Co-occurrence of depression and anxiety in elderly subjects aged 90 years and its relationship with functional status, quality of life and mortality

Gerda M. Van der Weele¹*, Jacobijn Gussekloo¹, Margot W. M. De Waal¹, Anton J. M. De Craen² and Roos C. Van der Mast³

¹Department of Public Health and Primary Care, Leiden University Medical Center, Leiden, The Netherlands
²Department of Gerontology and Geriatrics, Leiden University Medical Center, Leiden, The Netherlands
³Department of Psychiatry, Leiden University Medical Center, Leiden, The Netherlands

SUMMARY
Objective To examine the prevalence of concurrent depression and anxiety and its relationship with functional status, quality of life and mortality in individuals at age 90.
Methods In the Leiden 85-plus Study, a population based cohort study, depression (15-item Geriatric Depression Scale ≥5 points) and anxiety (Anxiety Screening Questionnaire ≥1 positive answer) were assessed in all 90-year old subjects with ≥19 points on the Mini Mental State Examination (MMSE). Functional status included: cognitive function (MMSE) and disability in activities of daily living (Groningen Activity Restriction Scale). Quality of life included: loneliness (Loneliness Scale of De Jong-Gierveld) and life satisfaction (Cantril’s ladder). For all subjects mortality data were available up to a maximum age of 95.3 years.
Results Of the subjects aged 90 years with MMSE ≥19 points (56 men, 145 women), 50 subjects (25%, 95% CI 19–31%) experienced depression and 25 subjects (12%, 95% CI 9–18%) anxiety; of them 34 (17%) experienced depression only, 9 (4%) anxiety only, and 16 (8%) both depression and anxiety. Presence of depression was associated with an overall decreased functional status and quality of life and with increased mortality. Within the depressed group, subjects with anxiety did not differ from subjects without anxiety, except for higher loneliness scores.
Conclusion Among individuals aged 90 years, depression and anxiety and their co-occurrence are highly prevalent. Anxiety does not add to poor functional status and increased mortality beyond that associated with depression, and is probably part of the phenomenology of depression in old age. Copyright © 2008 John Wiley & Sons, Ltd.

INTRODUCTION
In elderly people co-occurrence of depression and anxiety is highly prevalent (Gorman, 1996; Beekman et al., 2000) and it is well-documented that both disorders are related to reduced functional status and quality of life. Also, in old age depression has been shown to increase mortality (Vinkers et al., 2004). Furthermore, concurrent depression and anxiety is a more severe and more chronic form of psychopathology (Lenze et al., 2000; van Balkom et al., 2000; Schoevers et al., 2003, 2005; Diefenbach and Goethe, 2006). Recently, several studies have investigated the prevalence of concurrent depression and anxiety among community-living elderly people, most focusing on formally diagnosed depressive and anxiety disorders among relatively young elderly subjects. The findings of these studies are inconsistent, describing different rates of prevalence of concurrent depression and anxiety. Among non-institutionalized individuals aged 65–86 years living in Amsterdam, the Netherlands, only 1.8% of subjects had both a major
depression and an anxiety disorder (Schoevers et al., 2003), whereas among community-living elderly individuals of 65 years and over, randomly sampled in 11 municipalities in the Netherlands, the prevalence of concurrent depressive and anxiety symptoms varied between 4.3% and 9.5%, depending on subject’s level of cognitive function (Bierman et al., 2007). Furthermore, in a population-based study of elderly individuals aged 65 years and above living in England and Wales, the prevalence of concurrent depression and anxiety including both subthreshold and threshold disorders was 25%, whereas the prevalence of concurrent depressive and anxiety threshold disorders only was 2% (Kvaal et al., 2008).

However, co-occurrence of depression and anxiety and its association with functional status, quality of life, and mortality in the oldest old have not been described and the clinical relevance of concurrent depression and anxiety in this age group is not clear. Therefore, we studied the prevalence of depression and/or anxiety and their association with functional status, quality of life and mortality in subjects aged 90 years who were enrolled in the Leiden 85-Plus Study, a population-based cohort study in Leiden, the Netherlands. Based on the scientific literature we hypothesized that the co-occurrence of depression and anxiety is correlated with a worsening of functional status, quality of life and mortality risk, more than depression or anxiety alone.

METHODS

Subjects

This cross-sectional study is part of the Leiden 85-plus Study, a prospective population based study of the oldest old, with characteristics at baseline representative of the 85-year-old Dutch population (von Faber et al., 2001). The study has been described in detail elsewhere (Bootsma-van der Wiel et al., 2002). In short, between 1 September 1997 and 1 September 1999, all inhabitants of Leiden born between 1912 and 1914 (n = 705) were contacted within 1 month of their 85th birthday. A total of 599 subjects participated in the study, 92 subjects refused to take part, and 14 died before enrollment (response rate 87%; 397 women, 202 men). Subjects were visited annually at home from age 85 years through age 90 years or attrition. For our study subjects at age 90 years were considered. The Medical Ethical Committee of the Leiden University Medical Center approved the study. All subjects gave informed consent.

Assessment of depression and anxiety

The 15-item Geriatric Depression Scale (GDS-15) (Yesavage et al., 1982; Sheikh and Yesavage, 1986) was used at each annual visit to assess depression in all subjects with a score $\geq 19$ points on the Mini Mental State Examination (MMSE) (Folstein et al., 1975). The GDS has been developed specifically for screening for depression in elderly populations. The 15-item version ranges from 0–15 points, with higher scores indicating more depressive symptoms. Depression was considered present in subjects when their GDS-15 score was 5 points or more, since this cut-off point has been shown to give the best sensitivity and a good specificity for the presence of depression in a representative sample of community dwelling oldest old (de Craen et al., 2003).

Anxiety was assessed only at age 90 with the validated Dutch version of the Anxiety Screening Questionnaire (ASQ). The ASQ is a disorder-specific screening instrument that has been developed for use in primary care and has shown good test–retest reliability and a generally high sensitivity (>82%) for the diagnostic domains it covers (generalized anxiety disorder (GAD); panic disorder; post-traumatic stress disorder (PTSD); agoraphobia; and social phobia). ASQ-specificity is high for DSM-IV subthreshold and threshold GAD (Wittchen and Boyer, 1998). Each of the root questions in the questionnaire is indicative of one of the above mentioned anxiety disorders, e.g. ‘Did you feel worried, tense or anxious for most of the time during the last four weeks?’ is indicative of GAD. Anxiety was accepted as present if at least one of the root questions was answered positively. In order to discriminate between subthreshold and threshold disorders, all subjects who answered one of the root questions for anxiety disorders positively were asked the additional question, ‘Did this worried or anxious feeling interfere a lot with your everyday activities in the household or with your relationship with others?’. A confirmatory answer was considered indicative of a threshold disorder.

Functional status

Cognitive function was assessed using the MMSE. Total scores range from 0–30 points, with lower scores indicating poorer cognitive performance (Folstein et al., 1975). As the validity and sensitivity of the GDS-15, the ASQ, and the Loneliness Scale may be reduced in subjects with impaired cognitive function, only those with an MMSE score above 18 points were included in the study.
Disability in daily functioning was measured with the Groningen Activity Restriction Scale (GARS). The GARS consists of 11 items that measure problems with Activities of Daily Living (ADL), such as ‘Can you dress yourself?’ and seven items that measure problems with Instrumental Activities of Daily Living (IADL), such as ‘Can you do the shopping?’. The total GARS score ranges from 18–72 points, with higher scores indicating more difficulties with activities of daily living (Suurmeijer et al., 1994).

**Quality of life**

Feelings of loneliness were measured using the Loneliness Scale of De Jong-Gierveld, an 11-item questionnaire covering both emotional loneliness (six items) and social loneliness (five items) that was specifically developed for use in elderly populations (Tijhuis et al., 1999). The maximum score is 11 points, with higher scores indicating more loneliness.

Satisfaction with life was measured by Cantril’s ladder that has steps numbered from 0 to 10 (von Faber et al., 2001). Subjects are asked to rate their present overall satisfaction with life on this ladder, resulting in scores from 0 (low satisfaction) to 10 (high satisfaction).

**Mortality**

Survival time (in years) was defined as the period from subject’s 90th birthday until February 1 2008 (censoring date). All-cause mortality data were obtained from the municipality. For all subjects mortality data were available up to a maximum age of 95.3 years.

**Sociodemographic characteristics and presence of chronic diseases**

Sociodemographic characteristics were obtained for all subjects. Level of education was dichotomized at six years of schooling and marital status was dichotomized as married versus not married (i.e. not married, widowed or divorced). Living arrangements were dichotomized as living alone versus living with other persons and as living independently versus institutionalized (i.e. living in a care home for the elderly or a nursing home).

To assess the presence of chronic diseases in subjects at the age of 90 years, each subject’s general practitioner (or nursing home physician) was interviewed annually, using standardized medical history questionnaires, which included questions on present and past cardiovascular morbidity (myocardial infarction, angina pectoris, arrhythmias, heart failure, atrial fibrillation, left ventricular hypertrophy, stroke and peripheral arterial disease) and non-cardiovascular morbidity (Parkinson’s disease, chronic obstructive pulmonary disease, arthrosis (including rheumatoid arthritis and polymyalgia rheumatica), malignancies and hip fracture). These were dichotomized as chronic disease(s) present vs not present.

**Statistical analysis**

Data are presented as numbers with percentages and medians with interquartile ranges (IQR). Comparisons between groups of participants’ demographic characteristics were performed using Chi-square test. Differences in functional status including cognitive function (MMSE), daily functioning (GARS), loneliness (De Jong-Gierveld) and satisfaction with life (Cantril’s ladder) were analyzed using Mann–Whitney U-test. Hazard ratios and corresponding 95% Confidence Intervals (95% CI) were estimated in a Cox proportional hazards model. Statistical analyses were carried out using the Statistical Package for the Social Sciences 14.0 for Windows (SPSS Inc., Chicago, IL, USA).

**RESULTS**

**Demographic and clinical characteristics of study subjects**

In our study 201 subjects aged 90 years with an MMSE ≥ 19 points were included (Figure 1). Table 1
shows their demographic and clinical characteristics. Of all subjects, 50 (25%, 95% CI 19–31%) experienced depression and 25 (12%, 95% CI 9–18%) anxiety.

Correlations of depression

Table 2 shows that subjects with depression (n = 50) had more anxiety, both subthreshold and threshold disorders, compared to subjects without depression (n = 151). Furthermore, the subjects with depression differed from those without depression in being more often institutionalized, having more cognitive dysfunction, being more disabled in activities of daily living, feeling more lonely, and being more dissatisfied with life.

Distribution of anxiety diagnoses in subthreshold and threshold anxiety disorders

Table 3 shows the distribution of anxiety diagnoses in subthreshold and threshold anxiety disorders as assessed by the ASQ. Generalized anxiety disorder was the most common anxiety diagnosis. Seven (41%) of the 17 subjects with a subthreshold anxiety disorder and four (50%) of the eight subjects with a threshold anxiety disorder had more than one anxiety diagnosis.

Presence of anxiety in depressed and non-depressed subjects

Of all 201 subjects, 142 (71%, 95% CI 64–77%) subjects had neither depression nor anxiety, 34 (17%, 95% CI 12–23%) had depression only, 9 (4%, 95% CI 2–8%) anxiety only, and 16 (8%, 95% CI 5–13%) had both depression and anxiety.

Chronic diseases present: present and past cardiovascular morbidity (myocardial infarction, angina pectoris, arrhythmias, heart failure, atrial fibrillation, left ventricular hypertrophy, stroke and peripheral arterial disease) and non-cardiovascular morbidity (Parkinson’s disease, chronic obstructive pulmonary disease, arthrosis (including rheumatoid arthritis and polymyalgia rheumatica), malignancies and hip fracture).

ASQ = Anxiety Screening Questionnaire; GARS = Groningen Activity Restriction Scale; GDS = Geriatric Depression Scale; MMSE = Mini-Mental State Examination.
as depressed. However, this did not change any of the findings as presented in Table 4.

Mortality risks

During the follow up period (mean duration 3.3 years, to a maximum age of 95.3 years), 111 subjects died; 35 of the 50 subjects (70%) with depression and 76 of the 151 subjects (50%) without depression (hazard ratio 1.60; 95% CI 1.07–2.39). Within the group of subjects with depression, mortality did not differ between those with and those without concurrent anxiety (75% vs 68%, hazard ratio 0.73 (95% CI 0.34–1.57)).

Table 2. Sociodemographic and clinical characteristics depending on the presence of depression (GDS-15 ≥ 5 points)

<table>
<thead>
<tr>
<th>Demographic characteristics (n,% )</th>
<th>Depression Present (n = 50)</th>
<th>Depression Absent (n = 151)</th>
<th>p-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Female 34 (68)</td>
<td>111 (74)</td>
<td>0.45</td>
</tr>
<tr>
<td></td>
<td>Low education 28 (56)</td>
<td>85 (57)</td>
<td>0.86</td>
</tr>
<tr>
<td></td>
<td>Married 9 (18)</td>
<td>24 (16)</td>
<td>0.73</td>
</tr>
<tr>
<td></td>
<td>Living alone 41 (82)</td>
<td>120 (81)</td>
<td>0.82</td>
</tr>
<tr>
<td></td>
<td>Institutionalized living 18 (36)</td>
<td>30 (20)</td>
<td>0.02</td>
</tr>
<tr>
<td>Anxiety (n,% )</td>
<td>No anxiety 34 (68)</td>
<td>142 (94)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Subthreshold anxiety 9 (18)</td>
<td>8 (5)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Threshold anxiety 7 (14)</td>
<td>1 (1)</td>
<td></td>
</tr>
<tr>
<td>Chronic disease present (n,% )</td>
<td>present 42 (86)</td>
<td>135 (89)</td>
<td>0.48</td>
</tr>
<tr>
<td>Clinical characteristics (median, Interquartile range)</td>
<td>Cognitive function (MMSE) 26 (23–28)</td>
<td>27 (24–29)</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>Disabilities in activities of daily living (GARS) 50 (36–58)</td>
<td>34 (27–42)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td></td>
<td>Loneliness (de Jong-Gierveld scale) 4 (2–5)</td>
<td>0 (0–2)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Satisfaction with life (Cantril’s ladder) 6 (5–7)</td>
<td>8 (7–8)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Chronic disease present: present and past cardiovascular morbidity (myocardial infarction, angina pectoris, arrhythmias, heart failure, atrial fibrillation, left ventricular hypertrophy, stroke and peripheral arterial disease) and non-cardiovascular morbidity (Parkinson’s disease, chronic obstructive pulmonary disease, arthrosis (including rheumatoid arthritis and polymyalgia rheumatica), malignancies and hip fracture).

GARS = Groningen Activity Restriction Scale; MMSE = Mini-Mental State Examination.

* Categorical data were compared using Chi-square test; continuous data were compared using Mann–Whitney test; the three groups with different categories of anxiety were compared using linear-by-linear-association.

Table 3. Distribution of anxiety diagnoses in subjects with threshold and subthreshold anxiety disorders as assessed by the Anxiety Screening Questionnaire

<table>
<thead>
<tr>
<th>Threshold anxiety disorder (n = 8)*</th>
<th>Subthreshold anxiety disorder (n = 17)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generalized Anxiety Disorder (GAD)</td>
<td>8</td>
</tr>
<tr>
<td>Panic Disorder</td>
<td>3</td>
</tr>
<tr>
<td>Post Traumatic Stress Disorder (PTSD)</td>
<td>2</td>
</tr>
<tr>
<td>Agoraphobia</td>
<td>0</td>
</tr>
<tr>
<td>Social Phobia</td>
<td>0</td>
</tr>
</tbody>
</table>

* Four of the eight subjects with a threshold anxiety disorder and seven of the 17 subjects with a subthreshold anxiety disorder had more than one anxiety diagnosis.

DISCUSSION

This study shows that both depression and anxiety are highly prevalent among people at the very old age of 90 years; 17% of the subjects had depression only, 4% anxiety only and 8% had concurrent depression and anxiety. This means that 32% of the subjects with depression also had anxiety and that 64% of subjects with anxiety also had depression.

Our prevalence data of concurrent depression and anxiety are markedly higher compared to earlier studies focusing on co-occurrence of formally diagnosed depressive and anxiety disorders in subjects.
Table 4. Demographic and clinical characteristics depending on the presence of anxiety symptoms (including both threshold and subthreshold), stratified for presence of depression (GDS-15 ≥ 5 points)

<table>
<thead>
<tr>
<th>Demographic characteristics (n,%)</th>
<th>Depression present (n = 50)</th>
<th>Depression absent (n = 151)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Anxiety Present (n = 16)</td>
<td>Anxiety Absent (n = 34)</td>
</tr>
<tr>
<td>Female</td>
<td>13 (81)</td>
<td>21 (62)</td>
</tr>
<tr>
<td>Low education</td>
<td>9 (56)</td>
<td>19 (56)</td>
</tr>
<tr>
<td>Married</td>
<td>3 (19)</td>
<td>6 (18)</td>
</tr>
<tr>
<td>Living alone</td>
<td>12 (75)</td>
<td>29 (85)</td>
</tr>
<tr>
<td>Institutionalized living</td>
<td>7 (44)</td>
<td>11 (32)</td>
</tr>
</tbody>
</table>

| Chronic disease present (n,%)    | Anxiety Present (n = 14)    | Anxiety Absent (n = 137)   |
|                                   | (median MMSE 26, Interquartile range 24–28) | (median MMSE 26, Interquartile range 23–27) |
|                                   | Disabilities in activities of daily living (GARS) 44 (34–53) | Disabilities in activities of daily living (GARS) 53 (40–60) |
| Loneliness (de Jong-Gierveld scale) | 5 (4–6) | 3 (1–4) |    |
| Satisfaction with life (Cantrill’s ladder) | 6 (5–7) | 6 (5–7) |    |

Chronic disease present: present and past cardiovascular morbidity (myocardial infarction, angina pectoris, arrhythmias, heart failure, atrial fibrillation, left ventricular hypertrophy, stroke and peripheral arterial disease) and non-cardiovascular morbidity (Parkinson’s disease, chronic obstructive pulmonary disease, arthrosis (including rheumatoid arthritis and polymyalgia rheumatica), malignancies and hip fracture).

GARS = Groningen Activity Restriction Scale; MMSE = Mini-Mental State Examination.

*Categorical data were compared using Chi-square test and continuous data using Mann–Whitney test.

aged over 65 years, where prevalence rates of only 1.8–2.0% were observed (Schoevers et al., 2003; Kvaal et al., 2008). Our finding that 8% of subjects experienced concurrent depression and anxiety is in line with the results of the LASA study, in which prevalence rates for concurrent depression and anxiety have been shown to vary from 4.3–9.5%, depending on subjects’ level of cognitive function (Bierman et al., 2007).

It is important to note that our 90-year-old study population is substantially older than those of some earlier studies, and that symptoms of anxiety may change with increasing age. Indeed, age-specific anxieties such as fear of falling are not only frequently reported by elderly people, but also have a strong association with depression (Bryant et al., 2008).

It is somewhat surprising that in our sample of 90 year old people with moderate cognitive decline (median MMSE = 27) none reported social phobia and only one subject reported agoraphobia. This is in contrast with the findings of Bierman and colleagues who found social phobia in about 3% of the subjects with moderate cognitive decline (25 < MMSE < 27), whereas agoraphobia was particularly common in subjects with ‘poor cognition’ (MMSE ≤ 25; 3.4%) (Bierman et al., 2007). A possible explanation of this finding is that at very old age, it may be easier to avoid possibly embarrassing and frightening situations.

Our study shows that the presence of depression is strongly related to the presence of anxiety symptoms as part of subthreshold and threshold anxiety disorders. In comparison to non-depressed subjects, those who were depressed showed poorer functional status (reflected in cognitive impairment and poor daily functioning) as well as a decreased quality of life (expressed in feeling more lonely and being less satisfied with life) and also a higher mortality risk. This is in line with earlier findings (Vinkers et al., 2004). Although subjects with concurrent depression and anxiety felt lonelier than those with depression only, it is somewhat surprising that the presence of anxiety in addition to depression did not lead to a further decline in functional status or to a further increase in mortality. This may also be due to the low number of participants.

A recent study even reports a protective effect of anxiety on mortality in depressed elderly individuals (Holwerda et al., 2007) but our findings do not concur with this. Anxiety in elderly people is a well-known predictor of depression (Schoevers et al., 2003) and may be part of the phenomenology of depression in old age without contributing a negative impact on an individual’s functional status and mortality.

Because the number of subjects in our study, particularly in some subgroup-analyses, are rather small, the negative findings must be interpreted with
KEY POINTS

- Among individuals aged 90 years, depression and anxiety as well as their co-occurrence are highly prevalent.
- Anxiety does not add to poor functional status and increased mortality beyond that associated with depression.

caution. Nevertheless, this study provides a unique insight into the presence of depression, anxiety and their co-occurrence in very old age and how it affects functional status, well-being and mortality risk. A weakness of our study may be that the prevalence rates of depression and anxiety were determined using common cut-off scores that are not age-specific and thus may not be valid in very old subjects. Furthermore, because anxiety data were available only when subjects were aged 90 years, we were limited to cross-sectional analysis, which makes conclusions about possible causal pathways indiscernible. It can nevertheless be concluded that among individuals aged 90 years both depression and/or anxiety are highly prevalent.

The findings of this study may have important public health implications. Health care providers should be aware that the majority of nonagenarians with anxiety symptoms also have depressive symptoms. Further, a substantial number of depressed elderly people have concurrent anxiety, but the presence of anxiety most probably has only a minor negative influence if any on functional status, quality of life or mortality risk. Since most elderly people with anxiety are also depressed and since elderly people with depression are most in need of treatment, health care providers should focus on treating depression to improve quality of life in very old age.

CONFLICT OF INTEREST
None known.

REFERENCES
