contributors to health in old age (Harris et al., 2007). The mean GDS score of 2.35 (both responders and non-responders) in this study was lower than in the community study done by Sigurðardóttir, Árnadóttir, and Gunnarsdóttir (2011) where mean GDS score was 6.5 which may support the idea that those who did not accept the invitation to participate in the extensive AGES study were likelier to have depression and more depressive symptoms than those who participated.

4.5 Future Research

Knowing that our personality affects how we interpret the world around us and affects how we feel, behave and interact with each other could make therapy for depression more effective if personality was assessed. There is evidence that some personality facets are predictive of treatment outcome for depression (Hayward et al., 2013) and it would be beneficial to know more about whether depressive medication alleviates symptoms of depression for persons high in neuroticism. Personality can also influence recurrence of depression but other late life stressors can also relate to recurrence (Steunenberget al., 2010) and better information about that would be valuable. Future studies could look at different approaches in therapy

according to personality and disorder rather than only disorder. The personality trait of neuroticism is related to various physical (Smith & Spiro, 2002) and mental outcomes (Malouff et al., 2005) so from a public health perspective better understanding of how personality, especially neuroticism, is related to each outcome could lead to enhanced ways of preventing and alleviating many health problems linked to neuroticism (Lahey, 2009). Finally in research with elderly it is advisable to oversample the oldest old to assure representation of those who are frail in order to reduce bias in health surveys or research.

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Master Thesis

Abstract

Background: Personality is associated with various mental disorders. The personality factor of neuroticism is a risk factor for developing depression; extraversion and conscientiousness can also have an impact on depression. Few studies have looked at the elderly population in relation to personality and depression. The aim of this study was to examine the association between the Big Five personality factors of neuroticism, extroversion and conscientiousness and symptoms of depression and depressive episodes of community living elderly. An additional aim was to investigate what differentiates responders from non-responders in Postal Survey Research.

Method: In 2006, a random sample of 1,000 participants from the population-based AGES-Reykjavik Study received the NEO-Five Factor Inventory (NEO-FFI) by mail. Previously gathered data was also used in the study which made the comparison of responders versus non-responders possible. The Geriatric Depression scale (GDS) was used to assess depressive symptoms and the Mini-International Neuropsychiatric Interview (M.I.N.I.) determined a diagnosis of depression according to DSM-IV criteria. Response rate was 41%, usable data came from 38% of the total sample. Descriptive statistics, t-test, chi-square test, correlation, multiple regression and logistic regression were applied.

Results: Neuroticism and subjective health had the biggest impact on depressive symptoms; extraversion and gender also contributed significantly to the regression model. Those who considered themselves with poor health were 3.12 times likelier to experience a depressive episode, than those in good health. Higher neuroticism was related to greater odds of experiencing a depressive episode while higher extroversion and being older decreased the odds of depressive episodes. Non-responders had less education, reported worse health, were likelier to use anti-depressants and were older than responders.

Strengths and Limitations: Due to the cross-sectional design, no causal inferences can be drawn. Diagnosing depression according to DSM-IV is a

strength, but the fact that only 5.6% fulfilled the criteria increases the risk for type II error and therefore a significant effect may be missed.

Conclusion: This study adds to the knowledge that the personality factors of neuroticism and extroversion are associated with depressive symptoms and episodes in the elderly. In addition elderly persons that have less education and are frailer are likelier to refuse or drop out of research. That in turn may introduce bias into research of how mental and physical health of community living elderly is perceived.

Keywords: Elderly, Depression, Personality, Big Five, Neuroticism and Attrition.

5 Introduction

The proportion of people over 60 years of age is growing fast in almost every country. Globally people over 60 were around 739 million in 2009 and it is forecasted that by 2050 this number will have reached two billion (UN, 2009). In the 27 EU member states the size of the population aged 65 years and older is expected to be between 10.4% to 37.3% of the total population by 2030, compared to 9.1% to 26.8% in the year 2008 (Giannakouris, 2010). In January 2013 the Icelandic population was 321,857 persons and thereof 11% were of retirement age; 67 years or older. It is forecasted that in the year 2030 people 65 years and older will account for 19% of the total population of 371,796 persons (Hagtíðindi, 2013).

One of the concerns nations face is the economical consequence of a steadily growing group of vulnerable elderly people due to chronic diseases and long term care. The proportion of total disease burden in high-income countries was 35% for the age group 60 years and older, compared with 13% in low and middle-income countries (WHO, 2008). Overall, the top leading cause of burden of disease in middle- and high-income countries is unipolar depressive disorder followed by ischemic heart disease and cerebrovascular disease. Unipolar depressive disorder is also in the top leading causes of years lost due to disability (YLD) in both high-income and low- and middle-income countries (WHO, 2008).

Iceland has the second lowest environmental burden of disease of neuropsychiatric disorders compared with the other Nordic countries; Sweden has the lowest rate and Finland the highest (WHO, 2009). However, of the 34 OECD countries Iceland had the biggest consumptions of antidepressants in the year 2010 with a daily dose of 101/1000 people per day. In the other Nordic countries the daily dose was between 56-84/1000 people per day with Norwegians consuming the least amount of antidepressants (OECD, 2012). Antidepressants were prescribed to 30,000 people in Iceland in the year 2009 or about one in every 10 of the total population (Sjúkratryggingar Íslands, 2010). In 2006 dispensed drug prescriptions in Iceland were in total 2,460,988

and of those prescriptions 29.2% belonged to people 70 years or older not living in institutions. Almost a quarter (23.7%) of the prescriptions for the elderly are for psychotropic drugs (N05A, N05B, N05C, N06A) and as people get older prescriptions for anxiety and sleep problems increase (Samúelsson et al., 2009). This is reflected in the Age, Gene/Environment Susceptibility – Reykjavik Study (AGES-Reykjavík)¹ a population-based cohort study with 5,764 elderly participants where 2,072 persons (36%) used psychotropic drugs the two weeks before participating in the study. Close to half or 1,002 persons of this group used more than one psychotropic drug. Of those using psychotropic drugs the biggest consumptions were of medication for sleep problems and depression, 43% of the total drug use was of hypnotics and sedatives (N05C) and 34% was for antidepressants (N06A) (G. Eiríksdóttir, personal communication, July 31st). Another population based study showed similar results, 37% of the 186 community-dwelling elderly Icelanders used psychotropic drugs. The use of psychotropic drugs was markedly higher in the older age group, as 51% of those 75 years and older were using psychotropic drugs compared with 28% of those 65-74 years of age (Sigurðardóttir et al., 2011). A survey conducted in 2004 showed that Icelanders are willing to use antidepressants for the treatment of major depression. Women are likelier to believe in talking therapies but older participants (66-80) have less belief in the efficacy of supportive interviews and Cognitive-behavioral therapy (CBT) than younger people (Sigurdsson, Ólafsdóttir, & Gottfredsson, 2008).

If one examines the most common cause of disability in relation to age then depression is the most common cause of disability for the age group 0-59 while for those of 60 years and older it is hearing loss and osteoarthritis and not depression (WHO, 2008). Although depression is a less common cause of disability in the elderly than in younger people it is still a serious disabling condition that is important to diagnose and treat. At the same time it is important to consider what type of treatment is best suited for each individual. The elderly are vulnerable to side effects of drugs and are often

¹ Current study uses data from the AGES-Reykjavik study; see further information in the method chapter.

using several types of medicine at the same time (Samúelsson et al., 2009). It is well established that psychotropic drug use increases the risk of falling for elderly persons (Bloch et al., 2011; Hill & Wee, 2012) and the highest odds for falling accidents seems to be immediately after initiating medication treatment (Modén, Merlo, Ohlsson, & Rosvall, 2010).

It is important to understand what factors increase the risk for developing depression, whether it has to do with internal factors such as personality and genetic makeup, external factors such as loss or trauma, or a combination of both internal and external factors. Likewise it is important to find the best treatment available for each individual suffering from depression. This study explores how personality traits are related to depressive symptoms and episodes. Additionally, an unique opportunity to explore in what way non-responders differ from responders presents itself because of preexisting data about all persons receiving the questionnaires (Harris et al., 2007). Studies have shown that various factors including age, gender, education and health (Lundberg et al., 2005; Rönmark et al., 1999) influence response rate in postal surveys.

5.1 Depression

Mental disorders like depression are diagnosed according to the definition of the diagnostic classification systems of *International Classification of Diseases, ICD-10* (WHO, 1992) and *Diagnostic and Statistical Manual of Mental Disorders*, recently updated to the Fifth Edition (DSM-5) (American Psychiatric Association, 2013a). The core criterion symptoms and duration time applied to the diagnosis of major depression has not changed from DSM-IV (American Psychiatric Association, 1994) and they are (American Psychiatric Association, 2013b):

- A. Five or more symptoms that reflect depressive mood. The symptoms have to have lasted at least two weeks and representing a change from previous functioning, with clinically distressing or impairment in important areas of functioning in daily life. Those symptoms can be:
- Depressed mood most of the day, nearly every day.
 - Loss of interest or pleasure in all, or almost all activities most of the day, nearly every day.
 - Significant weight loss when not dieting or weight gain (e.g., a change of more than 5 percent of body weight in a month), or change in appetite nearly every day.
 - Insomnia or hypersomnia nearly every day.
 - Psychomotor agitation or slowness nearly every day (observable by others).
 - Fatigue or loss of energy nearly every day.
 - Feelings of worthlessness or excessive or inappropriate guilt nearly every day.
 - Diminished ability to think or concentrate, or indecisiveness, nearly every day
 - Recurrent thoughts of death or suicidal ideation.
- B. The symptoms cause clinically significant distress or impairment in social, occupational or other important areas of functioning.
- C. The symptoms are not due to the direct physiological effects of a substance (e.g., a drug of abuse, a medication) or a general medical condition (e.g., hypothyroidism).

Trained interviewers use, often for research purposes, specially designed structured interviews to make an assessment of mental disorders according to the classification systems. The Composite International Diagnostic Interview (CIDI) (Robins, Wing, Wittchen, & et al., 1988) and The Mini-International Neuropsychiatric Interview (M.I.N.I) (Sheehan et al., 1998) are examples of interviews that are used in epidemiologic studies (Ayuso-Mateos et al., 2001; Kessler et al., 2003).

5.1.1 Prevalence of depression

Results from a face to face survey of a nationally representative sample of the US adult using the structured interview CIDI, with 9,282 respondent 18 years and older, showed the prevalence estimates for major depressive episode (MDE) to be 19.2% for lifetime, 8.3% for the last 12 months and 3.1% for the last 30 days for the total sample. This estimate varies across four age groups with the highest lifetime prevalence for the age group 35-49 of 22.7% and lowest for the oldest group of 65+, with 9.8%. The oldest group also had the lowest 12-month prevalence of 2.6% and for the last 30 days it was 1.0% (Kessler, Birnbaum, Bromet, et al., 2010). A cross-national study with data from 18 countries, 10 developed and 8 developing countries according to the World Bank classification, found the estimated 12-month prevalence of major depressive episodes to be 5.5% in developed countries and 5.9% in developing countries. The estimates varied significantly across age groups in developed countries due to highest prevalence of depression in the youngest age group (18-34; 7%) and lowest in the oldest age group (65+; 2.6%). This was the usual pattern except for Israel, Italy and Spain where no age group difference was found. In the developing countries no difference was found between the age groups in Colombia, Lebanon, Mexico and South Africa. Brazil has a similar pattern as developed countries with highest prevalence in the youngest age group and lowest in the oldest age group. In Ukraine the pattern was reversed, the highest prevalence of depression was among the elderly with prevalence rate of 13% compared with 6% in the youngest group (Kessler, Birnbaum, Shahly, et al., 2010).

A systematic review of 25 studies from the twenty-seven EU countries plus Switzerland, Iceland and Norway, reported 12 months prevalence of major depression for the age group 14-65 years to be between 1.0 – 10.1%, with a best estimate from expert of 6.9% for the group 14-65 years of age. More recent studies in the review, updated from 2005 (Wittchen & Jacobi, 2005), included the elderly in their studies and found lower prevalence in that age group. The authors caution regarding limitations due to different methodological standards and approaches between studies (Wittchen et al.,

2011). A study from Norway part of the systematic review reported above had the highest prevalence of 10.1% in total, but the oldest group of 66 years and older had a much lower prevalence of 4.8% (Sandanger et al., 2007). In Norway the 12-month prevalence of major depression for people between 18 and 65 years is very different between the urban area of Oslo, with the prevalence being 7.3%, and rural area of Sogn and Fjordane in western Norway, with the prevalence being 3.3% (Kringlen et al., 2001; Kringlen, Torgersen, & Cramer, 2006). Another study from Norway shows the prevalence of major depression to be 7.0% in Oslo but 8.5% in the rural area of Rakkestad (Ayuso-Mateos et al., 2001) situated southeast of Oslo.

A study from Finland with a representative nationwide non-institutionalized sample of 5,993 persons between 15 and 75 years of age showed a 12-month prevalence of major depressive episodes to be 9.3%. The prevalence was 10.8% for the age groups of 25-54 years and dropped to 6.7% for the oldest group, 65-75 years of age (Lindeman et al., 2000).

In a longitudinal cohort study of 3,563 persons conducted between 1947 and 1997 in Sweden 5.8% were diagnosed as having major depression at some time during the follow-up time, and when all types of depression are included the prevalence rose to 9.7%. (Mattisson, Bogren, Horstmann, Munk-Jorgensen, & Nettelbladt, 2007).

There are no epidemiological studies of the prevalence of depression in Iceland, but one study which used The Diagnostic Interview Schedule showed a lifetime prevalence rate of 5.3% for people between 55-57 years of age (Stefánsson, Línal, Björnsson, & Guðmundsdóttir, 1991). In 2002-2006 the AGES-Reykjavik a population-based cohort study was conducted in Iceland. It originated from the Reykjavik study (Harris et al., 2007), where 5,343 participants between 66-96 years of age without dementia were scanned for depression. Of those 5,343 persons 23.8% fulfilled criteria for the M.I.N.I. interview and 22.5% finished the interview, which was done by trained health personnel. The prevalence of ever having (including current episode) a major depressive episode was 4.2% and an additional 2.1% with mild depressive episode. Participants currently depressed were 1.5% of the group and an additional 0.7% were diagnosed as having mild current depression (Magnúsdóttir, 2009).

5.1.2 Depression in the elderly

Although depression is less common in the elderly than in other age groups of adults, the elderly suffer from what Fiske and Jones (2005) call sub threshold depressive syndromes or mild depression. People over 65 years of age also rate the severity of their depression less than people younger than 65 and they report less role impairments, that is how much symptoms of depression interferes with home management, work, social life and personal relationships (Kessler, Birnbaum, Bromet, et al., 2010). However, many elderly with chronic medical illnesses and cognitive impairment also suffer from depression (Alexopoulos, 2005) and it increases disability and mortality (Kohn & Epstein-Lubow, 2006). Factors such as poor cognition, poor physical functions, greater disability, number of medications and greater neuroticism are associated with increased risk of depression among elderly people (Gale et al., 2011). The elderly (65+) are less likely than younger age groups to seek special treatment for depression. Males and depressed elderly patients receive a higher proportion of their treatment in the general medical sector than younger respondents do (Kessler, Birnbaum, Bromet, et al., 2010).

In a 8-year population-based prospective study from Germany the following factors increased risk of late-life depressive symptoms; being female, poor subjective health, stroke, excessive alcohol consumption, poor social network, functional impairment and depression score at baseline (Luppa et al., 2012). Suffering from depression in late life can also increase the risk of physical disorders (Petronijevic et al., 2008). Participants in the AGES-Reykjavík study without dementia and diagnosed with current major depressive disorder had reduced total brain volume compared with others, while those in remission did not (Geerlings et al., 2013). Late onset depression has been associated with increased neurobiological and cognitive decline. However, a recent systematic review on the distinction between early onset and late onset depression revealed that the only clinical difference between the groups was a higher frequency of mood disorders in early onset depression (Grayson & Thomas, 2013).

5.2 Personality

Everyone has a personality; we tend to describe each other as being nice, nervous, generous, and/or helpful amongst other characteristics. This refers to personality traits, a person's attributes or qualities that can be measured and assessed with a personality questionnaire (Costa Jr. et al., 1998). Personality traits have an impact on how we behave, feel, experience, interpret and interact with the world around us. In the mid-1980s scientists who studied personality achieved an initial consensus that almost all traits could be categorized into five broad dimensions that has become known as the 'Big Five' (John et al., 2008). The five-factor model of personality is a hierarchical organization of personality domains of extraversion, agreeableness, conscientiousness, neuroticism and openness to experience (Costa Jr. et al., 1998) which can be measured with personality tests like the NEO-PI-R inventory² (Costa Jr & McCrae, 1992). Each domain or factor is defined by six specific traits or facets (Costa Jr & McCrae, 1995).

- Neuroticism (N factor): identifies individuals who have tendency to experience psychological distress. Includes the facets of anxiety, angry/hostility, depression, self-consciousness, impulsiveness and vulnerability.
- Extraversion (E factor): tendency to experience positive emotions and intensity of energy directed outward socially. Includes the facets of warmth, gregariousness, assertiveness, activity, excitement seeking and positive emotions.
- Openness to experience (O factor): refers to being imaginative, sensitive to art and beauty and to appreciate the experience for their own sake. Includes the facets of fantasy, aesthetics, feelings, actions, ideas and values.
- Agreeableness (A factor): representing a tendency to be trusting and cooperative. Includes the facets of trust, straightforwardness, altruism, compliance, modesty and tender-mindedness.

² Detailed information of the NEO Personality Inventory (NEO-FFI) is in the method chapter.

- **Conscientiousness (C factor):** refers to a tendency to be organized, disciplined, and motivation in goal directed behaviors. Includes the facets of competence, order, dutifulness, achievement striving, self-discipline and deliberation.

Evidence from longitudinal studies shows that personality is stable after the age of thirty (Costa et al., 1994; Soldz & Vaillant, 1999) and into old age, although old-old (85-100) score somewhat lower on extraversion compared to middle-age/young-old (50-84) (Roepke et al., 2001). Researchers have shown that personality traits are most likely endogenous and therefore likelier to be a cause rather than the effect of life experience (Costa Jr. et al., 1998) although it is known that traumatic brain injury and diseases like Alzheimer's and Parkinson's can alter a person's personality which underpins the biological base of personality traits (Costa Jr et al., 2005).

5.3 Personality and depression

Studies show that personality is associated with various mental disorders (Malouff et al., 2005; Rector et al., 2012), treatment outcome (Ogrodniczuk et al., 2003; Quilty, De Fruyt, et al., 2008; Weber et al., 2011) and serotonin receptors, which have been implicated in major depressive disorder (Quilty, Meusel, & Bagby, 2008). A review of risk factors for depression in the elderly shows that personality traits can be both protective and risk factors (Vink et al., 2008). The personality factors that seem to be most influential regarding being depressed or developing depression is having a high level of neuroticism, low levels of conscientiousness and in some instance being low on the extroversion scale (Koorevaar et al., 2013). Higher score on openness has been linked with earlier onset of depression (Koorevaar et al., 2013). All facets of the neuroticism domain and some facets of extraversion and conscientiousness domain have association with depression (Hayward et al., 2013). A large Swedish longitudinal twin study showed that neuroticism, which is strongly heritable, is a major risk factor for developing depression later in life (Kendler et al., 2006). Gale et al. (2011) found that a standard deviation increase on the neuroticism factor was associated with more than a

two-fold increase in the odds of having depression. The personality factors of agreeableness and openness seems to be to a much lesser degree connected to depression, although some facets scores from those factors can have an impact (Gale et al., 2011; Goodwin & Gotlib, 2004; Hayward et al., 2013; Rector et al., 2012). Meta-analysis including 33 studies on relationship between the Five-Factor Model and symptoms of clinical disorders showed that low conscientiousness, low extraversion, low agreeableness and high neuroticism were associated with symptoms of clinical disorders, such as depression, anxiety, eating disorders and schizophrenia (Malouff et al., 2005). Of those 33 studies, ten studied depression and personality but none of them included elderly persons in their sample.

5.3.1 Personality and depression in the elderly

Few studies have investigated personality and depression in elderly persons. A prospective study of 512 older adults between 65-100 years of age who lived in New York, West Virginia, and Ohio, with disability and a history of significant health care utilization, showed that participants high on neuroticism and low on conscientiousness were at risk of developing either major or minor depression (Weiss et al., 2009). In a Dutch longitudinal aging study on subsample of 91 participants (55-85 years) with clinically relevant depressive symptoms at one or more time points 45% had a recurrence of the symptoms. High neuroticism, low level of mastery and remnants of depressive symptoms at the time of recovery predicted recurrence of depression. However when using multivariable analysis the level of neuroticism was no longer significant in relation to a recurrence of depression in later life, only mastery and remnants of depressive symptoms (Steunenberg et al., 2010). A study on the presence, onset and treatment outcomes of depression in 216 participants 60 years or older, from Durham in North Carolina, found that depression was related to higher neuroticism (and all its facets), lower extraversion (and facets of assertiveness, activity and positive emotions), and lower conscientiousness (and facets of competence, order, dutifulness and self-discipline). Personality was unrelated to depression severity at the beginning of treatment, but

improvement after three months and twelve months was related to lower neuroticism (and the facets of depressiveness and stress-vulnerability). Higher facets of warmth (from E) and competence (from C) was also related to improvement after three months (Hayward et al., 2013).

5.4 Participation and attrition in researches

It is important to get people to participate in research, as non-participation has the potential to introduce bias into the results. In longitudinal studies little is known about those who refuse at the beginning, but much more is known when participants drop out in the second or later waves (Chatfield et al., 2005; Jacomb et al., 2002). Participation rate in epidemiologic studies differ between countries, with lower response rates in south European countries as France, Italy and Spain, compared with higher response rate in Nordic countries (Goldberg, Chastang, Zins, Niedhammer, & Leclerc, 2006).

Various demographic and health variables have been found to predict non-participation. Non-responders are more often male (Heath et al., 2001) and older (Chatfield et al., 2005), but not always (Goldberg et al., 2006), with cognitive impairment, living alone and being unmarried (Chatfield et al., 2005). They have less education, lower occupational status (Jacomb et al., 2002) and have health problems (Chatfield et al., 2005; Goldberg et al., 2006). In a three wave longitudinal health survey of the elderly in Australia, where 1,377 community living elderly and 145 residents of nursing homes were selected for an interview in their homes, the authors concluded that refusal was predicted by low scores on a verbal IQ tests and cognitive impairment and distress caused by cognitive testing. In that study a close relative could be interviewed instead of the elderly person. One of the tests involved the participant to read; and sight impairment was higher in the group of people that allowed a relative to be interviewed in the second wave. In this informant only group there was also higher disability rate of Activities of daily living (ADL) and persons belonging to that group were likelier to have had a diagnosis of dementia at the first wave interview. For initial non-responders,

only age and gender was available. No difference was found for age but more women than men refused to take part (Jacomb et al., 2002).

In a longitudinal study on aging and dementia in Stockholm the non-responders in second or later waves had lower score on the Mini-Mental State Examination (MMSE) which is a brief cognitive test, they were older and had lower educational level (von Strauss et al., 1998). Multivariable analysis in a systematic review of attrition in longitudinal studies of elderly showed two consistent findings; dropout is related to getting older and having cognitive impairment (Chatfield et al., 2005).

There is an association between symptoms of mental problems and non-responding (Chang et al., 2009; Goldberg et al., 2006; Torvik, Rognmo, & Tambs, 2012), but not all studies confirm that (Jacomb et al., 2002). A study of almost twenty thousand Swedish citizens aged 20-64 years, who were sent questionnaire by mail and asked to participate in a health survey, showed, by linking personal identification numbers with registry data (The Hospital Discharges Register and The Disability Pension Register), that non-responders were likelier to have had an in-patient care or disability pension because of mental disorders. However, authors note that most psychiatric diagnoses were strongly related to other determinants of non-participation as low income, low education and being born outside the Nordic countries (Lundberg et al., 2005). Antipsychotic drug use, as depressive medication, has also been shown to have a strong link toward non-response in a French postal epidemiological population-based survey, where about half of the questions were connected to mental health (Vercambre & Gilbert, 2012).

5.5 Aims and purpose of the study

The aim of the present study is to investigate the influence of personality on depression among elderly persons. Based on previous research it is hypothesized that a higher score on the neuroticism scale and lower scores of extroversion and conscientiousness lead to a higher score on the Geriatric Depression Scale (GDS) and higher incidence of depression.

An additional aim is to investigate what differentiates responders from non-responders in answering and returning the personality questionnaire. It is hypothesized that non-responders are: males; older; living alone; with lower education; worse sight; more symptoms of depression; are likelier to use anti-depressive medication; have experienced depressive episode; and evaluate their subjective health worse than responders.

6 Methods

6.1 Study design

This was a cross-sectional study of a subsample of elderly persons born 1907-1935 taken from the Age, Gene/Environment Susceptibility-Reykjavik Study (AGES-Reykjavik), an ongoing multidisciplinary longitudinal study on risk factors in relation to disease and disability in old age.

6.1.1 AGES-Reykjavik

The AGES-Reykjavik originates from the Reykjavik Study established in 1967 to research cardiovascular disease in Iceland. The AGES-Reykjavik sample was extracted from the 11,549 (41.6% men) surviving participants of the Reykjavik study. The original sample consisted of homogenous group of 19,381 persons, born between 1907 and 1935 and living in Reykjavik in the year 1967 (Harris et al., 2007). All potential participants for AGES-Reykjavik ($N = 8,030$) were sent an information booklet with an invitation to call the Icelandic Heart Association to participate in the study. The booklet contained information about the study; its procedure and what would be tested. There were benefits for participating individuals as they got a pristine physical examination and subsequently were notified if examination revealed something that needed medical attention (Guðnason, 2003). The AGES-Reykjavik examination was completed in three clinic visits over four to six weeks. Participants ($N = 5,764$) had broad physical and psychological assessments and answered various questionnaires. For more detailed information about AGES-Reykjavik study procedure see Harris et al. (2007).

6.2 Participants and procedure

For this study a random sample of 1,000 participants (425 men and 575 women) was selected out of the 5,764 participants from the AGES-Reykjavik examination conducted between January 2002 and February 2006. Response rate was 41%. Early in the year 2006 a NEO-FFI personality test and DS14

questionnaire³ was mailed to the sample and they invited to join the study. Of those 414 that responded, unusable questionnaires came from 34 individuals in total. Of those thirty-four, 22 persons answered only one questionnaire and one was faulty, names or identity numbers were missing in 11 instances and therefore answers from 380 (38%) participants were entered into the data collection (Broddadóttir, 2006).

6.2.1 Screening for dementia

In the AGES-Reykjavik study everyone was screened for possible dementia with The Mini-Mental State Examination (MMSE) (Folstein et al., 1975) and the Digit symbol substitution test (Wechsler, 1981). Those with positive screened results for cognitive impairment were administered a diagnostic battery of neuropsychological tests. A panel consisting of a geriatrician, a neurologist, a neuropsychologist and a neuroradiologist made a consensus diagnosis of dementia according to international guidelines from the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (American Psychiatric Association, 1994).

In this sample of 1,000 persons, 53 persons, thereof 16 responders, were considered to have cognitive impairment (consensus rated as probable and possible), and excluded from any statistical analysis. An additional seven responders were excluded from statistical analysis as they failed to answer 10 or more questions on the NEO-FFI questionnaire, thus leaving 940 people for the comparison analysis.

6.2.2 Responders vs. non-responders

The information from AGES-Reykjavik study gave opportunities to compare responders with non-responders in regards to: gender, age, vision, education, marital status, subjective health, use of anti-depressant medication, depressive score on GDS and if participants had clinical depression at some point in their life, assessed with M.I.N.I..

³ DS14 is a measure of negative affectivity and social inhibition (Type D personality) (Denollet, 2005) and was not used in this study.

6.2.3 Approval of the study

The study of personality and AGES–Reykjavik was approved by the National Bioethics Committee in Iceland that acts as the institutional review board for the Icelandic Heart Association (approval number 00-063-V18 and VSN-00-063) and by the National Institute on Aging Intramural Institutional Review Board. A multistage consent was obtained for AGES–Reykjavik to cover participation, use of specimens and DNA, and access to administrative records. All requests to merge AGES–Reykjavik data with administrative, genealogic, hospital, or nationally maintained databases were reviewed by the Icelandic Data Protection Authority. Release of data for analysis is governed by rules created by these bodies to protect the privacy of Icelandic participants (Harris et al., 2007).

6.3 Measures

6.3.1 Depressive symptoms – outcome variable

The Geriatric Depression Scale (GDS) is made up of 30 dichotomous questions (Yesavage et al., 1982) and has been widely used (Wancata, Alexandrowicz, Marquart, Weiss, & Friedrich, 2006). It has been translated into Icelandic and validated on 70 elderly individuals aged between 65 and 87, the internal consistency with Alfa coefficient was .92 (Valdimarsdóttir, Jónsson, Einarisdóttir, & Tómasson, 2000). For this study the short version of GDS (Sheikh & Yesavage, 1986) with 15 yes and no questions was used. Wancata et al. (2006) reported after conducting a systematic review that a cut-off value for GDS short form was usually 5/6. A cutoff score above 4/5 has also been suggested to predict a diagnosis of major depression in community dwelling adults (Allen & Annells, 2009). Most researchers have reported internal consistency of the GDS-15 with Alfa coefficients around .80 (Almeida & Almeida, 1999).

In this study missing values were computed according to Yesavage (2004) which recommends to invalidate the scale if there are more than five missing answers. If missing answers are five or less, the recommendation is to divide the total score with answered questions and put that value instead of the missing value, then round total GDS score up to next whole number. The reliability of the 15-item GDS scale ($N = 915$) showed that the Alfa coefficient was adequate .73.

6.3.2 Depressive episodes – outcome variable

Screening criteria, to identify participants in the AGES-Reykjavik study who may have had past or current episodes of major or minor depression has been described previously (Geerlings et al., 2013). The Mini-International Neuropsychiatric Interview (M.I.N.I.) (Sheehan et al., 1998) was administered if the participants had; a score ≥ 6 on the 15-item Geriatric depression scale (Sheikh & Yesavage, 1986); scored 4 or 5 on the GDS and answered three of four anxiety questions with a yes: “In the past month, have you felt anxious or frightened?”; “Were there times lately that you felt anxious?”; “Are there special situations that make you anxious?”; “Have you ever had attacks of fear or panic?”; currently used medication for depression; reported ever having a physician diagnosis of depression. Only participants with no diagnosis of dementia and an MMSE score higher or equal to 21 (Folstein et al., 1975) were qualified to be interviewed with the M.I.N.I..

Mini International Neuropsychiatric Interview (M.I.N.I.) (Sheehan et al., 1998) is a short diagnostic structured interview designed both to standardize data collection in epidemiology studies and to adopt diagnostic criteria according to international classification systems as International Statistical Classification of Diseases (ICD) (WHO, 1992) and Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) (American Psychiatric Association, 1994). In this study the module A for diagnosing depression was used and five health professionals, who went through training and standardization, interviewed participants. For current major depression the sensitivity was 100% and specificity 64% and for past major depression the sensitivity was 93% and specificity 66% (Geerlings et al., 2013).

In this study, depression was dichotomized as 0 = no depressive episode and 1 = having had depressive episode; combining major depression, current major depression, mood disorder due to a general medical condition and mild depressive episode.

6.3.3 Personality - predictor variable

Personality characteristics were assessed with the NEO-Five Factor Inventory (NEO-FFI) (Costa and McCrae 1992) an abbreviated version of NEO Personality Inventory (NEO-PI), which has been standardized in Icelandic. Factor structure was replicated and Alfa coefficient were adequate and were between .82-.91: agreeableness .82, openness .87, conscientiousness .88, extraversion .88 and neuroticism .91 (Jónsson & Bergþórsson, 2004). NEO-FFI comprises 60 self-descriptive statements in which participants rate the extent to which each statement describes them. Item-scores are rated on a 5-point Likert scale ranging from '*strongly disagree*' to '*strongly agree*'. The NEO-FFI has demonstrated good internal consistency with Alfa coefficient between .75 to .83 and test-retest reliability, and has been validated against other personality inventories (Costa Jr & McCrae, 1992). NEO-FFI was revised in 2004 and 14 items were replaced (McCrae & Costa Jr, 2004) after few researchers criticized its psychometric properties (Becker, 2006; Egan et al., 2000).

In this study, each of the five factors summed score from the 12 items was computed. The sum of score could range from 0-48 for each factor. Questionnaires that had ten or more missing answers were not used in the statistical analysis. If five or more answers were missing from a single factor, it was dropped for analysis. Otherwise missing answers were handled by taking the mean from other participants for that question. For this study the reliability of the NEO-FFI scale ($N = 356$) and Alfa coefficient were adequate for neuroticism .80, extraversion .80 and conscientiousness .80, in the lower range for agreeableness .68 but inadequate for openness .55. The last two factors were therefore dropped from statistical analysis.

6.3.4 Sociodemographic variables - Covariates

Gender was dichotomized in: 0 = male and 1 = female.

Marital status was dichotomized in: 0 = married/living together and 1 = not married (widowed, divorced and single).

Education was dichotomized in: 0 = low education (primary school or less and secondary education) and 1 = middle to high education (college education and university education).

6.3.5 Health variables - Covariates

Subjective health was measured with the question “In general, how would you say your health is”? Answers were given on a 5-point categorical scale, ranging from *poor* to *excellent*. For the regression analysis it was dichotomized in: 0 = good health (good, very good and excellent) and 1 = poor health (fair and poor).

6.3.6 Medication for depression

Anti-depressant medication was categorized as N06 A (antidepressants) or N05 AN01 (lithium), and dichotomized in: 0 = not using depressant medication and 1 = currently using antidepressant. Participants were asked to bring all types of medication they were using, both over the counter drugs and prescriptive medication, for registration (Guðnason, 2003).

6.4 Statistical analysis

Statistical analysis was performed using SPSS 22. Descriptive statistics were used to describe the sample. To compare responders with non-responders *t*-test was used for continuous variables and chi-square test for categorical variables.

Bivariate analysis using the Pearson and Spearman correlation coefficient was carried out to assess the strength of association between the independent variables and with the dependent variable of total score on the Geriatric Depression Scale and having experienced depressive episodes according to the M.I.N.I. interview.

To explore the association between personality traits and depression variables that in the bivariate analysis had significant association with the outcome variable of symptoms of depression (GDS score) were entered into a hierarchical regression model with the exception of anti-depressive medication as such medication is a treatment to alleviate depressive symptoms. The same predictive variables were also used for logistic regression analysis with depressive episodes as the outcome variable. The critical value for significance was set at $p < 0.05$ for all analyses.

7 Results

7.1 Demographic and clinical data of responders and non-responders

Information on sample characteristics and difference between responders (n=356, 37.9%) and non-responders (n=584, 62.1%) can be seen in table 5.

The mean age of the respondents was 75 (5.3) years (range 66-91), 53.9% were female, 65.5% were married/living together, 65.1% had secondary schooling or less, majority had good vision (82.5%) and did not use anti-depressive medication (91%) and less than a quarter (23.9%) reported poor or fair health. Mean score on the Geriatric Depression Scale was 2.25 and most persons (94%) had never experienced depressive episode according to the M.I.N.I. interview.

Non-responders had less education ($p = .002$), reported worse health ($p = .005$), were likelier to use anti-depressants ($p = .002$) and were older than responders ($p = .001$) (table 5). They did not differ regarding gender, marital status, vision, GDS score or depressive episodes. Although not significant non-responders had somewhat higher GDS score and more persons had experienced depressive episodes than those who responded.

Table 5. Characteristics of the total sample of responders and non-responders (N=940)

	Sample	Responders	Non-resp.	Statistic: (t-test or χ^2)
Sample N (%)	940 (100)	356 (37.9)	584 (62.1)	
Gender N (%)	940 (100)	356 (37.9)	584 (62.1)	χ^2 (1 N = 940) = 3.08, p = .080
Male	399 (42.4)	164 (46.1)	235 (40.2)	
Female	541 (57.6)	192 (53.9)	349 (59.8)	
Mean age (SD)	75.6 (66-93)	74.97 (5.33)	76.19 (5.64)	t (938) = 3.27, p = .001
Marital status N (%)	932 (100)	355 (38.1)	577 (61.9)	χ^2 (3 N = 932) = 6.105, p = .107
Marr./living together	573 (61.5)	232 (65.4)	341 (59.1)	
Widowed	251 (26.9)	80 (22.5)	171 (29.6)	
Divorced	56 (6.0)	24 (6.8)	32 (5.5)	
Single	52 (5.6)	19 (5.4)	33 (5.7)	
Education N (%)	932 (100)	355 (38.1)	577 (61.9)	χ^2 (3 N = 932) = 14.71, p = .002
Primary school	207 (22.2)	66 (18.6)	141 (24.4)	Cramer's V .126
Secondary school	456 (48.9)	165 (46.5)	291 (50.4)	
College	165 (17.7)	69 (19.4)	96 (16.6)	
University	104 (11.2)	55 (15.5)	49 (8.5)	
Vision (%)	790 (100)	297 (37.6)	493 (62.4)	χ^2 (2 N = 790) = 4.20, p = .123
Good (1-3)	622 (78.7)	245 (82.5)	377 (76.5)	
Medium (4-6)	138 (17.6)	42 (14.1)	97 (19.7)	
Poor (7-9)	29 (3.7)	10 (3.4)	19 (3.9)	
Anti-depressant use (%)	940 (100)	356 (37.9)	584 (62.1)	χ^2 (1 N = 940) = 9.23, p = .002
Yes	125 (13.3)	32 (9.0)	93 (15.9)	Phi = -.10
No	815 (86.7)	324 (91.0)	491 (84.1)	
Subjective health	939 (100)	356 (37.9)	583 (62.1)	χ^2 (4 N = 939) = 14.87, p = .005
Excellent	186 (19.8)	77 (21.6)	109 (18.7)	V = .126
Very good	150 (16.0)	62 (17.4)	88 (15.1)	
Good	305 (32.9)	132 (37.1)	177 (30.4)	
Fair	241 (25.7)	70 (19.7)	171 (29.3)	
Poor	53 (5.6)	15 (4.2)	38 (6.5)	
Mean GDS score (SD)	2.38 (2,20)	2.25 (2.19)	2.46 (2.21)	t (860) = 1.37, p = .172
Depressive episode (%)	940 (100)	356 (37.9)	584 (62.1)	χ^2 (1 N = 940) = 0.45, p = .502
Yes	62 (6.6)	21 (5.9)	41 (7.0)	
No	878 (93.4)	335 (94.1)	543 (93.0)	

7.2 Correlation with depression and GDS score

The bivariate correlations (Pearson's r and Spearman's) between study variables and score on Geriatric Depression Scale that reached significance varied from small, $r = .10$ and explaining 1% of total variance, to large, $r = .50$ and explaining 25% of the total variance of GDS score (table 6). The personality trait of neuroticism had the highest correlation with symptoms of depression (GDS score), as people score higher on the neuroticism factor the more symptoms of depression they report which explains 22.5% of the total variance of GDS score. Higher score on the GDS was positively associated with the personality trait of neuroticism but negatively associated with the personality traits of extroversion and conscientiousness. Participants reporting worse subjective health and those who used antidepressants also scored higher on the GDS. Earlier or current depressive episodes were positively correlated with higher score on GDS. There was a weak association with age and gender; as participants got older they scored somewhat higher on GDS and males also scored somewhat higher than females. Length of education and marital status showed no correlation with score on GDS.

Earlier or current depressive episodes were positively correlated with the personality trait of neuroticism and negatively correlated with extroversion. No correlation was found with conscientiousness. Using antidepressants and reporting worse subjective health was positively correlated with depressive episode. There was weak association with depressive episodes and being younger.

Table 6. Bivariate correlation between variables used in the study (N=356)

Variable	Mean	S.D.	1	2	3	4	5	6	7	8	9	10
1. GDS	2.25	2.19	-									
2. Neuroticism	15.7730	6.90	.475**	-								
3. Extraversion	26.5385	5.98	-.334**	-.348**	-							
4. Conscientiousness	32.6652	6.10	-.307**	-.332**	.412**	-						
5. Age	74.97	5.33	.118*	-.072	.007	-.060	-					
6. Subjective health	.24	.43	.432**	.126*	-.060	-.138**	.168**	-				
7. Depressive episodes	.06	.23	.318**	.245**	-.169**	-.083	-.119*	.149**	-			
8. Marital status	.35	.45	.002	-.013	-.011	.021	.346**	.105*	-.050	-		
9. Education	.35	.48	-.046	.027	-.021	-.055	.059	.004	-.025	-.049	-	
10. Gender	.54	.50	-.109*	.112*	.115*	.031	.013	.029	.005	.303**	-.036	-
11. Antidepressants	.09	.29	.212**	.221**	-.083	-.098	-.017	.146**	.265**	.019	.017	.054

** Correlation is significant at the 0.01 level (2-tailed) and * at the 0.05 level (2-tailed).

Notes. Pearson's correlation coefficient was used for variables 1-5 and Spearman's rho coefficient of correlation for variables 6-11.

S.D.= standard deviation; GDS=Geriatric Depression Scale

N = 356 for all variables except GDS for which N = 330 and Education, and Married for which N = 355 and N = 329 for GDS x Education and GDS x Marital status.

7.3 Depressive symptoms

The third model in the regression analysis explained 39% of the variance in GDS score (table 7). Neuroticism ($t(323) = 7.50, p < .001$) and subjective health ($t(323) = 7.22, p < .001$), had the biggest impact on GDS score and their effects were medium strong. Extraversion ($t(323) = -2.66, p < .01$) and gender ($t(323) = -2.34, p < .05$) also contributed significantly to the third model, but their effects were weak. In the second model, age and conscientiousness had an effect on GDS score but by controlling for subjective health in the third model both variables lost their significance.⁴

Table 7. Multiple regression analysis on depressive symptoms (GDS score) (N=330)

	<i>B</i>	<i>SE B</i>	β
Model 1			
Constant	-1.32	1.74	
Gender	-0.30	0.24	-.07
Age	0.50	0.02	.12*
Model 2			
Constant	-1.26	1.76	
Gender	-0.41	0.21	-.09*
Age	0.06	0.02	.13**
Neuroticism	0.13	0.02	.41***
Extroversion	-0.05	0.02	-.13*
Conscientiousness	-0.04	0.02	-.11*
Model 3			
Constant	0.007	1.64	
Gender	-0.46	0.19	-.10*
Age	0.03	0.02	.08
Neuroticism	0.11	0.02	.36***
Extroversion	-0.05	0.02	-.13**
Conscientiousness	-0.03	0.02	-.07
Subjective health	1.64	0.23	.33***

Note: * $p < .05$, ** $p < .01$, *** $p < .001$

$R^2 = .02$ for step 1 ($p < .05$), $\Delta R^2 = .275$ for step 2 ($p < .001$), $\Delta R^2 = .098$ for step 3 ($p < .001$).

⁴ After checking the assumptions of the model I found two cases that could have undue influence on the model. I ran the regression analysis without those two cases and some minor changes occurred, the third model explained 36% of the variance of GDS score instead of 39% and age continued to have a weak influence in the third model; $B = 0.04$, $SE B = 0.18$ and $\beta = .04^*$. All other variables were similar.

7.4 Depressive episodes

In total there were 356 persons in the regression analysis, 5.6% of them had experienced a depressive episode according to the M.I.N.I. interview. Table 8 shows the results of hierarchical multivariate logistic regression analysis examining the predictors of depressive episode. In the final model subjective health had the strongest influence in the model, those who consider themselves with poor health had higher odds of experiencing depression than those who consider themselves in a good health. A higher score on the neuroticism factor was related to greater odds of experiencing a depressive episode. Higher extroversion decreased the odds of a depressive episode, as did being older. Gender and the personality factor of conscientiousness had no significant impact on depressive episodes.

These odds ratios indicate that each one-point increase in neuroticism is equal to 12% increase in the likelihood of depressive episodes and that each point decrease in extroversion is equal to 10% increase in the likelihood of depressive episodes. By raising odds ratios to a power (e) equal to ten-point change, one can determine that a ten-point increase in neuroticism is related to a 3.32 increase in the likelihood of depressive episodes. Likewise, every ten-point decrease in extroversion is related to a 3.0 increase in the likelihood of depressive episodes. The odds of a person with poor health for developing depression is 3.12 times greater than the odds for a person who consider themselves being in good health.

Table 8. Binary logistic regression analysis on current and ever depressive episodes ($N=356$).

	Depressive episode				
	Wald	<i>B</i> (SE)	OR	95% CI	<i>P</i> ^a
Model 1					
Constant	2.33	5.75 (3.77)	333.35		0.127
Age	5.08	-0.12 (.05)	0.89	0.80-0.99	0.024
Gender	0.02	0.06 (.47)	1.06	0.43-2.65	0.896
Model 2					
Constant	0.56	3.39 (4.56)	29.67		0.456
Age	3.09	-0.10 (.06)	0.91	0.81-1.01	0.079
Gender	0.00	0.00 (.52)	1.00	0.36-2.74	1.000
Neuroticism (N)	13.57	0.13 (.03)	1.14	1.06-1.21	0.000
Extraversion (E)	4.23	-0.10 (.05)	0.90	0.82-0.99	0.040
Conscientiousness (C)	0.61	0.03 (.04)	1.03	0.95-1.13	0.433
Model 3					
Constant	1.03	5.82 (4.84)	337.68		0.229
Age	4.14	-0.12 (.06)	0.89	0.79-0.99	0.042
Gender	0.02	-0.07 (.53)	0.93	0.33-2.60	0.888
Neuroticism (N)	10.41	0.12 (.04)	1.12	1.05-1.20	0.001
Extraversion (E)	4.27	-0.11 (.05)	0.90	0.81-0.99	0.039
Conscientiousness (C)	0.85	0.04 (.04)	1.04	0.96-1.14	0.357
Subjective health	4.32	1.14 (.55)	3.13	1.07-9.16	0.038

Notes: *B*: coefficient; OR: odds ratio; CI: confidence interval

^a *p* values for Wald chi-square test with *df* = 1.

Model 1: $\chi^2(8) = 7.79$, $P = .45$ (Hosmer & Lemeshow), .02 (Cox & Snell), .05 (Nagelkerke).

Model 2: $\chi^2(8) = 9.48$, $P = .30$ (Hosmer & Lemeshow), .09 (Cox & Snell), .26 (Nagelkerke).

Model 3: $\chi^2(8) = 4.57$, $P = .80$ (Hosmer & Lemeshow), .10 (Cox & Snell), .29 (Nagelkerke).

8 Discussion

The primary purpose of the present study was to examine the relationship between personality and its role in the predisposition to depressive symptoms and episodes with elderly persons. An additional goal was to look at factors that differentiated between responders and non-responders.

8.1 Personality and depressive symptoms and episodes

The association between personality and depression in this study points in the same direction as many other studies (Hayward et al., 2013; Koorevaar et al., 2013; Malouff et al., 2005; Weiss et al., 2009). The hypothesis that elderly people with a high score of neuroticism and low scores of extroversion and conscientiousness have more symptoms of depression (higher GDS scores) and that they have higher odds of experiencing depressive episodes was partly confirmed.

The result from the multiple regression analysis showed that persons high in neuroticism and low on extroversion had more depressive symptoms. Conscientiousness correlated only with score on the Geriatric Depression Scale in the bivariate correlation analysis, but not in the regression analysis when confounding variables were taken into account. Similar results can be seen in a large online twin research where two traits had a genetic correlation with major depression (which was assessed with self reported questionnaire); .43 for neuroticism and -.36 for conscientiousness, but when the researcher controlled for neuroticism it reduced the genetic correlation between conscientiousness and major depression (Kendler & Myers, 2010).

The logistic regression analysis showed that higher neuroticism was related to greater odds of experience depressive episode. This is similar of other studies where personality domain and facets (Hayward et al., 2013) of neuroticism have consistently been found to be related with major depression (Bienvenu et al., 2004; Koorevaar et al., 2013; Weiss et al., 2009), depressive symptoms (Gale et al., 2011) and with severity of depressive symptoms several months after treatment (Hayward et al., 2013). Additionally a higher score on the extroversion factor decreased the probability of developing

depressive episode. This is in line with results from Hayward et al. (2013) as a higher extroversion score was related to less odds of having depression, but only the facets of assertiveness, activity and positive emotions contributed to that not the facets of gregariousness nor excitement-seeking. Finally the personality factor of conscientiousness had no effect on depressive episode.

Findings from this study add to the knowledge that the personality trait of neuroticism and extroversion remain important factors in depression, not only in young and middle age (Malouff et al., 2005) but also into late life. In studies of geriatric depression, lower neuroticism is linked to improvement of depressive symptoms three and twelve months after initiation of treatment (Hayward et al., 2013). Higher neuroticism is linked with worse symptom severity (Lockenhoff et al., 2009) and, when treated with antidepressant medication worse mood outcomes (Steffens et al., 2013). Combinations of personality traits can also be critical when identifying those who are most at-risk for geriatric depression (Weiss et al., 2009). The negative association of extroversion and conscientiousness have not been as consistent in relations to depression and it has been suggested that one reason is that only subsets of the facets of extroversion and conscientiousness are related to depression and therefore there is more variation in study results (Hayward et al., 2013), this may become even more prominent when the short version of the personality questionnaire is used, as in this study.

8.1 Other confounding variables and depressive symptoms and episodes

Subjective health explained part of the variance of depressive symptoms (GDS scores) and had the strongest influence in the model for depressive episodes. Those who reported poor subjective health had a higher score on the Geriatric Depression Scale and they had over triple the odds of experiencing a depressive episode than those considering themselves being in good health. Other studies have shown poor subjective health and poor physical function to increase the risk of depression (Gale et al., 2011; Luppia et al., 2012). The nature of this relationship is complex as bad health can lead to depression, but also being depressed affects how one perceives health and experiences life.

Being male had a weak effect on depressive symptoms but gender had no effect in relation with depressive episodes, and this is in line with a Italian population-based study of people over 74 years of age where the authors found no gender difference in the prevalence of depression with the elderly, except when participants had severely disabling conditions like stroke, where men were then likelier than women to have depression (Forlani et al., 2014). However, most studies show a higher prevalence of depression amongst women, also in the elderly group as an Irish study of 8,175 older adults between 50 - 99 years of age shows. In that study women in all age groups had higher prevalence of depression (Regan et al., 2013)

Being older reduced the likelihood of having experienced depressive episodes as other studies have shown (Kessler, Birnbaum, Shahly, et al., 2010; Regan et al., 2013). It has been suggested that the most vulnerable elderly who have a history of depression selectively leave the population (Vink et al., 2008) which may be one of the explanation that the prevalence for depression is lower in older age group compared with younger ones.

8.2 Responders vs. non-responders

The hypothesis that non-responders are; males; older; living alone; with less education; worse sight; more symptoms of depression; are likelier to use anti-depressive medication; have experienced depressive episode; and evaluate their subjective health worse than responders was partly supported.

In this study the factors that differentiated between those who responded, and answered lengthy questionnaires, from non-responders was that the latter group reported worse subjective health, used more anti-depressant medication, were older and had less education. This is in line with other studies of non-responding to postal surveys as those who do not participate tend to be older (Chatfield et al., 2005), have less education (Jacomb et al., 2002; von Strauss et al., 1998), be frailer and regard themselves with worse health than respondents (de Souto Barreto, 2012) and use more antipsychotic drugs (Vercambre & Gilbert, 2012). Gender, living arrangement and sight did not matter. Surprisingly there was no difference

between responders and non-responder regarding depressive episodes and depressive symptoms as seen in some other studies (Chang et al., 2009; Lundberg et al., 2005). That was surprising, especially in the light that more non-responder used anti-depressant than responder. There could be different reasons for the fact that more participants in the AGES study were using anti-depressants than fulfilled the criteria for depression, according to the M.I.N.I. interview from the AGES study. One reason can be recall bias in the interview, so the participant does not recall depressive symptoms from the past. Heliövaara et al. (1993) found that the prevalence of mental disorders was underestimated in an interview with the participants compared with health examination that followed shortly after. Other reasons could be that elderly people are prescribed anti-depressants for symptoms other than depression (Maust et al., 2014; Mercier et al., 2013; Samúelsson et al., 2009) or the criteria according to the M.I.N.I. interview is not reached, but the doctor prescribes antidepressants because of the self report of low mood and/or lack of interest in daily activities from the client (Maust et al., 2014). Additionally once depressed people are on anti-depressant medication they may tend to stay on it for the years to come and this is especially true for elderly people (Helgason et al., 2003). In this study no attempt was made to differentiate between current or former depressive episodes, so there is a possibility that those who are currently depressed have higher odds of not responding. One can see there is a tendency, although it does not reach significance, that more non-responders have experienced depressive episodes sometime in their life. All in all this study confirms that elderly non-responders tend to be frailer and with less education than those who respond.

8.3 Strengths and Limitations

There are some strengths and limitations to this study. The obvious limitation was that the personality questionnaire was added later to the study and sent by mail to participants. This had an effect on the response rate, which was 41% and usable data came from 38% of the participants. It is known that having to answer and mail a lengthy questionnaires affects response rate (Ayuso-Mateos et al., 2001).

This was a cross-sectional study and the results can only be viewed as how and if personality and depressive symptoms or depressive episodes are related but cannot establish causality.

Although it is a strength having the diagnosis of depressive episodes done according to clinical diagnostic criteria the weakness is that only 20 persons (5.6%) fulfilled the depression criteria in the M.I.N.I. interview. Having so few persons that have experienced depressive episode in the research increases the risk for type II error – that is the probability of missing significant effects that truly exist. It is also likely that our analysis may have lacked statistical power because of low numbers, both with depressive symptoms and episodes.

The reason that there are so few participants in the study with depressive symptoms or episodes can possibly be explained with responder bias. Although there was no difference among responders and non-responders regarding depression and score on the GDS scale, the selective participation could have happened when the AGES-Reykjavik sample was drawn in 2002. The non-responders at that time had in their midlife profile higher blood pressure and higher glucose, both major contributors to health in old age (Harris et al., 2007). The mean GDS score of 2.35 (both responders and non-responders) in this study was lower than in the community study done by Sigurðardóttir et al. (2011) where mean GDS score was 6.5 which may support the idea that those who did not accept the invitation by the Icelandic Heart Association to participate in the extensive AGES study were likelier to have more depressive symptoms or depression than those who participated.

8.4 Future Research

Knowing that our personality affects how we interpret the world around us and affects how we feel, behave and interact with each other could make therapy for depression more effective if personality was assessed. There is evidence that some personality facets are predictive of treatment outcome for depression (Hayward et al., 2013) and it would be beneficial to know more about whether depressive medication alleviates symptoms of depression for persons high on neuroticism. Personality can also influence recurrence of depression but other late life stressors can also relate to recurrence (Steunenberg et al., 2010) and better information about that would be valuable. Future studies could look at different approaches in therapy according to personality and disorder rather than only disorder, as it is clear that one size does not fit all. The personality trait of neuroticism is related to various physical (Smith & Spiro, 2002) and mental outcomes (Malouff et al., 2005) so from a public health perspective better understanding of how personality, especially neuroticism, is related to each outcome could lead to enhanced ways of preventing and alleviating many health problems linked to neuroticism (Lahey, 2009). Finally in research with elderly it is advisable to oversample the oldest old to assure representation of those who are frail in order to reduce bias in health surveys or research.

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