# Reliability of the retrospective Life Chart method in late-life depression

Comparing the retrospective Life Chart with the IDS self-report questionnaire, among depressive respondents aged 60 years and older.

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Abstract

**Background:** The Netherlands Study of Depression in Older persons (NESDO) uses the retrospective Life Chart to image the course of late-life depression during a period of two years. Due to the fact that the Life Chart is a retrospective method, it appeals to someone's memory. The respondents in this study are aged 60 years and older and suffer from depression. Therefore, it is the question whether it is a reliable method to appeal on the memory of the respondents. To examine the reliability of the Life Chart, it is investigated whether there is a correlation between the Life Chart, administered at 2 year follow-up, and the Inventory of Depressive Symptoms questionnaire (IDS), that was administered every 6 months during those 2-years. Furthermore, it is investigated whether this correlation is influenced by the cognitive abilities of the respondents, their age, sex, education or their depression status at follow-up.

**Methods:** Data were used from the NESDO study (N=510). Only the respondents who were depressed at baseline were taken into account (N=378). After two years of follow-up, 285 respondents still participated in the study. There were 187 women and 98 men, with a mean age of 70.6 (SD=7.5), an average of 10.6 years of education and a mean Mini Mental State Examination (MMSE) score at two-year follow-up of 27.41 (SD = 3.372). Severity of depressive symptoms, according to the Life Chart, was obtained by asking the burden of the symptoms. Severity of depressive symptoms, according to the IDS, was obtained from 6-montly questionnaires. Cognitive functioning of respondents was assessed with the MMSE and diagnosis of depression was administered according to the DSM-IV criteria.

**Results:** Bivariate correlation analysis shows a Pearson correlation between 0.193 and 0.450. Multivariate regression analysis shows that the MMSE, as well as age, sex and education do not influence the strength of the correlation between the Life Chart and the IDS, at all three measurements, because their B changed less than 10%. On the other hand, depression at follow-up influenced the correlation between the Life Chart and the IDS, with a changed B of 19.77%. Results shows that 120 respondents who were depressed at follow-up had a lower correlation between the Life Chart and the IDS over a course of time of two years, in comparison to 49 non-depressed respondents at follow-up.

**Conclusions:** There was a correlation between the Life Chart and the IDS, which increased over time. The correlation was influenced by depression at follow-up. The correlation between the Life Chart and the IDS was lower among respondents who were depressed at follow-up, in comparison to non-depressed respondents at follow-up. However, the correlation between the Life Chart and the IDS was not influenced by the MMSE, age, sex and education. According to the results, the correlation between the Life Chart and the IDS at two years of follow-up is low, which should be a strong correlation. Moreover, the correlation at the one-year follow-up and baseline decline even further. Therefore, it is questionable whether the Life Chart is useful at all. The Life Chart is anyway not valid to use over a period longer than two years.

**Key words**: Late-life depression, course, Life Chart, IDS.

**1. Depression**

1.1. What is depression?

Depression is one of the most common mental disorders.(1,2) Depression is known as 'a persistent feeling of sadness or loss of interest'. This feeling of sadness or loss of interest is present most of the day, on a daily basis, in someone's life.(3) There are different kinds of depression. Globally, there are two groups of depression: unipolar and bipolar disorder. Unipolar disorder is also called 'regular depression'. It can be divided into two subgroups: dysthymia and major depressive disorder. With dysthymia the depressed mood is present most of the day, almost every day, for at least two years.(4,5) However, dysthymia is less severe than the episodes in major depressive disorder. Major depressive disorder includes more severe symptoms, but the episodes can last for a shorter period of time.(6) When dysthymia and major depressive disorder are present at the same time, it is called 'double depression'.(4) Bipolar disorder, on the other hand, is characterized by both depressive episodes and episodes of euphoric feelings, called manic episodes.(7)

1.2. DSM-criteria.

There are criteria to determine if someone has a depressive disorder. These criteria are defined in a categorical system, such as the Diagnostic and Statistical Manual of Mental Disorders (DSM). According to the DSM-V criteria(3), there are two core symptoms of depression: depressed feelings most of the day, almost every day and a clear decrease of interest and joy in the activities someone does during the day. This is for most parts of the day and almost every day.(4,5) Furthermore, there are seven other symptoms, which occur almost every day during depression. These are; change in weight, sleep deprivation or excessive sleep, restlessness or restrained behaviour, decrease of energy and/or feeling tired, feeling useless or incurred guilt, worsened concentration and thinking of death or the ending of life. Someone has a depressive disorder when they have at least one core symptom of depression and four other symptoms, for at least two weeks.

1.3. Depression late in life.

Depression is known as one of the most common mental disorder among the elderly.(8) Depression occurs in at least 1% to 5% of the elderly population.(9) This prevalence is based on the number of elderly who comply with the DSM-V criteria. However, elderly may have some of the symptoms of depression, but not enough to comply with the DSM-V criteria. When this is the case, these symptoms together are called 'clinically relevant depressive symptoms', also known as 'subclinical depression'. The prevalence of subclinical depression is higher than the prevalence mentioned above, because the criteria of subclinical depression are less strict. The prevalence of subclinical depression is around 13% of the elderly population.(10) When someone has 2-4 symptoms of depression, it is called a minor depression instead of a subclinical depression.(11) These symptoms have to be present for at least two weeks.(11) Minor depression occurs in 4% to 13% of the elderly.(11)

The prevalences mentioned above are based on the elderly in the community, but the prevalence of depression in nursing homes is much higher. Major depression occurs in 8%, subclinical depression occurs in 24% and minor depression occurs in 14% of the elderly population in nursing homes.(12) However, the indications of the prevalence of depression among the elderly are probably an underestimation of the real prevalence, because many elderly people go undiagnosed.(13) It is sometimes difficult to recognize depression among the elderly, because most elderly people already

suffer from physical illnesses and social problems. Therefore, most of the time, depression seems to be a normal consequence of these problems and to belong to the aging process.(13) Besides, the health care provider as well as the elderly themselves do not recognize depression most of the time, because one of the main symptoms of depression 'having depressed feelings for most of the day' is often less prominent than somatic symptoms of depression, like loss of appetite and sleep deprivation. Therefore, it is thought that the symptoms are due to the physical illnesses and social problems the elderly have, rather than depression.(13) Moreover, elderly people can suffer from memory problems or dementia and therefore do not recognise or report their own symptoms of depression.

There is a wide range of risk factors of depression in late life. These risk factors can be divided into stressors and vulnerability factors, based on the 'stress-vulnerability model', shown in figure 1. The stressors can be further divided into environmental and physical factors.(14) The first environmental factor is life events, including problems over a longer period of time, like financial or interpersonal problems.(15,16) The second environmental factor is loneliness, due to loss of loved ones, especially partners, and loss of social support due to e.g. death, retirement, migration or being unmarried.(15,17–19) Physical factors are, first of all, physical illness (chronic), like sleep disturbance or co-occurrence of physical conditions like hypertension, diabetes, stoke, cancer or disability.(15,20) It is known that there is a co-variation between disability and late-life depression.(21) Poor health leads to disability and this has a major effect on most everyday functioning.(21) It also influences the environmental factors, especially loneliness, because people are less mobile and able to do things. The second physical factor is illness with organic abnormality in the brain, such as dementia. Psychosocial factors due to illness are the last physical factors. Psychosocial factors due to illness can be e.g. loss of social support or loneliness.(21)

There are also several vulnerability factors. First of all, genetic predisposition is known as a vulnerability factor for depression. It is known that depression is a highly inherited disorder and therefore, someone can have genetic predisposition when depression occurs in the family.(22) Moreover, it is known that several genes play an important role in the pathophysiology of depression. When someone has one of these genes, they have a genetic predisposition to get a depression.(22) Secondly, earlier depression is known as a vulnerability factor. It is known that most late-life depression occurs in persons with a history of depression.(23) A third vulnerability factor is childhood trauma. It is known that childhood trauma, such as childhood abuse, is strongly related to late-life depression.(24,25) Finally, personality is known as a vulnerability factor for depression. An earlier study has shown that depression was significantly associated with higher neuroticism, lower extraversion, higher openness and lower conscientiousness.(26)

All the risk factors mentioned above are shown in figure 1. The stress-vulnerability model says that someone needs to have a certain vulnerability to become depressive when he or she is going to a difficult time, because of certain stressors.(14) When someone is not vulnerable, because the vulnerability factors shown in figure 1 are not present, there is less chance that someone will become depressed in response to certain stressors, in comparison to someone who is vulnerable.(27)

Stressors
Environmental factors
-Life events
-Loneliness
Physical factors
-Physical illness (chronic)
-Illness with organic abnormality in the brain
-Psychosocial factors due to illness

Vulnerability
-Genetic predisposition
-Earlier depression
-Childhood trauma
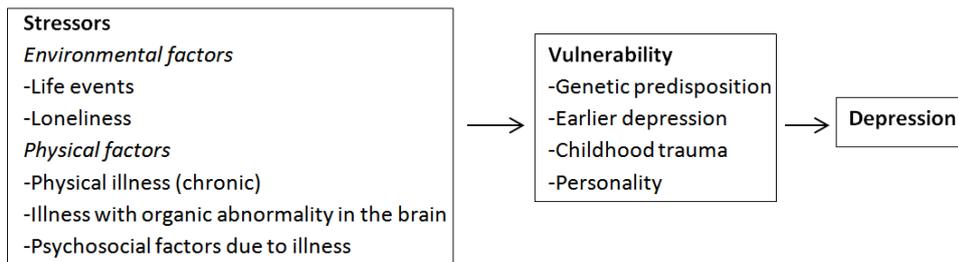-Personality

Depression

Figure 1: Stress-Vulnerability model.(14)

1.4. Course of depression.

It is known that the course of depression among the elderly is poor.(28) There are various types of courses of depression. First of all, someone can be in remission. This is a reduction, or a loss, of symptoms of depression, for a period of time.(5) The remission period is usually for at least eight weeks.(5) Secondly, someone can have a relapse after remission. When someone has a relapse, the depression is back again. Lastly, someone can have a recurrence. This is when someone's depression is gone for at least two months since the initial episode and returns within five years.(5,29) There are several risk factors for relapse and recurrence, e.g. history of depressive episodes, underlying presence of chronic-depression, comorbid illness and age.(5) These risk factors increase when the age of people increases.(30) This way, it will have a negative influence on the course of depression.

The difficulty about the course of depression among the elderly is the fact that most of the elderly do not meet the DSM-V criteria. There is a grey area between the DSM-V criteria and normal sadness. This grey area is seen frequently among the elderly and this makes it difficult to determine a reliable course of depression.(31) Moreover, the course of depression among the elderly is not based on the most severe cases of depression, because the most depressed people will live the shortest time, so they will not be able to reach a high age.(29)

Due to the fact that age is a risk factor for a poor course of depression, the chance that depressive episodes in elderly people will pass is less likely. Different studies have followed the course of depression over time. These studies generally show remission between a rate of 30% to 40% after 2 to 3 years.(31) The prognosis of depression is less positive for people with dysthymia and the worst for people with double depression.(32) A follow-up study is done by Mueller et al. (2004), which shows, with a 15 year-prospective study, that the median time for recovery for people between 65 and 79 years old is 12 weeks and the median time of recurrence is 90 weeks.(33) The time of recovery was the same for younger respondents, but the time of recurrence was shorter in elderly respondents.

Another follow-up study is done by Beekman et al. (2004), who did a follow-up study of six years and found that 14% of the elderly were depressed less than 20% of the time and 46% of the elderly were depressed more than 60% of the time.(31) After six years, there was a remission rate of 23%, a remission with a relapse rate of 12% and a chronic depression rate (sometimes intermittent) of 64%.(31) Chronic depression occurs mostly in people with double depression and is higher among the elderly compared to younger people. Cognitive impairments and disability were predictive factors for the duration and course of depression.(31)

At last, the Netherlands Study of Depression in Older persons (NESDO) did a follow-up study of two years, to examine the course of depression in the clinically depressed elderly aged 60 years and older.(34) The study shows that, according to the Composite Interview Diagnostic Instrument (CIDI),

48.4% of the respondents who were depressed at baseline were still depressed two years later.(34) The study also shows, according to the Inventory of Depressive Symptomatology Self-report questionnaire (IDS), that there was a recurrence rate of 20%, a remission rate of 19% and a chronic course of depression rate of 61%, of which severe chronic depression was 24%, mild to moderate chronic depression was 26% and chronic depression with variable severity was 11%.(34) The severity of the symptoms was high, even when the respondents did not have a diagnosis of depression. This is because these respondents still had symptoms, but not enough to meet the DSM-V criteria.

## 2. Measuring course of depression

There are several methods to examine depression and the course of depression. Frist of all, the Beck Depression Inventory (BDI), which is one of the most used rating scale, done by the respondents themselves.(35) There is also a measurement for elderly people, called the Geriatric depression scale (GDS). This measurement is useful for people who suffer from mild dementia or other cognitive impairments.(36) Furthermore, there is the Hamilton Rating Scale for Depression (HRSD), which measures the severity of symptoms people diagnosed with depression have(37), the Montgomery-Asberg Depression Rating Scale (MADRS), which measures the effects of treatment on depression(38) and the IDS, which measures depressive signs and symptoms in the past week and is comparable to the HRSD.(39) There is a self-reported and a clinical version of the IDS. The self-reported IDS will be used in this study.

To get the full picture of the course of depression, it is important that the assessments take place regularly. When the assessments do not take place regularly, the intervals between the assessments will be too long. This will lead to a lack of available information about the course of depression between the assessments and therefore the results will be less reliable.

Besides the fact that assessments have to take place regularly, the instruments that are used need to be reliable. This means that when the assessments will be repeated, the results have to be the same in comparison to the first time the instrument was used.(40,41) Moreover, the validity also needs to be as good as possible. The validity shows how well the instrument actually measures the aspects, which needs to be assessed by using the instrument.(42,43) At last, the sensitivity of the instrument has to be as high as possible. This means, e.g. when someone is depressed, the assessment also shows that someone is depressed. So the results of the assessment have to correspond with reality.(42)

## 3. Life Chart

3.1. Functioning of the Life Chart

One of the methods to determine the course of depression is using the Life Chart. The Life Chart shows the course of depression in detail, among a longer period of time, by asking respondents about previous depressive episodes. To increase the chance that the respondent is able to recall his or her memory in detail over a longer period of time, their memory will be refreshed. This is done by asking the respondent to name one or two important events in the period that has to be remembered. These important events will be filled in on a year calendar. This is done for all periods that have to be remembered. This way, the depressive episodes will be recalled better. Then, the depressive episodes will be determined. This is done by asking if the respondent was feeling depressed, had a loss of interest or if neither of these feelings were present in each month of a certain time period. When the respondent was depressed or had loss of interest, the burden of these

depressive feelings were asked. In this study, the Life Chart will be administered for a period of two years.
It is also possible to amplify the information of the respondent with information family and friends have, although, this is not done with the Life Chart in this study.

The Life Chart has been used before in several studies, like the Netherlands Mental Health Survey and Incidence Study (NEMESIS) and with studies of the National Institute of Mental Health (NIMH).(44,45) The Life Chart is also used in several studies to evaluate the effect of treatment on the course of an illness. However, until now there are no studies that used the Life Chart with an elderly population.

3.2. Pros and cons of the Life Chart
Positive of the Life Chart is the fact that it is a flexible method and it is able to adapt to respondents. When a respondent does not remember periods within a year, the rest of the periods can be administered, so the Life Chart is still useful. With the Life Chart, it is also possible to take comorbidity into account, by listing other illnesses that are pointed out by the respondent, besides depressive episodes and/or loss of interest. Another benefit is that administering the Life Chart is an easy way to learn for the interviewer. Furthermore, the Life Chart informs respondents about their own course of depression, by composing a clear image of their course on paper.(46) Moreover, the Life Chart is an inexpensive method to get information from a large group of respondents and there are no ethical issues with administering the Life Chart.(47–49) A last positive point of the Life Chart is the fact that it shows when episodes are associated with stress factors, like losses, separation, the change of season and more. This can give insight in the respondent's stress reactivity. However, there are also disadvantages of the Life Chart. First of all, it is a retrospective method. Therefore, the reliability of the outcome depends on how accurate the memory of the respondent was at the moment the Life Chart was administered. Memory is not always a reliable factor and can therefore have a negative influence on the results of the Life Chart. Moreover, it is known that mood can influence the memories of the respondent.(50) This can be negatively as well as positively. When this is the case, it will lead to false memories and therefore the results of the assessment will not be reliable.(51,52) Furthermore, previous research have shown that autobiographical memory of respondents with a major depression shows an overgeneralization of memories.(53) This means that these memories are primarily factual or repeated information and there is less information specific in time and place.(53) The information necessary for the Life Chart is specific in time and therefore it is doubtful whether the outcome of the Life Chart is reliable. Besides the fact that the mood of the respondents can influence their memory, it is also possible that the mood of the memories themselves influence the memory of the respondents. When e.g. a respondent has to think about two events that happened in the past year and the respondent thinks about someone who died and when he had a fight with a good friend, this can influence their memory because these are negative memories. However, previous research have shown that emotional content of memories does not necessarily influence memory accuracy.(54) So, there is less chance that this will influence the reliability of the Life Chart. Another disadvantage of the fact that the Life Chart is a retrospective method is the chance that the opportunity for follow-up will be lost, and this can cause bias.(47) The loss of a chance to follow-up is higher with the Life Chart than with the IDS, because when a respondent drops out of the study, there is no information on the Life Chart of the respondent. On the other hand, there is still information from the IDS, because the IDS is done more frequently and therefore a longer period of time with information of the respondent is left.

**4. This research**

4.1. What will I investigate?

Because it is not known yet how reliable the Life Chart is, especially in an elderly population, I will examine this with the Life Chart used in NESDO.(55,56) To determine the reliability of the Life Chart, the Life Chart will be compared with the IDS.(55,57) To investigate this, my first research question (RQ1) will be: Is there a correlation between the Life Chart, which was administered at two-year follow-up (FU), and the IDS self-report questionnaire? Expected is that the correlation between the Life Chart and the IDS is strong at two-year FU and decrease over time, with a low correlation at baseline. There are several reasons to expect this. First of all, the respondents of the NESDO study were aged 60 years and older. This means that they could suffer from memory problems, as a consequence of age related memory impairment (AAMI). It is known that the prevalence of AAMI is generally rated at 19%.(58) This way, it can be difficult for the respondents to recall their depressive episodes of the last two years and this will make the Life Chart less reliable or useless. To investigate whether memory problems influence the association between the Life Chart and the IDS, I will look at the Mini Mental State Examination (MMSE), which measures the cognitive functioning of the respondents. Therefore, research question 2 (RQ2) will be: Will the correlation between the Life Chart and the IDS be influenced by the MMSE? Furthermore, it is not clear yet if age, sex and education influence the recall of events.(59) Therefore, research question 3 (RQ3) will be: Will the correlation between the Life Chart and the IDS be influenced by age, sex and education? Finally, many NESDO respondents suffer from depression. It is known that depression can have a negative influence on memory.(60) This way, when respondents were depressed at the moment the Life Chart was administered, this can negatively influence their memories. Therefore, research question 4 (RQ4) will be: Will the correlation between the Life Chart and the IDS be influenced by depression at FU?

4.2. Relevance of this research

It is important to test the reliability of the Life Chart for future research with NESDO data. When information about the reliability of the Life Chart is available, it can be decided whether or not the Life Chart will still be used in the NESDO study and if the outcomes of the Life Chart are suitable to be used in further research. Besides the fact that it is important for the NESDO study, it is also necessary to know whether the Life Chart should be used in other, new studies or not. It will give a clear picture of the suitability of the Life Chart, something that has not been done before.

<u>Method</u>

**1. Study**

This study uses data from NESDO. This is a prospective cohort study. NESDO follows persons aged 60 years and older with one of the following depressive disorders; minor depression, major depression or dysthymia. The respondents suffer from different stages of depression. The aim of NESDO is to study the course and its determinants of depressive disorders in elderly people. This way, the quality of care for older persons who suffer from depression can be improved, as well as preventing chronicity of depression.(56)

The respondents who are depressed were recruited from mental health care institutes in the regions; Amsterdam/Haarlem, Leiden/Den-Haag, Apeldoorn/Zutphen, Groningen and Nijmegen. The respondents who functioned as a control group were recruited from primary care practices in the regions; Amsterdam, Leiden and Groningen. They were recruited through a screening procedure.

**2. Inclusion and exclusion criteria**

People were included in the study when they were aged 60 years or older and suffer from depression at various stages. Depression was diagnosed using the CIDI, a method designed by the World Health Organisation to assess mental disorders.(61) The CIDI is based on the DSM-IV criteria to determine if someone has a depressive disorder. The controls were included in the research when they were aged 60 years or older and no diagnosis of depression or dementia was present in their lifetime.

People who had or were suspected of dementia, or with a primary diagnosis of bipolar disorder, or a psychotic disorder were excluded from the study. This was the same for people who had less than 18 of 30 points on the MMSE. Moreover, when people did not command the Dutch language well enough, they were also excluded from the study.

**3. Times of assessment**

The time to FU was 2 years. Both the controls and the depressive respondents had an interview at the start of the study, called baseline, and after two years. Each half-year, all the respondents filled in a written questionnaire, in which the IDS was included. The Life Chart was administered during the interview after two years.

**4. Participants**

In total, 510 persons aged 60 years and older participated in NESDO. From the 510 respondents, 378 were diagnosed with a depressive disorder and 132 were controls. From Amsterdam/Haarlem, 113 respondents participated in the study, from Leiden/Den-Haag there were 70 respondents, Apeldoorn/Zutphen had 50, Groningen had 46 and Nijmegen had 47 respondents. The age of the respondents was between 60 and 93 years old, with a mean age of 70.6 years. The research population consists of 331 (64.9%) women and 179 (35.1%) men. The average number of years of education is 11.0 (SD = 3.6; range 5-18 years). The average sore of the MMSE at two-year FU is 27.69 (SD = 3.0; range 0-30) .

**5. Variables**

The predictor variable of this study is the Life Chart. When the Life Chart is administered, the depressive mood is asked for every month of the past two years. The first question is: 'Did you feel depressed in this month?' The respondents can answer yes or no. This variable is called 'Life Chart-depressionyes/no'.

When the answer is yes, the second question will be: 'What was the burden of these depressive feelings for you?' The respondents can answer that no burden was present, or a small burden, fair burden, high burden or severe burden. When the respondent answers the first question with no, the burden is categorized as no burden. This variable is called 'Life Chart-burden'.

Based on the data of the Life Chart, there is made another variable, called 'Life Chart-course of depression'. This variable shows whether respondents are depressive over a period of two years and is divided in the categories: no depression, depression but not chronic and chronic depression.

The outcome variable is the IDS questionnaire. The IDS is scored on a 4 point scale and total scores range from 0 to 84.(62,63) This variable is called 'IDS-totalscore'. The scores can subsequently be divided into severity categories, where an IDS score between 0 and 13 is categorized as no depression, a score between 14 and 25 is categorized as mild depression, a score between 26 and 38 is categorized as moderate depression, a score between 39 and 48 is categorized as severe depression and a score between 49 and 84 is categorized as very severe depression.(62) The variable about the severity classification of the IDS is called 'IDS-severity'.

Based on the data of the IDS there are made two other variables. First of all, a variable which shows whether the respondent was depressive yes or no. An IDS score of thirteen and lower is defined as no depression and an IDS score of fourteen and more is defined as depression. This variable is called 'IDS-depresionyes/no'. Secondly, a variable that shows the course of depression over two years. This variable is called 'IDS-course of depression' and is divided in the categories: remission (at least two observations with IDS score <14), recurrent (at least one observation with IDS score <14, but not the last two observations), variable severity (IDS scores varying between 14 and 84), chronic mild/moderate (all IDS score between 14 and 26) and chronic moderate/severe (all IDS scores between 26 and 84).(34)

There are also variables that may influence the correlation between the Life Chart and the IDS. First of all, the MMSE is taken into account. The range of the MMSE is between 0 and 30, where a higher score of the MMSE means a better cognitive functioning. Furthermore, age, sex and education are taken into account. The age of the respondents is between the range of 60 and 93. The sex of the respondents is either male or female. Education is defined as years of education, with a range between 5 and 18 years. Finally, whether respondents are depressive at FU is taken into account. It will be investigated whether a respondent was depressed at FU and whether their Life Chart is correlated with their IDS scores, for all three time measurements. When the correlation between the Life Chart and the IDS was good on all three time measurements, this is defined as a good correlation. When the correlation between the Life Chart and the IDS was not good at one or more time measurements, this is defined as a poor correlation. A good correlation on a certain time measurement is defined as the category of the burden of depressive symptoms corresponds with the IDS total score category. The fact that respondents were depressed at FU is based on DSM-IV diagnosis, administered during the interview at two-year FU.

**6. Statistical analysis**

All statistical procedures were computed with the aid of the software package SPSS 22.0 (IBM SPSS, Chicago, IL). To study whether there is a correlation between the Life Chart and the IDS (RQ1), a bivariate correlation is done. Bivariate correlation will show a Pearson correlation, which investigate the strength of the correlation between the Life Chart and the IDS. The value of the correlation lies between 0 and 1, whether a correlation around 0 is known a no correlation, a correlation around 0.20 is known as a weak correlation, a correlation around 0.50 is known as a moderate strong correlation, a correlation around 0.80 is known as a strong correlation and a correlation around 1 is known as a perfect correlation. To study the correlation between the Life Chart and the IDS further, the correlation between other variables of the Life Chart and the IDS will be investigated with a correlation coefficient. The variables that will be compared are; Life Chart-depression yes/no and IDS-depression yes/no, Life Chart-burden and IDS-severity and final, Life Chart-course of depression and IDS-course of depression.

To study whether the correlation between the Life Chart and the IDS will be influenced by the MMSE score (RQ2), multivariate regression analysis will be done. The burden of the depressive symptoms administered with the Life Chart and the MMSE score will be the independent variables and the IDS total scores will be the dependent variable. Multivariate regression analysis will show a B-coefficient, which shows the strength of the correlation between the Life Chart and the IDS and a p-value which shows the significance of the correlation, where $p<0.05$ is significant.(64) The MMSE will be considered as a factor that influences the correlation between the Life Chart and the IDS when the B-coefficient changes at least ten percent.(65)

The influence of age, sex and education on the correlation between the Life Chart and the IDS will also be studied by using multivariate regression analysis (RQ3). Age, sex and education will also be considered as factors that influence the correlation between the Life Chart and the IDS when their B-coefficient changes at least ten percent.

Finally, to study whether depression at FU will influence the correlation between the Life Chart and the IDS (RQ4), multivariate regression analysis will be done. The same applies for depression at FU, it will be considered as a factor that influences the correlation between the Life Chart and the IDS when the B-coefficient changes at least ten percent. Furthermore, a cross table will be made to present the amount of depressed and non-depressed respondents at FU and their correlations between the Life Chart and the IDS.

Results

From the 378 depressed respondents, 285 still participate after two years of FU. There was loss to FU of 93 respondents, due to decease, refusal, no possibility to participate or there was no contact with the respondent available.(34) Of the 285 respondents, 187 (65.6%) were women and 98 (34.4%) were men, with a mean age of 70.6 (SD: 7.5; range = 60-90). The average number of years of education was 10.6 (SD: 3.4; range 5-18 years). Table 1 presents the characteristics of the study sample.

*Table 1: Characteristics of the study sample (respondents diagnosed with depression at baseline, after two years of follow-up).*

|  | Depressed respondents (N=285) |
|---|---|
| *Socio-demographics* |  |
| - Mean MMSE at two-year follow-up (sd) | 27.41 (3.372) |
| - Mean age (sd) | 70.6 (7.5) |
| - Female gender, n (%) | 187 (65.6) |
| - Years of education, mean (sd) | 10.6 (3.4) |
| - # Depressed respondents at follow-up | 144 |
| *Clinical characteristics according to the Life Chart* |  |
| - # Months with depression in two years, mean (sd) | 11.35 (11.12) |
| - % of time with depressive symptoms, mean | 45 |
| - Chronic depression in two years, n (%) |  |
|  - No depression | 110 (38.6) |
|  - Depression, not chronic | 79 (27.7) |
|  - Depression, chronic | 96 (33.7) |
| *Inventory of depressive symptomatology (self-report)* |  |
| - Total score at baseline, mean (sd) | 29.7 (12.8) |
| - Severity classification at baseline, n (%)* |  |
|  - None | 28 (9.8) |
|  - Mild/moderate | 182 (63.8) |
|  - Severe/very severe | 72 (25.3) |
| - Total score at one-year follow-up, mean (sd) | 25 (12.8) |
| - Severity classification at one-year follow-up, n (%)* |  |
|  - None | 51 (17.9) |
|  - Mild/moderate | 163 (57.2) |
|  - Severe/very severe | 35 (12.3) |
| - Total score at two-year follow-up, mean (sd) | 23.7 (12.9) |
| - Severity classification at two-year follow-up, n (%)* |  |
|  - None | 72 (25.3) |
|  - Mild/moderate | 166 (58.3) |

| | | |
|---|---|---|
| - Severe/very severe | 45 (15.8) | |
| - Course of depression over two years, n (%) | | |
| - Remission | 50 (17.5) | |
| - Recurrent | 49 (17.2) | |
| - Variable severity | 31 (10.9) | |
| - Chronic mild/moderate | 66 (23.2) | |
| - Chronic moderate/severe | 60 (21.1) | |

*Does not add up to 285 respondents due to missing values.

### Research question 1:

To investigate whether there was a correlation between the Life Chart and the IDS, a bivariate correlation analysis is performed. Therefore, the Pearson correlation, seen in table 2, was used. The Pearson correlation at baseline is 0.193. This is known as a weak correlation.(66) However, the Pearson correlations at one-year FU and two-year FU are higher, respectively 0.327 and 0.450. These correlations are known as moderate strong correlations.(66)

*Table 2: Pearson correlation coefficients to investigate the correlation between the Life Chart and the IDS.*

| | Baseline | One-year follow-up | Two-year follow-up |
|---|---|---|---|
| - Life Chart-burden and IDS-totalscore | 0.193 | 0.327 | 0.450 |
| - Life Chart-depressionyes/no and IDS-depressionyes/no | -0.203 (p=0.001) | -0.276 (p<0.001) | -0.317 (p<0.001) |
| - Life Chart-burden and IDS-severity | 0.184 (p=0.007) | 0.321 (p<0.001) | 0.429 (P<0.001) |
| | **Course over two years** | | |
| - Life Chart-course of depression and IDS-course of depression | -0.343 (P<0.001) | | |

Also, an univariate regression analysis is performed. These results are shown in table 3. It shows that there is a positive relation between the burden of depression according to the Life Chart and the IDS total scores, at baseline, one-year FU and two-year FU.

*Table 3: Results of univariate and multivariate regression, to investigate the correlation between the Life Chart-burden and the IDS-totalscore.*

| | B (se) | β | P-value |
|---|---|---|---|
| *Life chart, baseline* | | | |
| Life Chart | 1.972 (0.599) | 0.193 | 0.001 |
| -Adjusted for age | 1.892 (0.607) | 0.185 | 0.002 |
| -Additionally adj. for sex | 1.940 (0.605) | 0.190 | 0.001 |
| -Additionally adj. for education | 1.924 (0.603) | 0.188 | 0.002 |
| *Life Chart, one-year follow-up* | | | |
| Life Chart | 3.165 (0.582) | 0.327 | <0.001 |
| -Adjusted for age | 3.228 (0.584) | 0.333 | <0.001 |
| -Additionally adj. for sex | 3.244 (0.584) | 0.335 | <0.001 |
| -Additionally adj. for education | 3.224 (0.584) | 0.333 | <0.001 |
| *Life Chart, two-year follow-up* | | | |
| Life Chart | 5.438 (0.644) | 0.450 | <0.001 |
| -Adjusted for MMSE | 5.467 (0.664) | 0.453 | <0.001 |
| -Additionally adj. for age | 5.461 (0.643) | 0.452 | <0.001 |
| -Additionally adj. for sex | 5.480 (0.643) | 0.454 | <0.001 |
| -Additionally adj. for education | 5.481 (0.644) | 0.454 | <0.001 |
| -Additionally adj. for depression at follow-up | 4.363 (0.636) | 0.361 | <0.001 |

Furthermore, the correlation between the Life Chart-depressionyes/no and the IDS-depressionyes/no is investigated. Table 2 shows a negative relation, with weak Pearson correlations, although, the correlations becomes stronger for every year.

Moreover, the correlation between the Life Chart-burden and the IDS-severity is investigated. Table 2 shows a positive relation, with moderate strong Pearson correlations. In this case, the correlations become also stronger for every year.

Finally, the correlation between the Life Chart-course of depression and the IDS-course of depression is investigated. Table 2 shows a moderate strong, negative Pearson correlation of -0.343 (P<0.001).

**Research question 2:**
To investigate whether the correlation between the Life Chart and the IDS is influenced by poor cognitive functioning, a multivariate regression is performed, by using the MMSE. Table 3 shows the MMSE at two-year FU. It is seen that the MMSE does not influence the correlation between the Life Chart and the IDS, because the B changes less than ten percent.

**Research question 3:**
To investigate whether age, sex and education may influence the correlation between the Life Chart and the IDS, also a multivariate regression analysis is performed. Table 3 shows, that age, sex and education do not influence the correlation between the Life Chart and the IDS at all three time measurements, because their B-coefficient changes less than 10 percent.

**Research question 4:**
Finally, to investigate whether depression at FU influenced the correlation between the Life Chart and the IDS, multivariate regression analysis is performed. The result is seen table 3. It shows that the B-coefficient changes 19.77%, which is more than ten percent. This means that depression at FU influenced the correlation between the Life Chart and the IDS.

Furthermore, a cross table is made to show the difference between depressed and non-depressed respondents at FU and their correlation between the Life Chart and the IDS, which is seen in table 4. It shows that respondents who were depressed at FU more often had a poor correlation between the Life Chart and the IDS, in comparison to non-depressed respondents at FU.

*Table 4: Difference in the correlation between the Life Chart and the IDS, for depressed and non-depressed respondents at follow-up. Good correlation= burden category corresponds with the IDS total score at all three time measurements. Poor correlation= burden category does not correspond with the IDS total score on at least one time measurement.*

|                            | Good correlation | Poor correlation | Total |
|----------------------------|------------------|------------------|-------|
| -Depression at follow-up   | 24               | 120              | 144   |
| -No depression at follow-up| 43               | 49               | 92    |
| -Total                     | 67               | 169              | 236*  |

\* Does not add up to 285 respondents due to missing values.

Discussion

This study has shown a correlation between the Life Chart and the IDS, which increased over time. The correlation between the Life Chart and the IDS was moderate strong at two-year FU and decreased to a low correlation at baseline. This means that the further back in time the respondent was asked about his or her depression, the less well the Life Chart and the IDS correspond with each other.

Furthermore, the study showed that the correlation between the Life Chart and the IDS was not influenced by the MMSE of the respondents. Moreover, the correlation between the Life Chart and the IDS was also not influenced by age, sex or education. However, the correlation between the Life Chart and the IDS was influenced by whether respondents were depressed at FU or not. The study showed that the correlation between the Life Chart and the IDS over a course of two years was lower for respondents who were depressed at FU in comparison to non-depressed respondents at FU. The hypothesis, that the correlation between the Life Chart and the IDS is strong at two-year FU and decreases over time with a low correlation at baseline, is partially confirmed. It is true that the correlation between the Life Chart decreased over time and that there is a low correlation at baseline. However, it is not true that the correlation between the Life Chart and the IDS at two-year FU is strong. The correlation at two-year FU is 0.450. This is known as a moderate strong correlation. Expected was that the correlation between the Life Chart and the IDS at two-year FU would be around 0.80.

The results about the correlation between the Life Chart and the IDS cannot be compared to previous studies, because it is something that has not been done before. However, explanations as to why the correlation between the Life Chart and the IDS is not strong can already be thought of. First of all, it can be due to the fact that the IDS is more of a snapshot of how someone has felt that week, while the Life Chart is more of an overview of how someone has felt that month. It is possible that someone has had some bad days and that therefore the IDS score is high that week, but it is possible that someone has felt all right the rest of the month, so the burden of the depression according to the Life Chart is low. Secondly, the severity of depression according to the IDS is based on 28 questions, which are based on the DSM-IV criteria. However, the severity of depression according to the Life Chart is only based on one question which is not based on the DSM-IV criteria. So the Life Chart and the IDS measure the severity of depression in different ways and this could lead to different results. Moreover, due to the fact that the questions used in the IDS are well explained multiple-choice answers, there is a low chance of misinterpretation by the respondent. However, the question used in the Life Chart can only be answered by choosing between different categories of severity. It is not explained clearly when to choose which category. Therefore, there is a higher chance of different interpretations by the respondents, because every person experienced their severity of depression in a different way. When there are no clear explanations for when to choose a certain category, every respondent will answer the question from their own perspective, which can lead to different outcomes of the Life Chart and the IDS. A last explanation can be that the Life Chart is an interview and the IDS is a questionnaire. It is possible that respondents feel more comfortable answering the questions when they are in a questionnaire which is send to their homes, instead of an interview where they have to tell someone how they have felt in the past two years. It is possible that respondents are uncomfortable with explaining their feelings to an interviewer or that they are ashamed about their depressive feelings. This can influence the results of the Life Chart, and in this way the correlation between the Life Chart and the IDS.

The results of the factors which can influence the  correlation between the Life Chart and the IDS can be compared with previous studies, because their role as influenced factors has been studied before. First of all, the results of this study showed that the MMSE does not have an influence on the association between the Life Chart and the IDS. This means that cognitive functioning, and therefore cognitive impairment, does not influence the reliability of the Life Chart. Although, several studies have shown that depression is associated with cognitive impairment and memory problems.(67–69)

Based on these studies, it is expected that the MMSE has an influence on the correlation between the Life Chart and the IDS, but this is not the case. The fact that the result is not in line with previous studies could be caused by the possibility that the MMSE is not sensitive enough to actually measure cognitive impairment and therefore does not measure when someone suffers from a decline in cognitive functioning. Moreover, it is possible that the kind of memory that is measured with the MMSE differs from the kind of memory that is used during administering the Life Chart. During administering the Life Chart the respondent had to remember emotional periods from the past. So emotions are part of his or her memories. On the other hand, during administering the MMSE, no emotional memories were asked. Therefore, it is possible that the MMSE measures another kind of memory than is used during administering the Life Chart.(70) This would explain how memory maybe does have an influence on the correlation between the Life Chart and the IDS, but that this influence will not be measured by using the MMSE.

Secondly, the results of this study showed that age does not have an influence on the correlation between the Life Chart and the IDS. However, previous studies have shown that memory problems are a manifestation of the normal ageing process.(71,72) Therefore, it should be expected that the respondents suffer from memory problems and that age will have an influence on the correlation between the Life Chart and the IDS. This is not the case, which is not in line with the previous studies. Thirdly, the results of the study showed that sex does not have an influence on the correlation between the Life Chart and the IDS. However, previous studies have shown that women have a better episodic memory, which is also used during administering the Life Chart.(73,74) Moreover, it is shown that the prevalence of mild cognitive impairment is higher among men than women.(75) Therefore, it should be expected that the correlation between the Life Chart and the IDS was stronger among women than men. Although, the results of the study have shown no difference between men and women, so this in contrast with earlier studies.

Finally, the results of the study showed that education does not have an influence on the correlation between the Life Chart and the IDS. Although, previous studies have shown that a higher educational was associated with higher performance in recall.(76,77) It should be expected that respondents with a higher education level will be able to recall their memories better and therefore will have a stronger correlation between the Life Chart and the IDS. However, this is not the case in this study, so this is also in contrast with the literature.

On the other hand, according to the results of the study, it can be said that the low correlation between the Life Chart and the IDS is partly caused by depression. This is in line with the literature. Previous studies have shown that depressed respondents experience significant difficulties retrieving specific autobiographical memories.(78) This can be caused by the fact that respondents recall memories less specifically, so there is a lower chance of negative or painful emotions. This can be a mechanism to protect themselves.(78) As mentioned above, other investigations have shown that there is an association between depression and (mild) cognitive impairment and memory problems.(62-64) It is possible that depression has influence on the cognitive functioning and memories of the respondents, but not enough to cause an effect on its own, shown by the influence of the MMSE.

Lyketsos et al. invented the Life Chart in 1993.(59) According to Lyketsos et al. it was not known yet how far back in time data could be collected reliably.(59) Since then, this was never studied, until this study was done. According to the results of this study it is questionable whether the Life Chart is useful at all. There was a moderately strong correlation between the Life Chart and the IDS at two-

year FU, instead of a strong correlation. This means that even results of this moment do not correlate between the Life Chart and the IDS and this is a worrying result. Furthermore, it can be said that collecting data from two years back in time is maybe reliable, but collecting data from more than two years back in time will probably not be reliable anymore. For two years of FU, the correlation at baseline was low. When there will be more years of FU, the correlation at baseline will probably further decrease, which makes it unreliable. Therefore, I recommend collecting data with the Life Chart over a period of no longer than two years.

During the NESDO study, the Life Chart was also administered after four years of FU. It is expected that these Life Chart results will not be reliable, so the Life Chart of four years of FU will probably not be useful.

Furthermore, due to the fact that the MMSE does not influence the correlation between the Life Chart and the IDS, the Life Chart will probably be unreliable when it is administered among younger respondents. The Life Chart is administered among younger respondents during The Netherlands Study of Depression and Anxiety (NESDA), which is highly comparable with the NESDO study. The respondents of the NESDA study were between 18 and 65 years old.(79) Due to the results of this study, it is expected that the outcomes of the Life Chart of the NESDA study will probably be reliable for two-years of FU, but not for four years, six years and nine years of FU.

The Life Chart is also often used to determine the influence of a treatment on the course of depression, especially with bipolar disorder.(80,81) It is therefore important to know that the outcome of the Life Chart is reliable when the course of depression is not asked more than two years back in time. However, the results of this study show that the reliability of the Life Chart is not always good, so it is questionable whether the Life Chart is a good method to investigate the effect of a treatment. Since the reliability of the Life Chart at baseline was low, there is a high chance that a respondent does not remember the effect of a treatment two years ago well enough. This can have negative consequences when e.g. wrong treatments are chosen, based on the Life Chart results.

Based on this study, some limitations need to be acknowledged. The most important limitation is the fact that the Life Chart data are assessed retrospectively and therefore the data might be biased by selective recall. However, to reduce this limitation as well as possible, the memory of the respondent was refreshed by asking after one or two important events for each year the Life Chart was administered, so the respondents received a clearer image of each year. However, it will still be difficult to determine whether there is a chance of underreporting or over-reporting of the depressive episodes and the burden of the depressive symptoms. Underreporting may be caused by memory problems or not wanting to remember painful memories. Over-reporting may be caused by a depressive mood during the administering of the Life Chart or when it is difficult for respondents to judge the burden of their depressive symptoms during depressive episodes at the moment that they are no longer depressed.

Another limitation is the fact that this study was a cohort study. Therefore, the sample, based on certain regions in the Netherlands, limits generalizability.

On the other hand, this study has some important strength. First of all, a major strength of the study is the large study sample. Due to close contact between the researchers and the respondents, most of the respondents felt involved in the study and therefore were willing to participate. This way, there were few missing values through the years and the study sample remained large. Secondly, good measurement methods are used during the study. The IDS questionnaire is well suited to older

people.(82) The Life Chart used in the study consists of giving the severity of the depressive symptoms a number and doing this for every month for the past two years. In most other studies, the Life Chart consists of a vas-scale, where a higher line means a higher burden of depressive symptoms.(46) However, this method is less reliable, because the difference between the heights of the lines is sometimes difficult to see and a higher level of personal interpretation is possible. The Life Chart used in this study has, on the other hand, no chance of personal interpretation, because of the use of numbers, which make this a more reliable method. Also the CIDI, used to diagnose depression among the respondents, is a reliable method. By using the CIDI, there was little chance of misdiagnosis. A third positive aspect of the study is the fact that measurements of the IDS were done frequently, so the time between each correlation of the Life Chart and the IDS was not too long. This makes the results reliable. A final, major strength, of the study is the fact that this is the first study that describes the correlation between the Life Chart and the IDS. There are several studies which have investigated the correlation between the Life Chart and the IDS, but in these cases the Life Chart was a prospective method. There are studies which have worked with the retrospective Life Chart, but their Life Chart was not compared with the IDS. Therefore, this study has shown new insight in the correlation between the Life Chart and the IDS.

Now that the correlation between the Life Chart and the IDS has been investigated, further research can be done. It is now possible to investigate whether the expectation that the Life Chart will not be reliable anymore at four years of FU will be correct.
Furthermore, it is possible to compare the Life Chart with other methods of measurement instead of the IDS questionnaire. The BDI, as well as the GDS, HRSD and the MADRS are frequently used methods to assess depression and the course of depression. It can be investigated whether there is a correlation between the Life Chart and these methods and what the differences between the correlations of these methods are.

References

1.  Degenhardt L, Whiteford H, Ferrari J, Baxter J, Charlson FJ, Hall WD, et al. Global burden of disease attributable to illicit drug use and dependence: findings from the Global Burden of Disease Study 2010. Lancet [Internet]. 2013;382(9904):1564–74. Available from: http://www.ncbi.nlm.nih.gov/pubmed/23993281

2.  Prince M, Patel V, Saxena S, Maj M, Maselko J, Phillips MR, et al. No health without mental health. Lancet. 2007;370(9590):859–77.

3.  American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders (DSM-5). 5th ed. American Psychiatric Pub; 2013. 155-188 p.

4.  Meeuwissen JAC, Hagemeijer A. DEPRESSIE (eerste revisie). 2010;54–60.

5.  Richards D. Prevalence and clinical course of depression: A review. Clin Psychol Rev [Internet]. Elsevier B.V.; 2011;31:1117–25. Available from: http://dx.doi.org/10.1016/j.cpr.2011.07.004

6.  De Graaf R, Van Dorsselaer S. De psychische gezondheid van de Nederlandse bevolking. 2010.

7.  Goodwin FK, Jamison KR. Manic-Depressive Illness: Bipolar Disorders and Recurrent Depression. 2th ed. Oxford University Press; 2007. 9-12 p.

8.  Parkar SR. Elderly Mental Health: Needs. Mens Sana Monogr. 2015;13(1):91–9.

9.  Fiske A, Wetherell J, Gatz M. Depression in older adults. Annu Rev Clin … [Internet]. 2009;363–89. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2852580/

10. Comijs H. Somatische en psychische problematiek bij ouderen; samenhang en zorggebruik. Longitud Aging Study Amsterdam. 2012;1–26.

11. Alexopoulos GS. Depression in the elderly. Lancet. 2005;365(panel 1):1961–70.

12. Jongenelis K, Pot M, Eisses MH, Beekman TF, Kluiter H, Ribbe MW. Prevalence and risk indicators of depression in elderly nursing home patients: The AGED study. J Affect Disord. 2004;83(2-3):135–42.

13. Comijs H. De diagnostiek van depressie bij ouderen. Psychopraktijk. 2014;5(1):51–7.

14. Comijs HC. Ouderen met psychische problemen: depressie en angstklachten. In: van Vliet J, Jukema JS, editors. Perspectieven op ouder worden en de sociaal professional. Den Haag: Boom Lemma Uitgevers; 2014. p. 153–62.

15. Glover J, Srinivasan S. Assessment of the Person with Late-life Depression. Psychiatr Clin North Am [Internet]. Elsevier Inc; 2013;36(4):545–60. Available from: http://dx.doi.org/10.1016/j.psc.2013.08.004

16. Alexandrino-Silva C, Alves TF, Tófoli LF, Wang Y-P, Andrade LH. Psychiatry: life events and social support in late life depression. Clinics (Sao Paulo). 2011;66(2):233–8.

17. Aziz R, Steffens DC. What Are the Causes of Late-Life Depression? Psychiatr Clin North Am. 2013;36(4):497–516.

18. Schwarzbach M, Luppa M, Forstmeier S, König HH, Riedel-Heller SG. Social relations and depression in late life - A systematic review. Int J Geriatr Psychiatry. 2014;29(1):1–21.

19. Blazer DG. Depression and social support in late life: a clear but not obvious relationship. Aging Ment Health. 2005;9(6):497–9.

20. Yang Y. How does functional disability affect depressive symptoms in late life? The role of perceived social support and psychological resources. J Health Soc Behav. 2006;47(4):355–72.

21. Schillerstrom JE, Royall DR, Palmer RF. Depression, disability and intermediate pathways: a review of longitudinal studies in elders. J Geriatr Psychiatry Neurol. 2008;21(3):183–97.

22. Wang Y, Sun N, Li S, Du Q, Xu Y, Liu Z, et al. A Genetic Susceptibility Mechanism for Major Depression. Medicine (Baltimore) [Internet]. 2015;94(23):1–5. Available from: http://content.wkhealth.com/linkback/openurl?sid=WKPTLP:landingpage&an=00005792-201506020-00003

23. Luijendijk HJ, van den Berg JF, Dekker MJHJ, van Tuijl HR, Otte W, Smit F, et al. Incidence and Recurrence of Late-Life Depression. Arch Gen Psychiatry. 2009;65(12):1394–401.

24. Comijs HC, Van Exel E, Van Der Mast RC, Paauw A, Oude Voshaar R, Stek ML. Childhood abuse in late-life depression. Journal of Affective Disorders. 2013. p. 241–6.

25. Kuhlman KR, Maercker A, Bachem R, Simmen K, Burri A. Developmental and contextual factors in the role of severe childhood trauma in geriatric depression: The sample case of former indentured child laborers. Child Abus Negl [Internet]. Elsevier Ltd; 2013;37(11):969–78. Available from: http://dx.doi.org/10.1016/j.chiabu.2013.04.013

26. Koorevaar AM, Comijs HC, Dhondt AD, van Marwijk HW, Oude Voshaar RC, van der Mast RC, et al. Big Five personality and depression diagnosis, severity and age of onset in older adults. J Affect Disord. 2013;151(1):178–85.

27. Driessen M. Geestelijke ongezondheid in Nederland in kaart gebracht. Cent Bur voor Stat (CBS). 2011;11–2.

28. Licht-Strunk E, van der Windt DWM, van Marwijk HWJ, de Haan M, Beekman A. The prognosis of depression in older patients in general practice and the community. A systematic review. Fam Pract. 2007;24(2):168–80.

29. Burcusa SL, Lacono WG. Risk for recurrence in depression. Clin Psychol Rev. 2007;27(8):959–85.

30. Petronell NJ, Van 't Veer-Tazelaar HWJ, Van Marwijk DAPD, Rijmen JF, Kostense PJ. Depression in old age (75+), the PIKO study. J Affect Disord. 2008;106(3):295–9.

31. Beekman ATF, Geerlings SW, Deeg DJH et al. Het beloop van depressie bij ouderen: resultaten van 6 jaar intensieve follow-up. Tijdschr Psychiatr. 2004;46(2):73–84.

32.    Hybels CF, Pieper CF, Blazer DG, Steffens DC. The course of depressive symptoms in older adults with comorbid major depression and dysthymia. Am J Geriatr Psychiatry [Internet]. American Association for Geriatric Psychiatry; 2008;16(4):300–9. Available from: http://dx.doi.org/10.1097/JGP.0b013e318162f15f

33.    Mueller TI, Kohn R, Leventhal N, Leon AC, Solomon D, Coryell W, et al. The course of depression in elderly patients. Am J Geriatr Psychiatry. 2004;12(1):22–9.

34.    Comijs HC, Nieuwesteeg J, Kok R, van Marwijk HW, van der Mast RC, Naarding P, et al. The two-year course of late-life depression; results from the Netherlands study of depression in older persons. BMC Psychiatry [Internet]. 2015;15:1–9. Available from: http://www.biomedcentral.com/1471-244X/15/20

35.    Wang YP, Gorenstein C. Psychometric properties of the Beck Depression Inventory-II: A comprehensive review. Rev Bras Psiquiatr. 2013;35(4):416–31.

36.    Marty MA, Pepin R, June A, Segal DL. Geriatric Depression Scale. In: M. T. Abou-Saleh CK and AK, editor. Principles and Practice of Geriatric Psychiatry. Third. Chichester, UK: John Wiley & Sons, Ltd; 2010.

37.    Bagby RM, Ryder AG, Schuller DR, Marshall MB. The Hamilton Depression Rating Acale: Has the gold standard become a lead weight? Am J Psychiatry. 2004;161(December):2163–77.

38.    Williams JBW, Kobak K. Development and reliability of a structured interview guide for the Montgomery Asberg Depression Rating Scale (SIGMA). Br J Psychiatry. 2008;192(1):52–8.

39.    Rush J, Carmody TJ, Ibrahim HM, Trivedi MH, Biggs MM, Shores-Wilson K, et al. Comparison of self-report and clinician ratings on two inventories of depressive symptomatology. Psychiatr Serv. 2006;57(6):829–37.

40.    Downing SM. Reliability: on the reproducibility of assessment data. Med Educ. 2004;38(9):1006–12.

41.    Bouter LM, van Dongen MCJM, Zielhuis GA. Klinimetrisch onderzoek naar de kwaliteit van meetinstrumenten is van belang voor de kwaliteit van het epidemiologisch onderzoek en de diagnostiek. Epidemiologisch onderzoek, opzet en interpretatie. 6th ed. Houten: Bohn Stafleu van Loghum; 2010. p. 110–1.

42.    Parikh R, Mathai A, Parikh S, Chandra SG, Thomas R. Understanding and using sensitivity, specificity and predictive values. Indian J Ophthalmol. 2008;56(1):45–50.

43.    Bouter LM, van Dongen MCJM, Zielhuis GA. Validiteit is het ontbreken van bias. Epidemiologisch onderzoek, opzet en interpretatie. 6th ed. Houten: Bohn Stafleu van Loghum; 2010. p. 126.

44.    Leverich GS, Post RM. The NIMH Life Chart Manual for Recurrent Affective Illness: The LCM-S / R Retrospective. 2002;(February).

45.    Spijker J, de Graaf R, Bijl R, Beekman ATF, Ormel J, Nolen W. Determinants of persistence of major depressive episodes in the general population. Results from the Netherlands Mental Health Survey and Incidence Study (NEMESIS). J Affect Disord. 2004;81(3):231–40.

46. Basco MR, Rush AJ. Life charts to get the big picture. Cognitive-behavioral Therapy for Bipolar Disorder. Guilford Press.; 2005. p. 124–7.

47. Song JW, Chung KC. Observational Studies: Cohort and Case-Control Studies. Plast Reconstr Surg [Internet]. 2010;126(6):2234–42. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2998589/

48. Hess DR, Faarc R. Retrospective Studies and Chart Reviews Introduction Case Series Case-Control Study Matched Case-Control Study Summary. Respir Care. 2004;49(10):1171–4.

49. Euser AM, Zoccali C, Jager KJ, Dekker FW. Cohort studies: Prospective versus retrospective. Nephron - Clin Pract. 2009;113:214–7.

50. Banich MT, Mackiewicz KL, Depue BE, Whitmer AJ, Miller G, Heller W. Cognitive control mechanisms, emotion and memory: A neural perspective with implications for psychopathology. Neurosci Biobehav Rev. 2009;33(5):613–30.

51. Lewis P, Critchley HD, Smith P, Dolan RJ. Brain mechanisms for mood congruent memory facilitation. Neuroimage. 2005;25:1214–23.

52. Wittekind CE, Terfehr K, Otte C, Jelinek L, Hinkelmann K, Moritz S. Mood-congruent memory in depression - The influence of personal relevance and emotional context. Psychiatry Res [Internet]. Elsevier; 2014;215(3):606–13. Available from: http://dx.doi.org/10.1016/j.psychres.2013.11.027

53. King MJ, MacDougall AG, Ferris SM, Levine B, MacQueen GM, McKinnon MC. A review of factors that moderate autobiographical memory performance in patients with major depressive disorder. J Clin Exp Neuropsychol. 2010;32(10):1122–44.

54. Laney C, Loftus EF. Emotional content of true and false memories. Memory. 2008;16(5):500–16.

55. Koenders M, Nolen W, Giltay EJ, Hoencamp E, Spijker AT. The use of the prospective NIMH Life Chart Method as a bipolar mood assessment method in research: A systematic review of different methods, outcome measures and interpretations. J Affect Disord [Internet]. Elsevier; 2015;175:260–8. Available from: http://linkinghub.elsevier.com/retrieve/pii/S0165032715000099

56. Comijs HC, Van Marwijk HW, Van der Mast RC, Naarding P, Oude Voshaar RC, Beekman ATF, et al. The Netherlands study of depression in older persons (NESDO); a prospective cohort study. BMC Res Notes. 2011;4:524.

57. Born C, Amann BL, Grunze H, Post RM, Schärer L. Saving time and money: a validation of the self ratings on the prospective NIMH life-chart method (NIMH-LCM). BMC Psychiatry [Internet]. 2014;14:130. Available from: http://www.biomedcentral.com/1471-244X/14/130

58. Decarli C. Reviews Mild cognitive impairment : prevalence , prognosis , aetiology , and treatment. 2003;2(January):15–21.

59. Lyketsos CG, Nestadt G, Joan CWI, Heithoff K, Eaton WW. The Life Chart Interview: a standarized method to describe the course of psychopathology. Int J Methods Psychiatr Res. 1994;4:143–55.

60. Hermans D, De Decker A, De Peuter S, Raes F, Eelen P, Williams JMG. Autobiographical memory specificity and affect regulation: Coping with a negative life event. Depress Anxiety. 2008;25(9):787–92.

61. Kessler RC, Abelson J, Demler O, Escobar JI, Gibbon M, Guyer ME, et al. Clinical calibration of DSM-IV diagnoses in the World Mental Health (WMH) version of the World Health Organization (WHO) Composite International Diagnostic Interview (WMH-CIDI). Int J Methods Psychiatr Res. 2004;13(2):122–39.

62. University of Pittsburgh. Inventory of Depressive Symptomatology (IDS) & Quick Inventory of Depressive Symptomatology (QIDS). 2015;18.

63. Nolen W, Dingemans P. Meetinstrumenten bij stemmingsstoornissen. Tijdschr Psychiatr. 2004;46(10):681–6.

64. JWR Twisk. Achterliggende principes van de verklarende statestiek - toetsen en schatten van steekproefgemiddelden. Inleiding in de toegepaste biostatestiek. 2th ed. Amsterdam: Reed Business; 2010. p. 46.

65. JWR Twisk. De analyse van continue uitkomstvariabelen - confounding en effectmofidicatie. Inleiding in de toegepaste biostatestiek. 2th ed. Amsterdam: Reed Business; 2010. p. 108–10.

66. O'Rourke N, Hatcher L. Preparing scattergrams and computing correlations. A Step-by-Step Approach to Using SAS for Factor Analysis and Structural Equation Modeling. 2th ed. SAS Institute; 2013. p. 381.

67. Ganguli M, Du Y, Dodge HH, Ratcliff GG, Chang C-CH. Depressive Symptoms and Cognitive Decline in Late Life. Arch gen pshychiatry. 2006;63.

68. Elderkin-Thompson V, Moody T, Knowlton B, Hellemann G, Kumar A. Explicit and implicit memory in late-life depression. Am J Geriatr Psychiatry [Internet]. American Association for Geriatric Psychiatry; 2011;19(4):249–55. Available from: http://dx.doi.org/10.1097/JGP.0b013e3181e89a5b

69. Gallassi R, Di Sarro R, Morreale A, Amore M. Memory impairment in patients with late-onset major depression: The effect of antidepressant therapy. J Affect Disord. 2006;91(2-3):243–50.

70. Nagae S, Moscovitch M. Cerebral hemispheric differences in memory of emotional and non-emotional words in normal individuals. Neuropsychologia. 2002;40(9):1601–7.

71. Mather M. Aging and cognition. Wiley Interdiscip Rev Cogn Sci. 2010;1(3):346–62.

72. Flight MH. Ageing: Rescuing age-related memory loss. Nat Rev Neurosci [Internet]. Nature Publishing Group; 2011;12(9):490–1. Available from: http://dx.doi.org/10.1038/nrn3096

73. Herlitz A, Nilsson LG, Bäckman L. Gender differences in episodic memory. Mem Cognit. 1997;25(6):801–11.

74.    Pillemer DB, Wink P, DiDonato TE, Sanborn RL. Gender differences in autobiographical memory styles of older adults. Memory. 2003;11(6):525–32.

75.    Petersen RC, Pankratz VS, Roberts RO, Knopman DS, Cha RH, Geda YE. Prevalence of mild cognitive impairment is higher in men. Neurology. 2010;75(10):889–97.

76.    Lachman ME, Agrigoroaei S, Murphy C, Tun PA. Frequent Cognitive Activity Compensates for Education Differences in Episodic Memory. Am J Geriatr Psychiatry. 2010;18(1):4–10.

77.    Meier B, Perrig-chiello P, Perrig W. Personality and Memory in Old Age Personality and Memory in Old Age. Aging Neuropsychol Cogn. 2002;9(2):135–44.

78.    Hermans D, De Decker A, De Peuter S, Raes F, Eelen P WJ. Autobiographical memory specificity and affect regulation: Coping with a negative life event. Depress Anxiety. 2008;25(9):787–92.

79.    Pennix BWJH, Beekman ATF, Smit JH, Zitman FG, Nolen WA, Spinhoven P. The Netherlands Study of Depression and Anxiety (NESDA): rationale, objectives and methods. Int J Methods Psychiatr Res. 2008;17(3):121–40.

80.    Kupka RW, Akkerhuis GW, Honig WN. De life-chart methode voor de manisch depressieve stoornis. Tijdschr Psychiatr. 1997;39(3):232–9.

81.    Barzman DH, DelBello MP, Kowatch RA, Gernert B, Fleck DE, Pathak S, et al. The Effectiveness and Tolerability of Aripiprazole for Pediatric Bipolar Disorders: A Retrospective Chart Review. J Child Adolesc Psychopharmacol. 2004;14(4):593–600.

82.    Hegeman JM, Wardenaar KJ, Comijs HC, de Waal MWM, Kok RM, Van der Mast RC. The subscale structure of the Inventory of Depressive Symptomatology Self Report (IDS-SR) in older persons. J Psychiatr Res [Internet]. Elsevier Ltd; 2012;46(10):1383–8. Available from: http://dx.doi.org/10.1016/j.jpsychires.2012.07.008

<u>Reflection report</u>

I have done an internship in the period of March to June 2015 at the Department of Psychiatry, at GGZ inGeest Amsterdam. My internship was part of the Netherlands Study of Depression in Older Persons (NESDO). My supervisor was Hannie Comijs and my daily supervisor was Anna Paauw. My main task was to arrange everything that has to do with questionnaires, which are completed every six months. I send the questionnaires to the respondents, called them when they have forgotten to fill in the questionnaires and called them when they have forgotten some questions on the questionnaire.

During my internship I have learned what it means to be part of large-scale research. I have learnt about all the different kinds of aspects that are part of research, such as arranging appointments with the respondents, making sure that they fill in the questionnaires, how an interview with a respondent works and that all the respondents differ so much in their physical and cognitive functioning, as well as their motivation to take part in the research. Also, arranging all the administrative work that is part of the research. Before my internship, I did not know that there is so much to arrange during a large research like NESDO, because there are a lot of things you are not aware of that need to be arranged. Now I have much more of an idea about the amount of work that goes into doing a large research like NESDO and how many people are working on this research.

I have had positive experiences during my internship. As well as my supervisor Hannie Comijs as well my daily supervisor Anna Paauw, have guided me very well during my internship. Hannie Comijs helped me with writing my thesis. She advised me what to include and exclude in my introduction and method and helped me with writing correct scientific English. She also helped me develop a good approach to analysing the data and to think about what the results of the analysis mean. Because we have had meetings almost every week, I was able to ask questions whenever something was not clear and she checked the work I had done, so I was sure I was doing the right thing. Anna Paauw helped me with the practical aspects of my internship. She explained how everything works in NESDO. How the computer system that is used works, how to arrange everything with the questionnaires and all the other aspects that are part of NESDO. This way, I knew how almost everything works in NESDO. Therefore, I was able to understand the research and find out what kind of problems they face to during the research and how to solve these problems. Because Anna Paauw explained all the work I needed to do, I was able to work by myself quite soon after I started my internship. I knew that whenever I had a question I could ask Anna Paauw, or one of the other colleagues when Anna Paauw was not around. Therefore, it was a nice place to work for me. I felt comfortable to be a part of the NESDO research, because there was a great atmosphere to work in.

Before the start of my internship I had three learning goals I hoped to achieve during my internship. First of all, how to write a proper, scientific thesis. During my study we had to write scientific assignments quite often, but never as long as my thesis. So it was new for me to write such a long thesis and also to be working on it for a couple of months. During the writing process, I have learned what kind of literature is used in psychiatric research. Moreover, I have learned more about writing proper, scientific English. I have learned that there are rules concerning which words can be used in scientific English and which words cannot. I have also learned that one of my weak points is that sometimes my writing is not clear enough. The things I have written look clear to me, but when someone else reads it for the first time it is not clear what I actually mean. So I need to explain my

writing more. Lastly, I have learned the value of clearly structuring my text before I start to write. It makes it easier to start writing and it makes sure that the text is easy to read. Even when the structure changes during the writing process, it gives you a clear image about what you are going to do. All in all, I achieved my first learning goal.

My second learning goal was working with data and how to analyse them in a correct way. During my study I have analysed data before, but the file we needed was always prepared for us, so we only ever had to analyse it. Making my own file is something I have learned during my internship. Moreover, I have learned to make a correct table of the characteristics of the target population, which is always used in the results section of scientific articles. Lastly, I have learned that it is possible to make my own syntax before I start with analysing the data, because then you are able to copy and paste the correct variables into your syntax and you can analyse your data quickly. This is a convenient method which I can use in the future. The analyses themselves were something I have done before during my study, but presenting them in a correct scientific way in a table as well as a text was something I did not have done quite often, so that was something I could practice. In conclusion, I also achieved my second learning goal.

At last, my third learning goal was to learn how it was to work in health science research. During my study, we mostly did research in biomedical sciences and less in health sciences. However, health sciences interest me more, which is why I have chosen this internship. During my internship I have learned a lot about depression and especially depression among the elderly. I have also learned a lot about working with elderly people. This is something I have not done before and during my internship I have learned about the problems you can face to while working with elderly people and also working with people with depression. These experiences have made me realise that I like doing research in health sciences. I like the fact that you learn everything about a subject, so you know a lot about it and even while you are doing research you still have contact with respondents. I also liked the variation between practical work and writing my thesis. The practical work and writing my thesis complement each other in a good way, because I could take the things I saw during my practical work into account while writing my thesis. Lastly, I have learned what it is like to be part of a working environment, like having colleagues and nine to five days. Partly due to the good atmosphere, it was easy to get used to the new work environment and therefore I can say that also my last learning goal has been achieved.

All in all, the most important things I have learned during my internship are, firstly; things that are important during each phase of the writing process, from introduction to discussion. Secondly, how a large research works in practice and what the things you face to while working on the research are. Thirdly, what it is like to have a "full-time job" and all the things that come with it. Finally, I have learned that I liked it to do research and that it is something I would like to do in the future.