

The impact of an unfavorable depression course on network size and loneliness in older people: a longitudinal study in the community

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Objective: This work aims to gain insight into the long-term impact of depression course on social network size and perceived loneliness in older people living in the community.

Methods: Within a large representative sample of older people in the community (Longitudinal Aging Study Amsterdam (LASA)), participants with clinically relevant levels of depressive symptoms (scores >16 on the Center for Epidemiological Studies Depression Scale) were followed up over a period of 13 years of the LASA study (five waves). General estimating equations were used to estimate the impact of depression course on network size and loneliness and the interaction with gender and age.

Results: An unfavorable course of depression was found to be associated with smaller network sizes and higher levels of loneliness over time, especially in men and older participants.

Conclusions: The findings of this study stress the importance of clinical attention to the negative consequences of chronicity in depressed older people. Clinicians should assess possible erosion of the social network over time and be aware of increased feelings of loneliness in this patient group. Copyright © 2014 John Wiley & Sons, Ltd.

Key words: depression course; older people; network size; loneliness; longitudinal perspective

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Introduction

Depression is one of the most disturbing psychiatric conditions in late life. Prevalence rates of late-life depression in Western society vary from 1–4% for major depression to 8–16% for sub-threshold depressive symptoms (Beekman *et al.*, 1995b; Blazer, 2003). It is widely accepted that depression is a treatable disorder in all age groups. However, for several reasons—among which the poor recognition of late-life depression in primary care, inadequate treatment (Licht-Strunk *et al.*, 2009), or inferior treatment

response due to medical comorbidity (Mitchell and Subramaniam, 2005)—the prognosis of depression in older people can be rather poor. A previous study of our group showed that in 43% of the respondents diagnosed with a late-life depression, the disorder developed a chronic course (Beekman *et al.*, 1995a). For comparison, other studies have shown that in 10–30% of younger adults with a depressive disorder, the disease takes a chronic course (Judd *et al.*, 1998; Spijker, 2002).

The consequences of depression for social participation of older people may be substantial (Beekman

et al., 2002a, 2002b; Blazer, 2003). Results from a cross-sectional study (Houtjes *et al.*, 2010) demonstrated that depression severity is associated with several unmet social needs of older patients, including the need for company, intimate relationships, and daytime activities.

The ability to perform in social roles and to participate in a meaningful social network may be considered as important aspects of human functioning and prerequisites for people's quality of life (Kawachi and Berkman, 2001). According to van Tilburg (van Tilburg, 1998), the size of the personal network is important in this regard. Extended networks show the potential to generate more social support than smaller networks. However, maintaining a meaningful personal network can be a problem in later life. For persons with late-life depression, especially for those in which the depression takes a chronic course, it is known that contact with network members is often disturbed because of persistent attitudes of hopelessness and helplessness in the depressed person (McCullough, 2003) or frustration and burden in the network members (van Wijngaarden *et al.*, 2004; Logan, 2011). So, it may be expected that a chronic course of a late-life depression in time is damaging for relationships within networks and therefore will lead to a decline in network size. The converse association may also be expected, where remittance of depression predicts stabilization or even increase of the network size.

Furthermore, it may be assumed that network size and loneliness are associated. De Jong Gierveld (1998) defined loneliness as "a situation in which the number of existing relationships is smaller than is considered desirable, as well as situations where the intimacy one wishes for has not been realized." However, it is important to note that there is not a straightforward association between network size and loneliness. Persons with a small network size may be socially isolated but may not experience feelings of loneliness (Townsend and Tunstall, 1973; Wenger *et al.*, 1996). In addition, when desired intimacy is lacking, even an extended network does not prevent older persons from feeling lonely. De Jong Gierveld concludes that "the subjective evaluation of the network is the mediating factor between the descriptive, objective characteristics of the network and loneliness" (De Jong Gierveld, 1998, p 74). Concerning the group of patients with depression, there is evidence from previous longitudinal research that an increase in depressive symptoms may lead to increased feelings of loneliness (Holmén and Furukawa, 2002; Heikkinen and Kauppinen, 2004).

With regard to interpersonal variability in older people, we found evidence that the course of depression

varied with gender and age (Prince *et al.*, 1999; Sonnenberg *et al.*, 2000). However, accurate knowledge about the associations between course of late-life depression, sample characteristics, size of the personal network, and perceived loneliness, from a longitudinal perspective, was found to be absent. For this reason, we designed a prospective study with the primary objective to investigate whether the course of late-life depression impacts network size and perceived loneliness, taking into account gender and age of the respondents involved.

Methods

Sampling and procedures

The present study concerns a 13-year prospective study in the context of the Longitudinal Aging Study Amsterdam (LASA). LASA is an ongoing interdisciplinary study that started in 1992. The aim of LASA is to conduct research on predictors and consequences of changes in autonomy and well being in the aging population in the Netherlands. For full details on the study characteristics, we refer to Huisman *et al.* (2011). A large representative sample of older adults (age >55, $n=3107$) was interviewed at baseline in 1992/1993. The sample was stratified for sex, age, and level of urbanicity with oversampling of oldest old and men to anticipate attrition due to mortality and to ensure that even after a long period of follow-up, there would be sufficient numbers (Huisman *et al.*, 2011). Full follow-up measurements were carried out every 3 years.

At baseline, all subjects scoring ≥ 16 on the Center for Epidemiological Studies Depression Scale (CES-D) ($n=448$) were considered as eligible for inclusion in the sample for the current study. Respondents with an incomplete diagnostic interview or with less than two follow-up observations were excluded from the study, ultimately resulting in a sample of 277 respondents. CES-D scores were studied in a more frequent follow-up schedule (5–6 months interval) using postal questionnaires between the full follow-up measurements.

In accordance with legal requirements in the Netherlands, informed consent was obtained from all respondents in the study. The study was approved by the Medical Ethical Committee of VU University Medical Centre.

Measurements

Dependent variables. **Network size.** In this study, network size was defined as the total number of

socially active relationships of the respondent, not only in the core but also in the outer layers of the network (van Tilburg, 1995). An in-depth description of the method of determining the network size was published elsewhere (van Tilburg, 1995, 1998; Broese van Groenou and van Tilburg, 2007). In short, respondents were asked to mention names of persons with whom they had regular contact in the past year and who were important to them. Network members were identified in seven domains including household members, children, children-in-law, siblings, siblings-in-law, other relatives, friends, neighbors, or other non-relatives. Only network members 18 years or older were included.

Loneliness. Loneliness was measured using the 11-item De Jong Gierveld Scale (De Jong Gierveld and Van Tilburg, 2010), ranging from 0 (*not lonely at all*) to 11 (*extremely lonely*). The scale showed sufficient validity and reliability (Pinquart and Sorensen, 2001; Dykstra and Fokkema, 2007).

Both network size and loneliness were measured in five 3-yearly waves between 1992/1993 and 2005/2006, covering a total time span of 13 years.

Independent variable. Depression course type. The 20-item self-report CES-D (Radloff, 1977) was used to measure depressive symptoms. The CES-D was developed to measure depressive symptoms in the community. The Dutch version of the CES-D showed the same good psychometric properties measuring depressive symptoms in samples of older people as the original instrument (Berkman *et al.*, 1986; Beekman *et al.*, 1994). The CES-D results in a total score ranging between 0 and 60. A cutoff score of 16 is generally accepted to make a distinction between absence or a mild level of depressive symptoms and a clinically relevant level of depressive symptoms (Beekman *et al.*, 1994). Repeatedly measured CES-D scores were used to construct a nominal variable “depression course” with three possible values (course types) based on up to 14 five-monthly scores measured between Wave 1 (1992–1993) and Wave 3 (1998–1999) of the main LASA interviews. Three different depression course types, previously defined and reported by Beekman *et al.* (2002a, 2002b), were distinguished, that is, remission, a fluctuating course, and a chronic course of depression. Remission was defined as a combination of the following: (1) a relevant decline of symptoms; (2) CES-D scores remaining below 16; and (3) no affective disorder diagnosis throughout the rest of the study. A fluctuating course was defined as a situation where after remission the respondent had a relevant increase

of symptoms (CES-D ≥ 16) later on in the study. A relevant increase (or decrease) of symptoms was defined as a change of 5 points or more between measurements on the CES-D crossing the cutoff score of 16. A chronic course was defined for respondents who had a CES-D score of ≥ 16 in more than 80% of the occasions. On average, 9.8 (standard deviation = 3.9) valid CES-D observations per respondent were available to determine course type. The statistical underpinning to define change was described in detail elsewhere (Jacobson and Truax, 1991; Beekman *et al.*, 2002a, 2002b). For an overview of measurements in our study, we refer to Table 1.

Sample characteristics. Sample characteristics selected and considered as covariates were measured at baseline and included age, marital status (married or not married), education level (low, middle, or highly educated), urbanization (low vs. high urbanization), and chronic physical disease. Regarding this latter variable, the number of most prevalent chronic diseases in the Netherlands (chronic obstructive pulmonary disease, cardiac disease, peripheral arterial disease, diabetes mellitus, cerebrovascular accident or stroke, osteoarthritis, rheumatoid arthritis, and cancer) was counted and dichotomized (0 for no chronic physical disease, 1 for one or more chronic physical diseases) (Kriegsman *et al.*, 2004).

Statistical analysis

All models were estimated using generalized estimating equations in SPSS 19 (IBM Statistics, Amsterdam, The Netherlands). In our analyses, we considered linear trends for dependent variables network size and loneliness over the five time periods (waves). All models included main effects for course type and wave together with their interaction. Our main interest was in the effect of the two-way interaction between wave and course type on the dependent variables and whether this was modified by sample characteristics. A significant two-way interaction effect between wave and course type indicates that the average yearly increase/decrease in the dependent variable (i.e., the slope of dependent variable vs. follow-up time) differs between the course types. To assess modification of the longitudinal relationship between course type and the dependent variables by sample characteristics, we included a main effect for the characteristic in the model together with its (two-way) interaction with course type and its (three-way) interaction with course type and wave. A significant three-way interaction effect indicates

Table 1 Response to follow-up of a community-based cohort of depressed older subjects: 16 observations covering 13 years

Main study wave ^a	Side study measurements	Mode ^b	Time (month/year)	No. of subjects	CES-D score ^c	No. of subjects	Network size score ^c	No. of subjects	Loneliness score ^c
1992–1993	1	Interview	Baseline	277	22.6 (6.8)	256	12.16 (7.2)	274	4.42 (3.2)
	2	Post a	5	205	17.4 (9.5)				
	3	Post b	10	230	17.6 (9.7)				
	4	Post c	15	226	16.7 (8.3)				
	5	Post d	20	221	16.2 (8.5)				
	6	Post e	25	171	16.6 (8.0)				
	7	Post f	30	191	15.5 (8.2)				
1995–1996	8	Interview	36/3	224	16.8 (9.8)	221	12.13 (7.1)	222	4.15 (3.3)
	9	Post g	42	164	14.7 (6.4)				
	10	Post h	48	167	14.7 (7.5)				
	11	Post i	54	163	14.9 (6.9)				
	12	Post j	60	158	14.7 (7.1)				
	13	Post k	66	151	14.7 (7.3)				
1998–1999	14	Interview	72/6	171	16.4 (9.3)	154	13.16 (8.0)	168	4.21 (3.3)
2001–2002		Interview	108/9			119	11.65 (6.6)	126	3.97 (3.2)
2005–2006		Interview	144/13			69	13.19 (7.0)	88	3.99 (3.3)

CES-D, Center for Epidemiological Studies Depression Scale.

^aMain waves of the Longitudinal Aging Study Amsterdam covering a period of 13 years.

^bPost a indicates the first measurement of the postal questionnaire.

^cData are given as mean (standard deviation).

that differences between course types in the slopes relating the dependent variable and time vary with categories or levels of the sample characteristic considered. Analyses to assess modification were performed separately for each sample characteristic of interest. To account for the relative oversampling of oldest old and men, all analyses were corrected by including main effects for gender and age (at baseline), as well as interactions between these variables and wave in all models. Variables age and wave were included as continuous variables. The variable age was centered at 70 years (which was approximately the mean age at baseline). The variable wave was centered at Wave 3 (1998–1999), the final data collection point that was used to determine the subject's depression course type. The generalized estimating equations method takes into account correlation between measurements for the same patients in different waves. In our model, an unstructured correlation matrix was used imposing no restrictions on the form of the correlation matrix of the repeatedly measured outcomes. In accordance to West and Aiken (1991), interactions with a p -value < 0.1 were considered to be significant.

Results

Characteristics of the sample. At baseline, the study sample ($N = 277$) consisted of 96 men and 181 women with an average age of 71.8 years (standard deviation = 8.8 years). Of the 277 subjects, 45% were married, 68% lived in an urbanized area, and 96% lived

independently. For a complete overview of the sample baseline characteristics, we refer to Table 2.

Network size. In a first analysis, in which we compared average network sizes of participants with distinct depression course types ignoring possible modifying variables, a significant main effect of course type on network size was found (Wald $X^2 = 8.9$, $df = 2$, $p = 0.011$),

Table 2 Baseline characteristics of the study sample ($N = 277$)

Characteristics	No. (%) of subjects ^a
Age group (years)	
55–64	79 (29)
65–74	82 (30)
75–85	116 (42)
Average age 71.8 years (SD 8.8 years)	
Gender	
Male	96 (35)
Female	181 (65)
Married	
Yes	124 (45)
No	153 (55)
Urbanization	
Low	88 (32)
High	189 (68)
Living situation	
independent	265 (96)
Residential home	12 (4)
Chronic disease	
0	63 (23)
≥1	212 (77)

^aPercentages are based on category total and may not total to 100 because of rounding.

indicating that average network sizes at the reference point Wave 3 (1998–1999) differed between course types. The average network size at Wave 3 for the remission course type was significantly higher than the network size for the chronic course type (Wald $X^2 = 8.902$, $df = 1$, $p = 0.03$), whereas no significant difference was found between the fluctuating and chronic course (Wald $X^2 = 2.295$, $df = 1$, $p = 0.13$). The interaction between wave and course type was not significant (Wald $X^2 = 3.418$, $df = 2$, $p = 0.181$). This means that we found no evidence that changes in network size differed between the distinct course types.

Considering gender as a modifying variable, we found no modifications of the relation between course type and changes in the average network size over time (Wald $X^2 = 3.283$, $df = 2$, $p = 0.194$). However, gender did modify the relation between course type and average network size at Wave 3 (1998–1999) (Wald $X^2 = 5.709$, $df = 2$, $p = 0.058$), with differences between course types being larger for men than women (Table 3).

Age at baseline was found to modify the relation between course type and changes in average network size over time (Wald $X^2 = 7.209$, $df = 2$, $p = 0.027$), indicating that differences in the slopes of network size over time, between the course types, varied with age at baseline.

To illustrate the modifying effects of age at baseline, model-based estimates of the average course of network size during the 13 years of follow-up are presented in Figure 1, separately for the different course types, for each gender, and for three different values for age at baseline (60, 70, and 80 years). In particular, the slope for the remission course type seems to strongly depend on age at baseline, as increasing slopes are found at 60 years but decreasing slopes for the age at baseline of 70 and 80 years. Also, for the other course types, slopes of average network size tended to become more negative with increasing age at baseline, but changes were smaller with slopes close to 0 for age at baseline of 60 years. Note that Figure 1 contains estimates based on a linear trend

over time and that some lines for men aged 80 years at baseline have been truncated in time, where the estimated network size fell below 0. This is due to the combination of a strong decrease and lack of oldest old men in the sample (no data at 13 years follow-up were available for men older than 75 years at baseline).

Marital status, level of urbanization, and chronic diseases were also found to modify the relation between course type and the change in average network size over time (Wald $X^2 = 5.413$, $df = 2$, $p = 0.067$; Wald $X^2 = 18.415$, $df = 2$, $p = 0.001$; Wald $X^2 = 11.497$, $df = 2$, $p = 0.003$; and Wald $X^2 = 9.616$, $df = 2$, $p = 0.008$, respectively).

Loneliness. For the dependent variable loneliness, the same procedures were used. Corrected for gender and age, we found a significant main effect of depression course on loneliness (Wald $X^2 = 33.286$, $df = 2$, $p < 0.0001$). The interaction between course type and wave (Figure 2) on loneliness was also found to be significant (Wald $X^2 = 10.408$, $df = 2$, $p = 0.005$). As hypothesized, perceived loneliness was found to increase over time for the chronic course type. It was found to be relatively stable for fluctuating course type and decreasing over time for the remission course type.

None of the sample characteristics were found to modify the longitudinal relationship between course type and loneliness scores.

Discussion

The primary objective of the current study was to investigate whether the course of late-life depression has an impact on network size and perceived loneliness taking into account the characteristics of the population involved.

We expected to find evidence for decreasing network sizes and increasing feelings of loneliness over time in our research sample, especially in subjects in which the depression would take a chronic course. Focusing on the main effect of depression course on the dependent variables network size and loneliness, our expectations were confirmed. However, only with regard to loneliness we found the longitudinal changes to differ between the course types. With regard to network size and the effect of aging, our findings differ from those of van Tilburg (1998) who observed that although the composition of older people's networks varied, the total network sizes appeared to remain stable within the time frame of his longitudinal study, that is, 4 years. The differences with the latter study may be explained by the following: (a) differences in

Table 3 Estimated average network size at Wave 3 separately for men and women and the different course types

Course type	Estimated average network size at Wave 3 (95% CI)	
	Men	Women
Remission	12.7 (8.0, 17.3)	13.0 (10.7, 15.4)
Fluctuating	6.8 (3.0, 10.6)	12.2 (10.5, 13.8)
Chronic	4.0 (0, 10.1) ^a	11.3 (8.5, 14.2)

CI, confidence interval.

^aLower confidence limit truncated at 0.

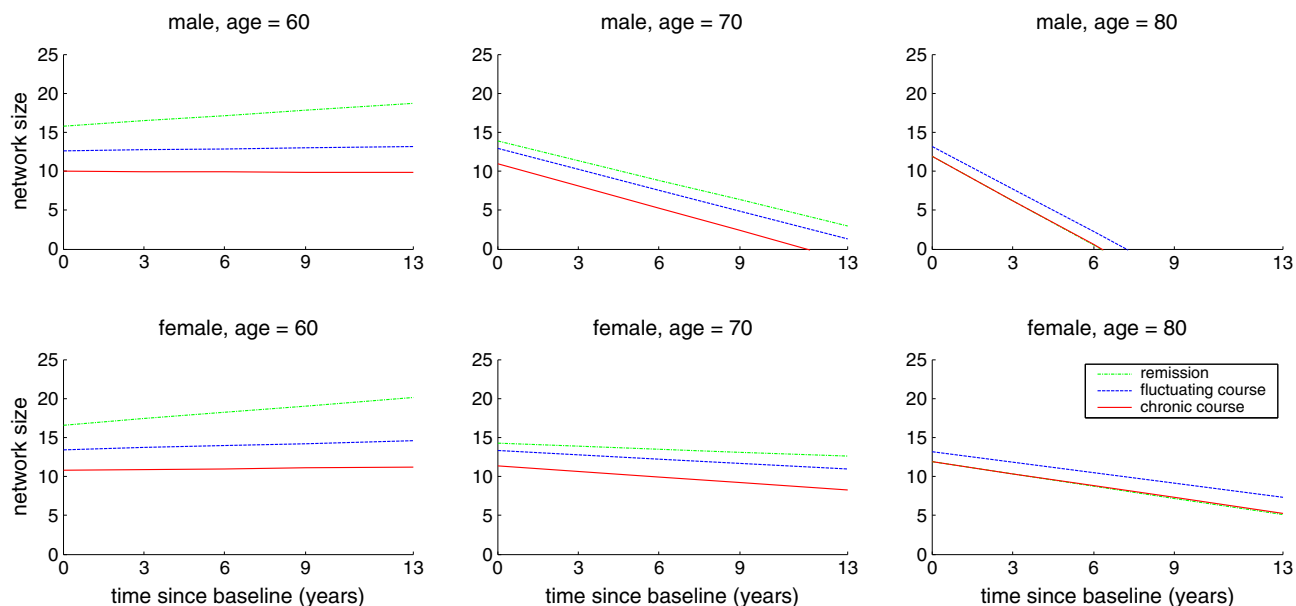


Figure 1 Relation between depression course type and changes in average network size over time modified by age at baseline in men and women.

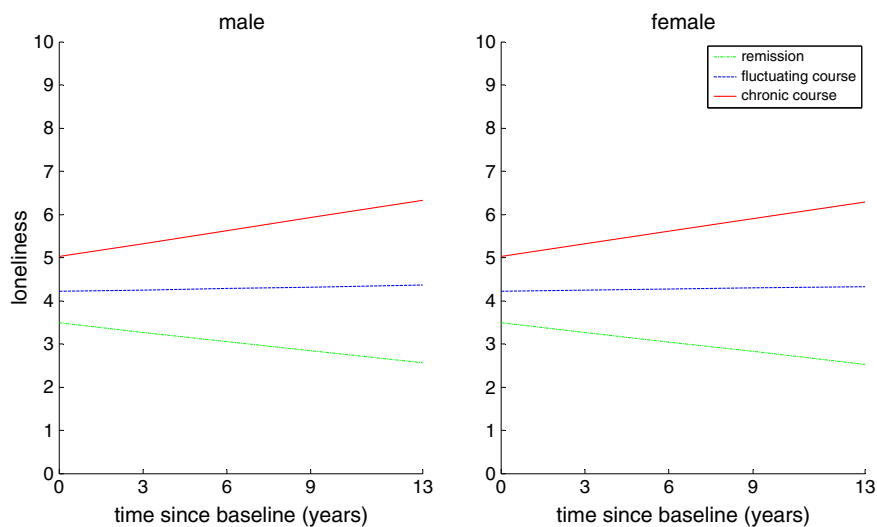


Figure 2 Depression course types predicting loneliness scores over time.

years of follow-up (4 vs. 13 years) and (b) sample differences (general population sample of people aged >55 years vs. a sub-sample of people aged >55 years with a CES-D score >16). We found decreasing network sizes for all depression course types in persons with older age at baseline. Moreover, Figure 1 shows that differences between course types at Wave 3 tend to decrease with age. The clinical implication of this finding could be that depression course in itself was not the meaningful factor we expected it would be predicting network changes over time. Only when

we added age to the model as a modifier the results became more meaningful.

Adding gender to the model, we only observed a significant two-way interaction between gender and course type indicating that gender did modify the relation between course type and average network size at the chosen reference point (Wave 3), but not over time. It is not clear how the relation between course type and network size was actually modified by gender. However, it is known that with regard to network size, also a general population of older adults

may show gender differences, as was demonstrated in an Australian population-based cohort study by McLaughlin *et al.* (2010). In their study, older women appeared to maintain more extensive networks than men (McLaughlin *et al.*, 2010). In our study, men suffering from a chronic course of depression seem to be especially at risk of losing a substantial part of their personal network. Gender differences could also be observed when the variable marital status was added to the model. In contrast to what we expected, and despite of the depression course, marriage did not protect men from shrinking network sizes. Single or widowed women may fear the loss of network members only when their depression takes a chronic course.

A depression in remission seems to be beneficial for the network sizes of both men and women living in rural regions. Living in an urbanized region seems to be only beneficial for women despite their depression course type.

As expected, with regard to loneliness, we found that both men and women may fear loneliness when their depression takes a chronic course.

The clinical implication of our findings may be considerable. It is known that both late-life depression and loneliness were found to be independently associated with an increased mortality risk (Blazer *et al.*, 2001; Holwerda *et al.*, 2012). General practitioners and other primary care professionals should be aware of the impact of the depression course on the network size and loneliness, taking into account the personal characteristics of older people. In adults older than 65 years, it is advisable to invest in interventions aimed to prevent network loss and loneliness in an early stage of a depression.

Strengths and weaknesses

To our knowledge, this is the most in-depth study of the longitudinal effects of the course of depression on network size and loneliness, covering a substantial period (13 years). However, we used a relatively small sample ($N=277$) of older people already suffering from depression at baseline. We had no knowledge about psychiatric treatment prior to our research. Former psychiatric treatment might be a confounding factor we were not able to control for. We limited ourselves to considering the one-way association between (course of) depression and network size/loneliness. It is highly likely that converse associations (loneliness and smaller networks contributing to an unfavorable outcome of depression) also exist.

Conclusion

A chronic course of depression may have far-reaching consequences for older people including a decreasing network size and increased feelings of loneliness. As was discussed, these effects may lead into further depression, creating a vicious cycle that undermines social embeddedness and leading to social isolation, depriving the patient of the very resources necessary to recover. If and when older people are at risk depends on the course of depression and a combination of personal characteristics involved. Practitioners within the realm of mental health may find the results of our study useful in developing tailored interventions to support older adults, especially men to preserve their network and help them prevent loneliness.

Conflict of interest

None declared.

Key points

- The prognosis of depression in older people can be poor.
- Depression has substantial consequences for social participation of older people.
- Evidence was found for decreasing network sizes and increased feelings of loneliness in subjects with a chronic course of depression, especially in men.
- If and when older people are at risk depends on the course of depression and a combination of personal characteristics involved.
- Adults with late-life depression should be supported to preserve their social network and prevent loneliness.

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