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**Incidence of depressiveness from 2011 to
2015 among Estonians aged 53 years and
older**

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Abstract

Mental health is an important part of well-being, and population ageing has brought the health of middle-aged and older people into focus. The prevalence of depressiveness among Estonian middle-aged and older adults is comparatively high. Analysing the factors influencing its incidence helps to understand the emergence of depressive symptoms better. We analyse the incidence of depressiveness between 2013 and 2015, and also between 2011 - 2015 among Estonian population aged 53 and older. Depressiveness is defined based on the EURO-D indicator, collected in the Survey of Health, Ageing and Retirement in Europe (SHARE). We find that 21.9% of non-depressive respondents in 2013 developed depressiveness over the two year period, and that 16.0% of those neither depressive in 2011 nor in 2013 developed depressiveness over the four year period by 2015. Having a prior higher depressiveness score explained differences in the incidence of depressiveness between men and women, between higher and basic education levels, and between those limited and not limited in everyday activities. When analysing those who were not depressive also in 2011, women, people with a lower level of life satisfaction, worse computer skills, and those not solving crosswords/ puzzle games became significantly more likely depressive by 2015. Estonian care practitioners and -givers might benefit from an update and a regular review of the guidelines of mental health coping strategies, and an assessment of the extent to which relevant services correspond to the demand.

Keywords

Depressive symptoms, ageing, gerontology, Estonia, EURO-D, SHARE

1. Introduction

Depression is an important mental health problem. Depression is described by several psychological, emotional and physical symptoms that influence the wellbeing and functioning of a person. A person is considered depressed when having at least two main symptoms (low mood or sadness, loss of interest and enjoyment of life and loss of energy) and two additional symptoms (appetite or weight changes, sleep changes, loss of concentration, self-loathing, anger or irritability, suicidal ideation) for two weeks or longer (WHO 2016). Depression can have different levels of severity and chronicity, and it can be related to other illnesses; it can be recurrent, debilitating a person in his/her work or social life.

Depression is estimated to affect over 300 million people globally (WHO 2017a). It contributes to the disablement of the population, constituting 7.5% of years lived with disability¹ worldwide. In Europe this is even higher at 8.1%, and in Estonia this indicator is one of the highest in Europe at 8.9% (WHO 2017a). Depression prevalence is higher among older people and its rate increases with age in low-middle income countries, as has been shown for Estonia or Ukraine (Bromet et al. 2005, Kleinberg 2014). Therefore, increasing population ageing in these countries places the topic high on the research agenda.

This article focuses on depressiveness - a positive outcome on the depression screening test, based on self-reported outcomes of various depression related symptoms. Depressiveness is described by having three or more symptoms of depression during the last four weeks. Depressiveness prevalence at international level is difficult to estimate, because several measures exist. However, depressiveness can show the actual number of people needing different types of support compared with the formal depression diagnosis. For example, the prevalence of depression is estimated between 6% - 9.7% among Estonian middle-aged and older adults (Elm 2019, Valma 2018), while the prevalence of depressiveness reaches as high as 37% - 51% (Laidra 2016, Valma 2018). Incidence rate of depressive symptoms was established at 5.9 cases per 100 person-years for Estonian population aged 65+ in a recent study (Conde-Sala et al. 2019).

From a comparative perspective, both Estonian depression and depressiveness prevalence are higher than in other European countries, including neighbouring Finland (Ferrari et al. 2019,

¹ Years lived with disability (YLD) refers to the burden of disease. These are calculated by multiplying the prevalence of a disorder by the short- or long-term loss of health associated with that disability (the disability weight). Adding YLDs to the number of years of life lost for a certain disease or disorder, the burden of disability associated with a disease or disorder can be reported as disability-adjusted life years (DALYs) (NIMH <https://www.nimh.nih.gov/health/statistics/disability/what-are-ylds.shtml>)

Suija et al. 2012, WHO 2017a). This might be a real difference, or difference due to demographic structures, or due to variations in measurement or samples. Looking at the incidence as compared to prevalence of a disease allows us to understand the onset of a disease as well as insight into the risk factors. This article looks at the incidence of depressiveness over a two- and a four-year period among middle-aged and older Estonian population to understand the factors explaining these high proportions. With one exception (Conde-Sala et al. 2019), incidence of depressiveness using a large-scale population-based survey with older people has not been analysed before for Estonian population. No study has focused on middle-aged people and taken a single-country perspective.

2. The Distinction between Depression and Depressiveness

Depression is defined through experiencing a set of symptoms during at least two weeks almost daily or for most part of the day. These symptoms may include a lack of positive affect (loss of interest and enjoyment), sustained low mood, disturbances in sleep, diminished appetite, tearfulness, irritability, low self-esteem, decreased attention and concentration, pains in the body, suicidal ideation, anxiety, diminished energy and diminished participation in activities (National Collaborating Centre for Mental Health 2010, WHO 2016, WHO 2017a).

Depression is a clinically diagnosed condition, and its prevalence estimates are usually based on primary diagnosis given by medical personnel. However, due to lack of agreement at global level of a unified depression definition, and since it may be often related to other illnesses (WHO 2016, WHO 2017a), self-reported information on depressive symptoms, also referred to as depressiveness is also collected through surveys. This gives a better idea of the scope of people influenced by this condition, even in the case of mild or low level chronic depressive symptoms. Different periods of duration can be estimated, including lifetime depression with prevalence as high as 20% in some countries (Kessler & Bromet 2013).

Depressive symptoms are usually based on self-reported identification using a scale of different psychological, emotional, social or psychological conditions. A person selects the severity or frequency of each symptom, based on which a general depressiveness level can be estimated. Commonly such scales include around 20-30 self-reported items concerning affective and motivational elements (Sawyer 1977, Yesavage et al. 1982). A separate scale has been developed

for identifying late life depression – the EURO-D – it has been validated in some European countries, and is also the basis for our analysis (Prince et al. 1999, Castro-Costa et al. 2008).

In this article we refer mostly to studies dealing with depressive symptoms, however, in case of Estonia we also refer to findings about depression. Thus “depression” and “depressiveness” are used interchangeably.

3. Previous Findings on Associated Factors

3.1. Demographic and Social Factors

Although typically depression occurs first in young ages, depression and depressiveness tend to be more prevalent in older age with depressiveness levels reaching 51% among the oldest groups (Kleinberg 2014, Laidra 2016, Valma 2018). Early onset depression is more likely to reoccur by middle- and old age, also untreated depression may lead to severe outcomes by later age, and comorbidity make response to antidepressants less effective (Mitchell & Subramaniam 2005). The risk of depression or depressive symptoms may increase with age due to negative life events such as retirement, death of a close person or accumulating health and financial problems (Buber & Engelhardt 2011, WHO 2017b). Therefore, depression/ depressiveness in old age is more related with other factors rather than age (Buber & Engelhardt 2011, Valma 2018). Socio-economic, other socio-demographic and health factors have explained age differences in depression among Estonian middle-aged and older adults previously (Aluoja et al. 2004, Kleinberg 2014).

Depression and depressiveness are typically more prevalent among women (Kleinberg 2014, Laidra 2016, Velde, Bracke & Levecque 2010, Veronese et al. 2017). Similarly, incidence is higher among women, including in Estonian older adults (Conde-Sala et al. 2019). Women report around twice as high levels of depressiveness as men in European adult populations, with gender differences being higher in Southern and Eastern European countries. Socio-economic and family related factors moderate the association between gender and depressiveness. Smallest risk of depressiveness has been associated in both genders with good socio-economic position and partnership status. However, education is more predictive of depression for women than for men among adult Europeans up to 75 years old (Velde, Bracke & Levecque 2010). This might be due to women being more dependent on education to achieve socio-economic success. Housekeeping or looking after children does not increase depression level for women, it does

however for men (Velde, Bracke & Levecque 2010). Gender differences in Estonia could be affected by health status and income – the significant association between gender and depression disappeared after taking these factors into account (Kleinberg 2014), although not among middle-aged and older people analysed some years later (Valma 2018).

Marital and partnership status as well as living arrangements are also important – widowed, separated or divorced people report higher depression levels than married people (Jang et al. 2009, Kessler & Bromet 2013, Kleinberg 2014). Marriage is an important source of social support to middle-aged and older people. Separated or divorced people report higher levels of depressiveness than widows (Brown, Bulanda & Lee 2005, Jang et al. 2009), and older cohabitators report slightly more depressive symptoms than married people. Middle-aged and older cohabitators report less social support, poorer physical health and fewer economic resources than do married people (Brown, Bulanda & Lee 2005). Becoming widowed has a stronger effect on becoming depressed for men than women among adult Europeans up to 75 years old (Velde, Bracke & Levecque 2010). Household size, cohabitation status and social network factors (emotional satisfaction with partner, emotional and social loneliness) have been earlier associated with depression among adult Estonian population (Kleinberg 2014).

Depression is also associated with participation in community activities, loss of a close relative (Baiyewu, Yusuf & Ogundele 2015), social network structure (membership in organizations, frequency of contact with other people), and network function (emotional and social loneliness). Positive effect of frequency of contact with people can be associated with higher social- and self-efficacy, which is a higher social support outcome and can be protective of depression (Kleinberg 2014). Loss of a close person may remind of an inevitable end (Baiyewu, Yusuf & Ogundele 2015), leading to some depressive symptoms at least for a certain time period. Among middle-aged and older people loneliness has predicted rise in depressive symptoms over time (Luo et al. 2012). Not having any close relatives whom to seek emotional support from is associated with an increased depression level (Werner-Seidler et al. 2017). Long-term effects may result in chronic and recurrent depression.

3.2. Socio-Economic Factors

Generally, the risk of depressiveness is higher among lower educated people (Cakici et al. 2017, Flores et al. 2017, Jang et al. 2009, Valma 2018) whereas completing above primary school

education may have a protective effect against depressive symptoms among older adults (Lee et al. 2011). Better education functions as a social and human capital resource that enables access to better (health-related) information as well as socio-economic position. Among Estonian adults, no independent association between the level of education and depression has been identified (Kleinberg 2014), among middle-aged and older adults only primary education was significantly associated with depressiveness some ten years later (Valma 2018). Results could be affected by employment and income, so these factors must be analysed together because of their strong relation to education (Fryers et al. 2005).

Estonian middle-aged and older people unemployed or unable to work due to permanent illness or disability have higher odds of depressiveness, compared to other employment statuses (Valma 2018). Lower household income or a mismatch between the care need and what the state offers might be some of the explaining factors. However, becoming retired can have a beneficial effect on the decrease of depressiveness than preserving or keeping the same working time (Wels 2018).

Mixed evidence exists for the role of income and income inequality in depression. Life-time prevalence of depression has been reported to be higher in higher income than low-middle income countries (Kessler & Bromet 2013). The effect of income inequality on older adults' depressiveness hasn't found confirmation, but rather social deprivation of localities has (Fernández-Niño et al. 2014). No differences in depressiveness between urban and rural areas have been observed for Estonian adult population (Raju 2019).

3.3. Health and Health Behaviour Factors

Chronic diseases and activity limitations are associated with depression and depressiveness among middle-aged and older people (Ahn & Kim 2015, Jang et al. 2009, Meeks et al. 2011, Park et al. 2016, Rodda, Valma 2018, Walker & Carter 2011). Chronic diseases may include recurrent episodes of depression. People with more functional limitations suffer from higher levels of depression and depressive symptoms (Ahn & Kim 2015, Kim et al. 2018, Lue, Chen & Wu 2010), and are more likely to develop suicidal thoughts (Ahn & Kim 2015). Recently a similar finding was confirmed for Estonian population aged 65 and above - the incidence of depressiveness was higher among people with difficulties performing activities of daily living (ADL) (Conde-Sala et al. 2019). Older people (65+) not reporting everyday activity limitations

enjoy higher levels of independence, sustain satisfying lives and are more active (Kim et al. 2018). Satisfaction with life is associated with development of fewer everyday activity limitations, but it is also associated with better mental health (Collins, Goldman & Rodriguez 2008). Becoming more dissatisfied with life predicts developing late-life depression over time among older people (65+) (Lue, Chen & Wu 2010).

Higher physical activity is related to lower level of depressive symptoms in a two year period among middle-aged and older people, however, this direction of the relationship is significant only in older adults (65+) not in younger olds (50–64- year-olds). The reverse relation from earlier higher depressiveness leading to lower physical activity was significant only among younger olds (Lindwall, Larsman & Hagger 2011). It is important that a person chooses the level of physical activity according to their preferences and capabilities (Nyström et al. 2015). Previously, being physically active 1–4 times a month was associated with lower depressiveness level among Estonian middle-aged and older adults, compared to a more frequent physical activity of once or more times per week (Valma 2018).

Current alcohol use was associated with relatively lower levels of depressive symptoms among older people (60+), compared to abstainers (Gibson et al. 2017). Higher depressive symptoms among abstainers may be explained by lower social networking and participation level of abstainers (Friske, Wetherell & Gatz 2009, Gibson et al. 2017), other related health problems (Valma 2018) or previous heavy drinking (An & Xiang 2015). Also, smokers are more likely to develop depression compared to non-smokers (An & Xiang 2015). Never smoked persons are less likely to have depressiveness than current smokers among middle-aged and older Estonian population. However, former smokers and current smokers show equivalent odds to have depressive symptoms. (Valma 2018)

3.4. Other Related Factors

Internet and computer use decrease depression, especially through reducing loneliness and social isolation (Choi, Kong & Jung 2012, Cotten et al. 2014). However, internet users may be demographically different than non-users (Cotten et al. 2014). A relatively low share of Estonian population aged 55+ report using the internet compared to other European countries. Low skill-set has been observed among older working people and especially men due to lack of external computer skill learning possibilities (Tambaum 2016). Taking part in different social, leisure and

cognitive activities can also benefit mental health in later life (Schwartz & Litwin 2019). Only every fifth person in Estonia aged 65+ has been taking part in some leisure activities, being one of the lowest indicators among European countries. Solitary activities such as reading have been more popular than social activities among the older Estonian population (Tambaum 2016).

3.5. Aim of the Paper

The main purpose of the article is to describe and analyse incidence of depressiveness and its associated factors among middle-aged and older Estonian population between 2013 and 2015, and between 2011 and 2015.

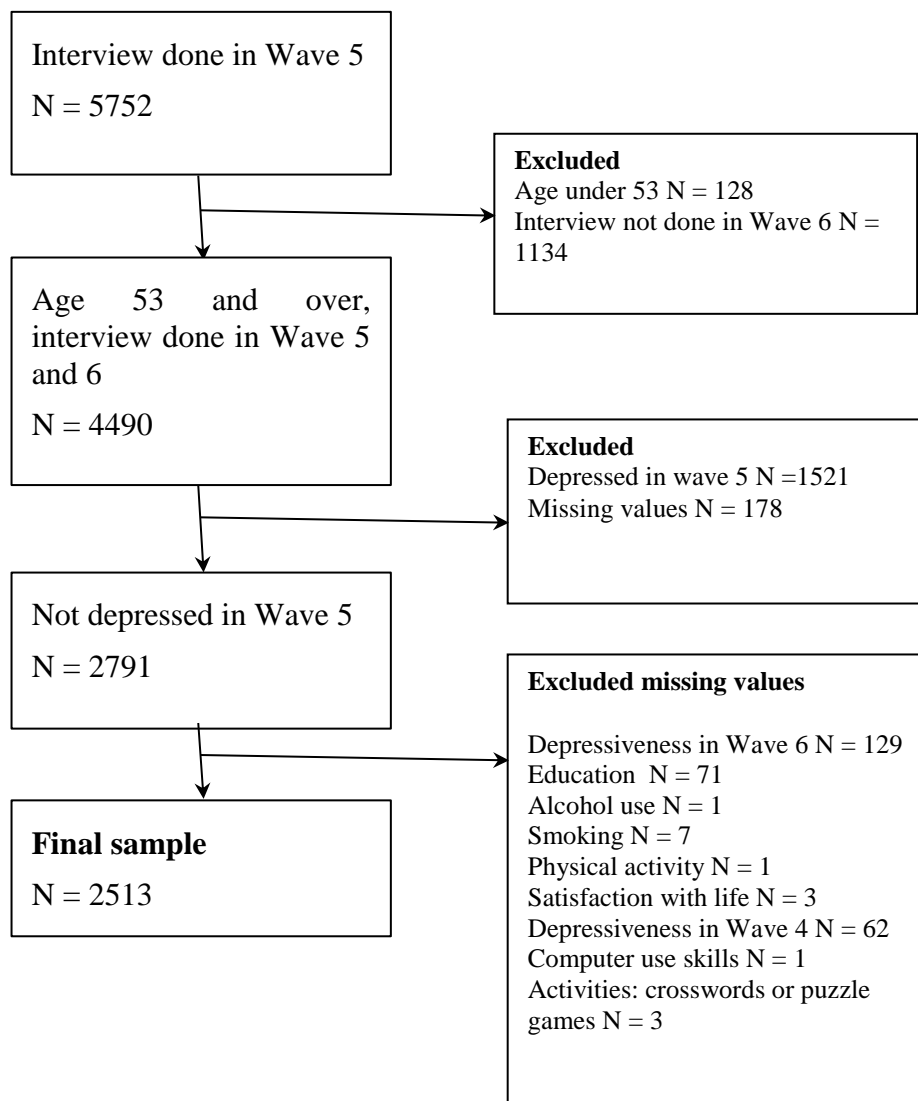
4. Data and Sample

Survey of Health, Ageing and Retirement in Europe (SHARE) is a longitudinal pan-European study of the population aged 50+. Respondents are interviewed every two years in Estonia starting from 2010. A refresher sample of 50-52-year-olds is added every other wave. Respondents have been chosen based on a probability sample of people aged 50+ residing in Estonia according to the population register. People were interviewed using computer-assisted personal interviewing (CAPI). People were informed about the purpose of the survey, and were asked for consent to participate.

Current paper uses SHARE data from Waves 5 and 6, carried out in 2013 and 2015, version 7.0.0, with additional information from previous waves added in some cases. As there were no new 50-52-year-olds added in Wave 5, we analyse people from age 53 (in 2013) onwards to avoid the problem of under-representation of younger people. We include people from their fifties to be able to capture a broader range of the life course prior to reaching old age. The individual response rate for Estonia was 86% in Wave 5, and 85% in Wave 6 (Malter & Börsch-Supan 2015, Malter & Börsch-Supan 2017).

In total, 5752 respondents were included in Wave 5 in Estonia. After excluding people with unsuitable age (n=128), not interviewed in Wave 6 (n=1134), with depressive symptoms in Wave 5 (n=1521) or missing values on depressiveness in Wave 5 (n=178), with missing values on different variables (n=278), including depressiveness in Wave 6 and Wave 4, we were left with an analytical sample of 2513 people (Figure 1). As a second step of the analysis, we focused on those who did not report depressiveness also in Wave 4, in 2011 (n=1853).

Figure 1. Analytical sample selection



4.1. Measures: Dependent Variable

Depressiveness was measured based on the discrete EURO-D measure which captures self-reported depressive symptoms such as pessimism, guilt, suicidal thoughts, irritation, sleep disturbances, change in interest, appetite, fatigue, concentration, enjoyment. EURO-D has been developed based on two scales, including the Center for Epidemiological Survey Depression (CES-D) scale, and three additional instruments for comparing late life depressiveness specifically across European countries. It has been validated among the 50+ and separately among the 65+ year old population in different countries, including neighbouring Finland, but not in Eastern Europe (Prince et al. 1999, Castro-Costa et al. 2008). The EURO-D scale includes 12 binary variables with a value 0 or 1. Upon summing the values of all binary variables together, the larger sum score indicates higher depressiveness. The cut-point for depressiveness

was chosen at the value of three and above (i.e. EURO-D \geq 4 indicated caseness). (Prince et al. 1999). Incidence was defined as the proportion of persons with a new depressive episode out of those who did not report depressive episodes at the baseline.

In addition, there might be differences in reporting heterogeneity that cause different outcomes in depressive symptoms based on the EURO-D scale (King et al. 2004, Kok et al. 2012). However, evaluation of different EURO-D elements neither its validation has been conducted in Estonia. Cronbach's alpha shows relatively high internal reliability of the EURO-D scale for Estonia: 0.8399 for Wave 4, 0.7585 in case of Wave 5 and 0.7532 for Wave 6.

4.2. Construction of Independent Variables

Most of the independent variables were self-reported in the survey, and were included in our analysis at the baseline time (2013). Socio-demographic variables include continuous age variable, sex (male-female), marital status (married/ cohabiting, never married, divorced, widowed), receipt of practical or personal help from others within or outside the household during the last 12 months (yes or no).

Socio-economic variables include education (basic, secondary (incl. post-secondary non-tertiary), and tertiary level based on the ISCED classification), employment status (retired, employed, other) and income. Household income was divided by the number of household members to calculate individual average income, and categorised according to the minimum and average salary levels in Estonia at the time of conducting the survey in 2013 (0-319, 320-929, 930+ euros).

Health and well-being variables included everyday activity limitations (having limitations included severe and moderate levels, or having no limitations), life satisfaction level (continuous scale 0-10), and Wave 4 depressiveness score (continuous scale 0-12, based on the EURO-D score) to adjust for recurrent depressive symptoms. Moderate physical activity was categorised into the following groups: "more than once a week", "1-4 times a month", "almost never or never". Alcohol consumption frequency was categorised into "6-7 days a week", ".25-4 days a week", "less than once a month", "did not consume alcohol during the last 3 months". Smoking behaviour was constructed as: "never smoked", "former smoker", "current smoker".

4.3. Analytical Strategy

Chi-square and ANOVA tests were used to estimate statistically significant differences in the distribution of different variables by depressiveness. Binomial logistic regression models were estimated to calculate associations between depressive incidence from Wave 5 until Wave 6 and socio-demographic, economic and health factors at baseline.

In addition to the models presented in this article, associations were run with other variables – country of birth or origin indicator, residence area (urban or rural), actual partnership status (whether partner is living in the household or not), household size, the number of children one has had, social network characteristics, number of chronic diseases, vigorous physical activity frequency, participating in different activities (social, reading, etc.) as well as change over time in different statuses (e.g. in everyday activity limitations, marital status, partnership, etc.) over waves. As these variables did not have explanatory power and/ or depressiveness outcome did not differ by these indicators, these were excluded from the final models.

Also, we experimented with running models for only one of the household respondents, however finally we present models including both partners – this increases sample size as well as is more representative of the Estonian population of middle-aged and older adults. Descriptive and statistical models were run for weighted as well as unweighted samples. Since the results did not differ by having or not having a partner in the household as well as between weighted and unweighted models, we present here only unweighted results including both partners in the analytical sample.

As one of the factors (depressiveness in Wave 4) was very influential in explaining the incidence of depressiveness, we ran a second set of analysis selecting those people who also did not demonstrate depressiveness in Wave 4 (n=1853). This allowed us to understand the onset of a disease and the factors of incidence from a longer term perspective. Analysis was done using Stata/IC 14.2 software.

5. Results

5.1. Descriptive Results

Characteristics of the sample by outcome are presented in Table 1. Depressiveness developed in 21.9% of Estonian middle-aged and older population initially free from depressiveness in 2013 – this share held in the regular as well as in the weighted sample². 16.0% of those not depressive also in Wave 4 (2011) became depressive by 2015 (descriptive results in Table 2, Appendix).

Respondents who had developed depressiveness were on average slightly older than non-depressive people (68.0 vs 66.6, Table 1), at a statistically significant level. Significantly more women than men developed depressiveness (24.9% vs 17.5%). There was an educational gradient – depressiveness incidence was most common among respondents with basic education (25.9%), followed by those with (post-)secondary non-tertiary education (21.9%) and higher education (18.2%, $p=0.005$).

According to marital status, depressiveness developed in 20.7% among those married to 25.5% among those widowed. Still, there were no statistically significant differences in developing depressiveness by marital status, with those divorced or widowed getting depressed somewhat more frequently. Respondents who had received any personal or practical help within or outside the household in Wave 5 developed depressiveness more frequently (26.1 vs 22.5%, $p=0.004$).

Employment status was related to getting depressed with symptoms occurring more frequently among those either unemployed (29.3%) or retired (23.7%) compared to employed respondents (17.5%) ($p=0.000$). The number of unemployed people was the smallest, with those developing depressiveness being especially low ($n=49$). Income was negatively associated with developing depressiveness, ranging from 19.3% among the highest income group (930+ euros per month) to 28.18% among the lowest income group (0-319 euros per month) ($p=0.008$).

Having activity limitations was related to developing depressiveness with 27% of the respondents with activity limitations getting the symptoms (vs 19.93%, $p=0.000$). There were no differences in developing depressiveness by smoking status, although incidence was highest among those who reported never smoking (23.1%), followed by ex-smokers (20.8%) and current smokers (19.9%). Regarding alcohol use, incidence of depressiveness varied from 15.9% in

² Incidence was slightly higher for the period between previous waves (2011 - 2013) - 22.8%. Among the initially non-depressed 65+ population 25% became depressed by 2013, and 22.8% by 2015. These findings are almost twice higher than reported in the study of Conde-Sala et al. (2019) for Estonia.

those respondents who drank alcohol .25-4 days a week to 27.4% in those not consuming alcohol during the last 3 months at all ($p=0.000$). Respondents being moderately physically active more than once a week had the lowest incidence of depressiveness (20.0%) while those being active once a week had the highest share of people developing depressiveness (28%). People being less frequently or almost never active had an incidence of 26.7% ($p=0.002$).

People who developed depressiveness had lower average satisfaction with life (5.9) than those who did not develop depressiveness (6.6). The average discreet EURO-D score from Wave 4 was higher among those developing depressiveness by 2016 (3.4 vs 2.3) with the score for depressed reaching above the cut-off level of considering someone depressed. Also, the average level of computer skills was slightly higher among those who did not develop depressiveness (2.4 vs 2.1, $p=0.000$). Engaging in cognitive activities such as crosswords or puzzle games was related to getting depressed less frequently (18.4 vs 26.0%, $p=0.000$).

Table 1. Descriptive statistics of the incidence of depressiveness among the Estonian middle-aged and older population by socio-demographic, socio-economic, health and behavioural characteristics among of those who did not report depressiveness in Wave 5 (SHARE, n = 2513).

Characteristics	Depressiveness in Wave 6		Total	p-value
	No m/n (SE/%)	Yes m/n (SE/%)		
Age in Wave 5				
age (53–95)	66,60 (0,20)	68,02 (0,41)	2513	<0.001
Gender				
male	842 (82.6)	178 (17.5)	1020	<0.001
female	1121 (75.1)	372 (24.9)	1493	
Education				
higher	530 (81.8)	118 (18.2)	648	0.005
secondary	989 (78.1)	277 (21.9)	1266	
basic	444 (74.1)	155 (25.9)	599	
Marital status				
married	1266 (79.3)	330 (20.7)	1596	0.164
never married	158 (78.6)	43 (21.4)	201	
divorced	223 (76.4)	69 (23.6)	292	
widowed	316 (74.5)	108 (25.5)	424	
Receiving assistance in Wave 5				
yes	215 (73.9)	76 (26.1)	291	0.004
no	1420 (77.6)	411 (22.5)	1831	
na	328 (83.9)	63 (16.1)	391	
Employment status in Wave 5				
employed	731 (82.5)	155 (17.5)	886	<0.001
unemployed	118 (70.7)	49 (29.3)	167	
retired	1114 (76.3)	346 (23.7)	1460	
Income in wave 5 (2013)				
930+	615 (80.7)	147 (19.3)	762	0.008
320–929	1139 (78.0)	321 (22.0)	1460	
0–319	209 (71.8)	82 (28.2)	291	
Activity limitation in Wave 5				
no	1051 (84.0)	200 (16.0)	1251	<0.001
yes	912 (72.3)	350 (27.7)	1262	
Smoking in Wave 5				
current smoker	346 (80.1)	86 (19.9)	432	0.270
former smoker	553 (79.2)	145 (20.8)	698	
never smoked	1064 (76.9)	319 (23.1)	1383	
Alcohol use in Wave 5				
did not use in last 3 months	692 (72.6)	261 (27.4)	953	<0.001
6–7 times a week	69 (78.4)	19 (21.6)	88	<0.001
0.25–4 times a week	769 (84.1)	145 (15.9)	914	
less than once a month	433 (77.6)	125 (22.4)	558	

Table 1. Continued.

Characteristics	Depressiveness in Wave 6		Total	p-value
	No m/n (SE/%)	Yes m/n (SE/%)		
Moderate physical activity in Wave 5				
>once a week	1501 (80.0)	376 (20.0)	1877	0.002
once a week	229 (72.0)	89 (28.0)	318	
1–3 times a month	96 (73.3)	35 (26.7)	131	
almost never	137 (73.3)	50 (26.7)	187	
Satisfaction with life				
satisfaction level (0–10)	6,79 (0,04)	6,09 (0,08)	2513	<0.001
Depressiveness in Wave 4				
depressiveness (0–12)	2,17 (0,04)	3,39 (0,08)	2513	<0.001
Computer skills in Wave 5				
skills (1–6)	2,56 (0,03)	2,21 (0,05)	2513	<0.001
Activities: word or number games in Wave 5				
selected	1108 (81.6)	250 (18.4)	1358	<0.001
not selected	855 (74.0)	300 (26.0)	1155	

The p-value is calculated using T-test for means and Chi-square for crosstabs.

5.2. Regression Results for Two-Year Incidence of Depressiveness

Univariate models show that with each year that one is older incidence of depressiveness increases by 2% (95% CI 1.01-1.03, Table 3). Significant age differences disappeared mainly after taking into account everyday activity limitations and computer skills while earlier higher depressive score reinforced age differences to statistically significant levels again. Finally, each added year was associated with an incidence of depressiveness by 1%, but not at a significant level³.

Women had 57% higher odds of getting depressed than men (OR=1.57, 95% CI 1.30-1.90). Gender differences in becoming depressive by Wave 6 were smallest after adjusting for previous depressive score, although solving crosswords/ puzzle games and computer skills' level reduced some of the differences as well (AOR⁴ = 1.48, 96% CI 1.15-1.90).

Lower education was a risk factor for developing depressiveness in a dose-response manner, with those having basic education presenting 57% higher odds of becoming depressive and those having secondary education presenting 26% higher odds compared to those with higher education. Each set of variables except household or family -related variables (marital status,

³ When adding age as a categorical variable of 5-year age groups, the results remained not significant.

⁴ Adjusted Odds Ratio (M8)

household size, receiving help) decreased educational differences in developing depressiveness over the two years. After adjusting for depressiveness in Wave 4, there were no statistically significant educational differences in any of the categories in developing depressiveness anymore. This remained so until the final model with computer skills and being involved in crosswords/ games changed the direction – now the odds of developing depressiveness were highest among those with tertiary education (not significant though).

Married or never married respondents had somewhat lower odds of developing depressiveness compared to those who were divorced (OR=1.19, 95% CI=0.88-1.60) or widowed (OR=1.31, 95% CI=1.02-1.69). The effects were reversed after controlling for socio-demographic and mental health variables with married people having the highest and never married the lowest risk of incidence of depressiveness (though not statistically significantly).

Having received help had higher incidence of depressiveness than people not having received help (by 22%) or for whom no information on receiving help was available (by 85%). The direction of the association remained the same, higher by only 4% in adjusted models, and not statistically significant.

Compared to employed, unemployed respondents had about double the odds (OR=1.96, 95% CI=1.34-2.86) and retired people almost 50% higher odds (OR=1.46, 95% CI=1.18-1.82) of becoming depressed. The differences between the categories of employment status in depressiveness incidence disappeared after adjusting for computer skills and solving crosswords/ puzzles. Household income had a gradual negative association with becoming depressed, with the lowest income group bearing the highest odds (OR=1.64, 95% CI=1.20-2.25). These directions reversed after controlling for socio-economic and mental health variables. Finally, people with the highest income had 22% higher incidence of depressiveness than people in both of the other categories (AOR = 0.82, 95% CI 0.55 – 1.23, AOR = 0.82, 95% CI 0.63 – 1.06).

Table 3. Multivariate logistic regression of associations between incidence of depressiveness and socio-demographic, socio-economic, health and behavioural characteristics of those who did not report depressiveness in Wave 5 (n = 2153).

Variables	Model 1 ^a (95 % CI)	Model 2 ^b (95 % CI)	Model 3 ^c (95 % CI)	Model 4 ^d (95 % CI)	Model 5 ^e (95 % CI)
Age in Wave 5					
age (52–95)	1.02 (1.01–1.03)**	1.02 (1.00–1.03)*	1.01 (1.00–1.03)	1.02 (1.00–1.04)*	1.01 (1.00–1.03)
Gender (ref: male)					
female	1.57 (1.30–1.90)***	1.58 (1.29–1.93)***	1.56 (1.24–1.96)***	1.37 (1.07–1.75)**	1.48 (1.15–1.90)**
Education (ref: higher)					
secondary	1.26 (0.99–1.60)	1.23 (0.96–1.58)	1.19 (0.92–1.53)	1.08 (0.83–1.40)	0.99 (0.76–1.30)
basic	1.57 (1.20–2.06)**	1.49 (1.12–1.99)**	1.39 (1.03–1.86)*	1.19 (0.87–1.62)	0.93 (0.67–1.30)
Marital status (ref: married)					
never married	1.04 (0.73–1.50)	0.86 (0.56–1.27)	0.90 (0.61–1.32)	0.81 (0.54–1.22)	0.81 (0.53–1.22)
divorced	1.19 (0.88–1.60)	1.02 (0.74–1.40)	1.06 (0.77–1.47)	0.97 (0.69–1.36)	0.98 (0.69–1.38)
widowed	1.31 (1.02–1.69)*	0.87 (0.64–1.17)	0.89 (0.66–1.20)	0.84 (0.62–1.16)	0.83 (0.61–1.15)
Receiving assistance in Wave 5 (ref: no)					
no	0.82 (0.61–1.09)	0.91 (0.67–1.23)	0.94 (0.69–1.28)	0.97 (0.69–1.34)	0.96 (0.69–1.34)
n/ a	0.54 (0.37–0.79)**	0.73 (0.48–1.09)	0.85 (0.56–1.30)	0.95 (0.61–1.48)	0.96 (0.61–1.49)
Employment status in Wave 5 (ref: employed)					
unemployed	1.96 (1.34–2.86)**	1.87 (1.26–2.77)**	1.57 (1.05–2.34)*	1.54 (1.01–2.35)*	1.45 (0.95–2.21)
retired	1.46 (1.18–1.82)**	1.09 (0.81–1.45)	1.01 (0.76–1.36)	0.93 (0.68–1.26)	0.87 (0.64–1.20)
Income in Wave 5 (ref: 930+ €)					
320–929	1.18 (0.94–1.48)	0.96 (0.75–1.23)	0.91 (0.71–1.17)	0.86 (0.66–1.11)	0.82 (0.55–1.23)
0–319	1.64 (1.20–2.25)**	1.17 (0.81–1.69)	1.07 (0.73–1.55)	0.89 (0.60–1.32)	0.82 (0.63–1.06)

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

^a Unadjusted

^b Adjusted for socio-demographic, socio-economic factors

^c Adjusted for socio-demographic, socio-economic and behavioural factors

^d Adjusted for socio-demographic, socio-economic, behavioural, mental health and satisfaction with life factors

^e Adjusted for all factors

Table 3. Continued.

Variables	Model 1 ^a (95 % CI)	Model 2 ^b (95 % CI)	Model 3 ^c (95 % CI)	Model 4 ^d (95 % CI)	Model 5 ^e (95 % CI)
Activity limitations in Wave 5 (ref: none)					
yes	2.02 (1.66–2.45)***		1.75 (1.42–2.17)***	1.41 (1.13–1.76)**	1.41 (1.13–1.75)**
Smoking in Wave 5 (ref: current smoker)					
former smoker	1.05 (0.78–1.43)		1.03 (0.75–1.41)	1.11 (0.79–1.55)	1.15 (0.82–1.61)
never smoked	1.21 (0.92–1.59)		0.89 (0.66–1.22)	1.07 (0.77–1.49)	1.08 (0.78–1.52)
Alcohol use in Wave 5 (did not use in last 3 months)					
6–7 times a week	0.73 (0.43–1.23)		0.62 (0.36–1.07)	0.68 (0.38–1.22)	1.05 (0.57–1.94)
0.25–4 times a week	0.50 (0.40–0.63)***		0.79 (0.45–1.39)	0.80 (0.44–1.48)	0.75 (0.57–0.99)*
less than once a month	0.77 (0.60–0.98)*		0.93 (0.53–1.62)	0.94 (0.52–1.73)	0.87 (0.67–1.14)
Moderate physical activity in Wave 5 (ref: > once a week)					
once a week	1.55 (1.18–2.03)**		1.34 (1.02–1.78)*	1.40 (1.05–1.88)*	1.39 (1.03–1.87)*
1–3 times a month	1.46 (0.97–2.18)		1.18 (0.77–1.79)	1.04 (0.67–1.61)	1.00 (0.65–1.56)
almost never	1.46 (1.03–2.05)*		0.97 (0.66–1.42)	0.81 (0.54–1.23)	0.81 (0.54–1.23)
Satisfaction with life					
satisfaction level (0–10)	0.82 (0.78–0.86)***			0.87 (0.82–0.92)***	0.87 (0.82–0.92)***
Depressiveness in Wave 4					
depressiveness (0–12)	1.43 (1.36–1.51)***			1.37 (1.29–1.45)***	1.37 (1.29–1.45)***
Computer skills in Wave 5					
skill level (1–6)	0.81 (0.75–0.87)***				0.88 (0.79–0.98)*
Activities: word or number games in Wave 5 (ref: selected)					
not selected	1.56 (1.29–1.88)***				1.48 (1.19–1.83)***
R squared	0,0171	0,0215	0,0412	0,1040	0,1180

$p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

^a Unadjusted

^b Adjusted for socio-demographic, socio-economic factors

^c Adjusted for socio-demographic, socio-economic and behavioural factors

^d Adjusted for socio-demographic, socio-economic, behavioural, mental health and satisfaction with life factors

^e Adjusted for all factors

Similarly, people with activity limitations in Wave 5 exhibited twice the odds of becoming depressive (OR=2.02, 95% CI=1.66-2.45). The differences reduced after adjusting for socio-demographic and health variables, but most notably after previous depressiveness, keeping the OR similar also in the final model (AOR = 1.41, 95% CI 1.13-1.75).

In univariate regression, neither smoking nor alcohol use frequency were significantly related to developing depressiveness – this did not change in the adjusted model. More frequent moderate physical activity (1+ times a week) was protective against developing depressiveness compared to other less frequent categories of practicing physical activity in the univariate model. After adjusting, moderate activity of once a week had the highest incidence of depressiveness (AOR = 1.39, 95% CI 1.03-1.87) and almost never doing physical activity had the lowest incidence (although not significant).

Higher satisfaction level with life and better computer skills were both protective of becoming depressed (OR=0.82, 95% CI=0.78-0.86; OR=0.81, 95% CI=0.75-0.87 resp), whereas scoring higher on the depressive scale in Wave 4 and not having been engaged in crosswords or puzzle games was predictive of becoming depressed by Wave 6 (OR=1.43, 95% CI=1.36-2.51; OR=1.56, 95% CI=1.29-1.88 resp). The coefficients of these factors did not change to a great extent in the adjusted models (life satisfaction AOR = 0.87, 95% CI=0.82-0.92; computer skills AOR=0.88, 95% CI=0.79-0.98, Wave 4 depressiveness AOR= 1.37, 95% CI 1.29-1.45, crosswords/ puzzles AOR = 1.48, 95% CI 1.19-1.83).

After adjusting for all possible variables, incidence of depressiveness remained statistically significantly higher among women, respondents with everyday activity limitations, with moderate physical activity once a week, lower level of life satisfaction, higher depressiveness score in Wave 4, worse computer skills, and not solving crosswords/ puzzle games. All variables were added to the models step by step, allowing seeing the effect of each added variable on the previous models.

As depressiveness in Wave 4 was one of the most important factors to explain differences in the incidence of depressiveness, we decided to run a second set of models. For this we selected only those who did not show depressiveness in Wave 4 in addition to not reporting depressiveness in Wave 5. The sample size for this analysis decreased to 1851 individuals. The best model with the highest R square indicator is presented, meaning that the explanatory power of these variables included in the models was the highest.

5.3. Four-Year Incidence of Depressiveness

16% of those not depressive in Wave 4 (2011) nor in Wave 5 (2013) developed depressiveness by Wave 6 (2015). Regression results for those not depressive over the four years indicated similar results as for those not depressive for two years (Table 4). There remained no significant age differences in the incidence of depressiveness (AOR = 1.97, 95% CI 0.95-1.20), this result emerged after adjusting for everyday activity limitations. Whereas adjusting for life satisfaction level, statistically significant differences in the incidence of depressiveness by everyday activity limitations disappeared (AOR = 1.28, 95% CI 0.98-1.69).

Yet, women remained with almost 50% higher odds of depressiveness incidence also in the current models. Initially, controlling for alcohol consumption reduced gender differences to non-significant levels. However, adjusting for internet skills and word or puzzle games increased the differences again to significant levels.

Finally, women, people with moderate physical activity once a week (vs more often), lower life satisfaction, lower internet and computer skills and not being active in crossword or puzzle games at Wave 5 indicated significantly higher odds of incidence of depressiveness two years later.

5.3.1. Gender Differences in Four-Year Incidence of Depressiveness

As women indicate constantly higher depressiveness prevalence as well as incidence, we ran separate models for men and women (Table 5, Appendix). Some differences in risk factors appeared. For example, the four-year incidence of depressiveness was significantly higher among highly educated women than women with basic education. Among men, having everyday activity limitations indicated twice higher odds of incidence compared to those men not having any impairments. For both men and women, not having solved crosswords or puzzle games was significantly associated with the incidence. For women, also lower satisfaction with life and lower level of computer skills were significantly associated with the incidence.

Table 4. Multivariate associations between incidence of depressiveness and socio-demographic, socio-economic, health and behavioural characteristics for of those who did not report depressiveness in Wave 4 as well as not depressive in and Wave 5 (SHARE, n = 1851).

Variables	Model 1a (95 % CI)	Model 2b (95 % CI)
Age in Wave 5		
age (53-95)	1.03 (1.01-1.04) ***	1.07 (0.95-1.20)
Gender (ref: male)		
female	1.35 (1.05-1.73) **	1.49 (1.08-2.05) *
Education (ref: higher)		
secondary	1.04 (0.77-1.41)	0.77 (0.51-1.16)
basic	1.41 (1.00-1.99) *	0.78 (0.56-1.09)
Marital status (ref: married)		
never married	1.20 (0.75-1.91)	1.02 (0.62-1.69)
divorced	1.12 (0.75-1.68)	1.05 (0.67-1.65)
widowed	1.34 (0.96-1.86)	1.00 (0.67-1.48)
Receiving assistance in Wave 5 (ref: yes)		
no	0.83 (0.57-1.22)	1.01 (0.67-1.52)
n/ a	0.57 (0.35-0.94) *	0.92 (0.51-1.54)
Employment status in Wave 5 (ref: employed)		
unemployed, home, ill, other	1.84 (1.11-3.06) *	1.43 (0.83-2.48)
retired	1.59 (1.19-2.11) **	0.94 (0.63-1.39)
Income in Wave 5 (ref: 930+ €)		
320–929	1.26 (0.94-1.68)	0.87 (0.62-1.21)
0–319	1.49 (0.97-2.30)	0.72 (0.43-1.22)
Activity limitation in Wave 5 (ref: none)		
yes	1.65 (1.29-2.11) ***	1.28 (0.98-1.69)
Smoking in Wave 5 (ref: current smoker)		
former smoker	1.02 (0.69-1.51)	1.05 (0.69-1.61)
never smoked	1.19 (0.83-1.70)	0.93 (0.61-1.42)
Alcohol use in Wave 5 (ref: 6-7 times a week)		
0.25–4 times a week	0.53 (0.27-1.04)	0.52 (0.26-1.02)
less than once a month	0.99 (0.50-1.96)	0.79 (0.39-1.61)
did not use in last 3 months	1.13 (0.58-2.18)	0.82 (0.40-1.65)
Moderate physical activity in Wave 5 (ref: >once a week)		
once a week	1.69 (1.20-2.38) **	1.49 (1.04-2.13) **
1–3 times a month	1.09 (0.59-2.00)	0.84 (0.44-1.58)
almost never	1.27 (0.76-2.10)	0.91 (0.54-1.55)
Satisfaction with life		
satisfaction level (0–10)	0.85 (0.80-0.91) ***	0.87 (0.81-0.93) ***
Computer skills in Wave 5		
skill level (1–6)	0.77 (0.70-0.86) ***	0.83 (0.72-0.96) **
Activities: word or number games in Wave 5 (ref: selected)		
not selected	1.77 (1.38-2.27) ***	1.70 (1.29-2.30) ***
R squared		0.0595

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

^a Unadjusted

^b Adjusted for all variables

6. Discussion

This paper assessed the incidence of depressiveness among middle-aged and older Estonian population (53+ years) between 2013 and 2015 as well as between 2011 and 2015. We made use of a longitudinal survey, analysing factors associated with becoming depressed over a two year period for people who reported not being depressed at the baseline. Additionally, we had the opportunity to control for depressiveness also four years earlier. Such an approach allows zooming in on the potential factors of developing depressive symptoms better, especially in an ageing context and in a country with a relatively high proportion of previously reported depressiveness among middle-aged and older people. Incidence analyses of mental health based on large-scale population surveys have been rare, especially in the Eastern European setting.

We find that 21.9% of non-depressed respondents became depressed over the two year period. Similar incidence (19.7%) for a four-year interval was found among 65+ year old Taiwanese (Lue, Chen & Wu 2010) while much lower incidence (10.6%) for a five-year interval was found among 55+ year old Mexicans (Fernández-Niño et al. 2019). Considering the sample and observation period differences, Estonian findings are high. However, our findings also show that a lower proportion - 16.0% - of those aged 53 and older who did not report depressiveness four years earlier became depressed by 2015. In the European context, these findings are high (Conde-Sala et al. 2019 found that incidence of depressiveness between 2013-2015 for Europeans aged 65+ was 13.2%). Differences between the latter and our study might lie in different sample selection procedures⁵.

Earlier depressive score in Wave 4 was the most important factor reducing or eliminating differences in the incidence of depressiveness between men and women, between higher and basic education levels, between those limited and not limited in everyday activities and to some extent also between groups of income and receiving help. Previous depressiveness also heightened age differences to a statistically significant level again, after health and health behaviour had reduced them. After selecting non-depressive people over the four-year-period into our analysis, no significant age differences in the incidence of depressiveness remained. In this case, everyday activity limitations explained these differences.

⁵ The exact numerator and denominator for Estonia has not been specified in the study of Conde-Sala et al. (2019). In their study the total Estonian sample (aged 65+) included 2393 people, however, it is not clear how many of them were included in the calculation of incidence. If we separate our sample into those aged 53-64 and 65+, then the sample size for the first groups includes 1430 individuals, and for the latter 1083 individuals. This may be behind the different incidence outcomes.

Our results suggest that everyday activity limitations and depressiveness are strongly interrelated over time. Having limitations for a longer period can cause depressiveness, leading to recurring or even chronic depressiveness, especially in case of worsening of functional limitation status. Depressive symptoms themselves may lead to developing some limitations in everyday activities, which may then develop into a cycle of depressiveness. The causal mechanisms between the two should be identified by analysing a longer panel. However, controlling for differences in everyday activity limitations deleted differences in depressiveness incidence between people of various age – therefore, to a large extent depressive symptoms in mid- and old age develop due to obstacles that limitations incur, confirming earlier findings (Buber & Engelhardt 2011, Lue, Chen & Wu 2010). Preventing and targeting specific illnesses early on in one's life might help avoid or ease depressiveness later. Also, addressing barriers that prohibit people with everyday activity limitations to participate in society fully might give positive results.

While employment status and income explained incidence differences between people with tertiary and (post-)secondary education, previous depressiveness explained away differences between tertiary and basic education. This might be related to people with lower education developing more likely depressive symptoms than people with tertiary education. Higher education has a protective effect against developing diseases, which might be related to better access to medically related information or coping mechanisms and resources. In the Estonian case, socio-economic and marital status associations with education do not hold. A reverse causal link is also possible – early onset of depression in life has kept one from acquiring higher levels of education.

Reappearing significant age differences after health and health behaviour reduced those confirms somewhat that recurring depression is likely also in Estonian older people (Mitchell & Subramaniam 2005, Burcusa & Iacano 2007). However, better computer skills or solving crosswords/ puzzle games act as coping mechanisms as they reduced age differences to non-significant levels, confirming similar findings elsewhere (Choi, Kong & Jung 2012, Cotten et al. 2014). Having a higher level of these skills and being involved in such activities showed lower odds for incidence of depressiveness in both two- as well as the four-year incidence analysis. Computer skills might reflect general social, material and cognitive resources; solving puzzle games cognitive resources that people have. The distribution of such resources varies and protects against developing depressiveness in later life differently. As these variables may reflect various aspects of life, they should be conceptualised and studied more closely in future studies on this topic.

6.1. Conclusions

Several conclusions can be drawn. Firstly, the emergence of depressive symptoms among middle-aged and older Estonian population is more explained by physical and mental health and cognitive activities than by differences in demographic or socio-economic structure and characteristics. These findings confirm earlier results on middle-aged and older Estonian population (Conde-Sala et al. 2019, Laidra 2016, Valma 2018). Therefore, previous life events, trajectories or situations that have brought about depressive symptoms, and have affected women and men differently, are behind old age depressiveness (Alvarado et al. 2007). Childhood hunger has been shown to significantly be associated with depressive symptoms in 25-84 year old Estonian population (Stickley & Leinsalu 2018) which is an example of long-term effects of previous life events on old age health.

Women and men are affected by different incidence factors. Everyday activity limitations are especially important for men while education, satisfaction with life and computer skills matter for women. From the public health perspective, our findings highlight the need to monitor middle-aged and older people with previous depression as well as with everyday activity limitations.

We confirm that age itself is not a risk factor for developing depressive symptoms (Buber & Engelhardt 2011, Laidra 2016, Valma 2018), but health and cognitive resources that differ between people of different ages bring out the variation in the risk of becoming depressive in mid- and old age. This might be related to not coping well or not knowing how to cope with the changing circumstances individual ageing brings. These changes may include developing physical health limitations, loss of close people, and an accompanying change in social roles and skills. Low computer skills may reinforce the social and physical barriers that a person with activity limitations is experiencing, cutting off the person from the rest of the (social) life. Recurrent depressive symptoms differ between people of different ages, referring to a variety of causes, diagnosis, treatment of and coping with depression in those ages.

A helpful approach to deal with old age mental health problems has been proposed in geriatric psychiatry literature (Anthony 1993, Blanchard et al. 2009, Biering 2019) which may be useful to consider in the Estonian setting as well. This approach emphasises adjustment to different life changes accompanying old age because these require also attention, not only depressive symptoms. All parties – mental health and care professionals, people in need themselves as well as caregivers and surrounding networks – have their responsibility in finding a balance between

dignity, autonomy, capabilities and degree of dependence. The adjustment strategies include creating new meaning and purpose in life and non-judgemental reintegration after age-related changes and stressors occur (Anthony 1993, Blanchard et al. 2009, Biering 2019). Estonian caregivers and care practitioners might benefit from an update and a regular review of the guidelines of mental health coping strategies, and an assessment of the extent to which relevant services correspond to the demand.

6.2. Limitations

The incidence was observed during a two- and a four-year follow-up periods, which might be too short to give an idea of long-term effect of different factors in developing depressive symptoms. Also, currently, the results are still mainly associations and cannot be interpreted as entirely causal relationships. We haven't been able to determine the primary age-of-onset of depressive symptoms which tends to be much earlier than 50 years (Kessler & Bromet 2013), so it is likely that earlier life and health situations are behind current life stage outcome.

The incidence of depressiveness is relatively high in our findings. Validation for the EURO-D should be conducted for Estonia to evaluate the functioning of the measure as it has been previously validated primarily for West-European countries. A twice higher incidence compared to a similar analysis conducted earlier (Conde-Sala et al. 2019) suggests that different sampling procedures have been used to reach these varying results, and thus the results are not comparable.

We have used only self-report measures which tend to result in higher depressive incidence, but may result in different outcomes also for other measures than when using objective indicators. We have used household income instead of individual income as this was how the measure was reported in the SHARE survey. However, income may be distributed differently within households, and we cannot account for the actual individual distribution.

Attrition may have played a role in shaping the sample between Wave 4 and Wave 5. Therefore, it is possible that some selection bias exists in terms of having more or less depressive people in our analytical sample. The proportion of institutional population in Estonia is relatively low (Leinbock & Sakkeus 2014), and not specifically sampled in our analysis. Depression is generally higher among the institutionalised population (Biering 2019), so it might be that our results would be different with more people in this vulnerable position. People in institutional

settings can have higher psychological unmet needs that cause psychological distress, such as depression (Biering 2019).

6.3. Strengths

The sample from a large population-level survey of middle-aged and older people allowed for an in-depth analysis of different factors associated with emergence of depressive symptoms. No differences in results between weighted and unweighted samples suggests that the results are properly representative of the 53+ population in Estonia. A panel survey design enabled us to study the incidence of depressiveness and related factors over a two-year observation period, including previous depressiveness score before the chosen baseline interview. This approach gave additional insights into depressive symptoms that has not been done before for Estonia.

SHARE Estonia survey has a large enough sample without the upper age limit, being representative of the 50+ population in Estonia. Often, other surveys (such as the Estonian Health Survey) exclude people in age group 80 and over. Respondents at this age ($n = 232$) have been described and analysed in our study. In other cases, surveys focus on only the older population (65+).

This study brings out the importance of looking at depressive symptoms among middle-aged and older people by clarifying its associated factors in incidence, especially those relating to age. We find indication of cumulative effects of previous events on developing depressive symptoms in old age, especially of everyday activity limitations. Another important finding relates to the role of cognitive sources, especially computer and internet usage as well solving puzzle games in the incidence of depressiveness. These findings contribute to the knowledge of depressiveness dynamics over time.

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Until July 2011, Survey of Health, Ageing and Retirement in Europe (SHARE) was reviewed and approved by the Ethics Committee of the University of Mannheim. Since then, the Ethics Council of the Max Planck Society for the Advancement of Science (MPG) is responsible for ethical reviews and the approval of the study.

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Appendix

Table 2. Descriptive statistics of the incidence of depressiveness among the Estonian middle-aged and older population by socio -demographic, socio-economic, health and behavioural characteristics among of those who did not report depressiveness in Waves 4 or 5 nor in Wave 4 (SHARE, n=1851).

Characteristics	Depressiveness in Wave 6		Total	p-value
	No m/n (SE/%)	Yes m/n (SE/%)		
Age in Wave 5				
age (53–95)	66,58 (0,22)	68,87 (0,41)	1851	<0.001
Gender				
male	710 (86.2)	114 (13.8)	824	0.020
female	844 (82.2)	183 (17.8)	1027	
Education				
higher	333 (80.4)	81 (19.6)	414	0.083
secondary	785 (84.8)	141 (15.2)	926	
basic	436 (85.3)	75 (14.7)	511	
Marital status				
married	1024 (85)	181 (15)	1205	0.347
never married	118 (82.5)	25 (17.5)	143	
divorced	171 (83.4)	34 (16.6)	205	
widowed	241 (80.9)	57 (19.1)	298	
Receiving assistance in Wave 5				
yes	164 (80.8)	39 (19.2)	203	0.063
no	1112 (83.5)	220 (16.5)	1332	
na	278 (88)	38 (12)	316	
Employment status in Wave 5				
employed	868 (82)	191 (18)	1059	0.002
unemployed	592 (87.8)	82 (12.2)	674	
retired	94 (79.7)	24 (20.3)	118	
Income in Wave 5 (2013)				
930+	507 (86.2)	81 (13.8)	192	0.130
320–929	892 (83.3)	179 (16.7)	1071	
0–319	155 (80.7)	37 (19.3)	588	
Activity limitations in Wave 5				
no	873 (87)	130 (13)	1003	<0.001
yes	681 (80.3)	167 (19.7)	848	
Smoking in Wave 5				
current smoker	272 (85.3)	47 (14.7)	319	0.459
former smoker	443 (85)	78 (15)	521	
never smoked	839 (83)	172 (17)	1011	
Alcohol use in Wave 5				
did not use in last 3 months	53 (81.5)	12 (18.5)	65	<0.001
6–7 times a week	655 (89.2)	79 (10.8)	734	
0.25–4 times a week	329 (81.6)	74 (18.4)	403	
less than once a month	517 (79.7)	132 (20.3)	649	

Table 2. Continued.

Characteristics	Depressiveness in Wave 6		Total	p-value
	No m/n (SE/%)	Yes m/n (SE/%)		
Physical activity in Wave 5				
Moderate				
>once a week	1210 (85.2)	210 (14.8)	1420	0.020
once a week	184 (77.3)	54 (22.7)	238	
1–3 times a month	69 (84.2)	13 (15.8)	82	
almost never	91 (82)	20 (18)	111	
Satisfaction with life				
satisfaction level (0–10)	6,88 (0,05)	6,32 (0,11)	1851	<0.001
Computer skills in Wave 5				
skills (1–6)	2,60 (0,03)	2,17 (0,07)	1851	<0.001
Activities: word or number games in Wave 5				
selected	890 (79.7)	128 (20.3)	833	<0.001
not selected	664 (87.4)	169 (12.6)	1018	

The p-value is calculated using T-test for means and Chi-square for crosstabs.

Table 5. Adjusted odds ratios for incidence of depressiveness by socio-demographic, socio-economic, health and behavioural characteristics among of those who did not report depressiveness in Waves 5 nor in Wave 4, separately separated for by men and women (SHARE).

Variables	Men AOR (95 % CI)	Women AOR (95 % CI)
Age in Wave 5		
age (53–95)	1.12 (0.95 - 1.32)	1.04 (0.88 - 1.22)
Education		
higher	1	1
secondary	0.81 (0.44 - 1.47)	0.73 (0.48 - 1.10)
basic	1.08 (0.56 - 2.08)	0.54 (0.30 - 0.97) *
Marital status		
married	1	1
never married	1.32 (0.59 - 2.95)	0.76 (0.39 - 1.50)
divorced	1.95 (0.90 - 4.21)	0.79 (0.45 - 1.36)
widowed	0.97 (0.43 - 2.22)	0.99 (0.63 - 1.57)
Receiving assistance in Wave 5		
yes	1	1
no	1.11 (0.47 - 2.63)	0.93 (0.58 - 1.50)
na	1.06 (0.41 - 2.76)	0.74 (0.35 - 1.58)
Employment status in Wave 5		
employed	1	1
unemployed	1.50 (0.65 - 3.47)	1.27 (0.58 - 2.76)
retired	0.92 (0.51 - 1.66)	0.91 (0.53 - 1.56)
Income in Wave 5 (2013)		
930+	1	1
320–929	0.58 (0.35 - 0.96)	1.08 (0.70 - 1.65)
0–319	0.85 (0.34 - 2.12)	0.73 (0.38 - 1.40)
Activity limitation in Wave 5		
no	1	1
yes	1.99 (1.24 - 3.18) **	0.96 (0.67 - 1.38)
Smoking in Wave 5		
current smoker	1	1
former smoker	1.13 (0.63 - 2.03)	0.91 (0.44 - 1.86)
never smoked	0.72 (0.38 - 1.37)	1.12 (0.61 - 2.05)
Alcohol use in Wave 5		
6–7 times a week	1	1
0.25–4 times a week	0.38 (0.18 - 0.80) *	0.81 (0.51 - 1.27)
less than once a month	0.76 (0.34 - 1.72)	0.97 (0.65 - 1.45)
did not use in last 3 months	0.76 (0.36 - 1.63)	1.00 (omitted)

Table 5. Continued.

Variables	Men AOR (95 % CI)	Women AOR (95 % CI)
Physical activity in Wave 5		
Moderate		
>once a week	1	1
once a week	1.28 (0.70 - 2.37)	1.58 (1.01 - 2.46) *
1–3 times a month	1.22 (0.53 - 2.81)	0.53 (0.20 - 1.40)
almost never	1.21 (0.53 - 2.73)	0.87 (0.43 - 1.75)
Satisfaction with life		
satisfaction level (0–10)	0.90 (0.81 - 1.00)	0.85 (0.77 - 0.93) **
Computer skills in Wave 5		
skill level (1–6)	0.81 (0.64 - 1.02)	0.82 (0.68 - 0.98) *
Activities: word or number games in Wave 5		
selected	1	1
not selected	1.71 (1.10 - 2.65) **	1.77 (1.24 - 2.53) **
N	824	1022
R squared	0.1072	0.0547

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

