Depressed mood and health service use

Relation between depressed mood, somatic comorbidities and health service utilisation in older adults: results from the KORA-Age study

MARIA ELENA LACRUZ1, REBECCA THWING EMENY1, SIBYLLE HAFFNER1, ANJA KERSTIN ZIMMERMANN1, BIRGIT LINKOHR1, ROLF HOLLE2, KARL-HEINZ LADWIG1,3

1Institute of Epidemiology II, Helmholtz Zentrum München, German Research Center for Environmental Health, Ingolstädter Landstr. 1, 85764 Neuherberg, Germany
2Institute of Health Economy and Health Care Management, Helmholtz Zentrum München, German Research Center for Environmental Health, Ingolstädter Landstr. 1, 85764 Neuherberg, Germany
3Department of Psychosomatic Medicine and Psychotherapy, Klinikum rechts der Isar, Technische Universität München, Munich, Germany

Address correspondence to: K.-H. Ladwig. Tel: (+49) 89 3187 3623; Fax: (+49) 89 3187 3667. Email: ladwig@helmholtz-muenchen.de

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Abstract

Background: prior literature suggests that comorbidity with depression significantly worsens the health state of people with chronic diseases.

Objective: the present study examines whether depressed mood increased medical care use for patients with a comorbid physical disease.

Design, setting and subjects: the study was a population-based study (KORA-Age), with 3,938 participants aged 64–94.

Methods: we investigated differences in health services use in participants with and without depressed mood (Geriatric Depression Scale). A further adjustment for disease was done and differences were examined with the Mann–Whitney U test. The incidence rate ratios (IRRs) for doctors’ appointments or the number of days in hospital were explored with (zero-inflated) negative binomial regression models.

Results: there are increased self-neglecting behaviours and medical comorbidities in participants with depressed mood. Depressed mood increased participants’ use of medical services (P < 0.0001). Among participants who visited the doctor during the last 3 months, those with depressed mood had more visits than those without depressed mood, irrespective of somatic comorbidities (P < 0.0001 and P < 0.05 for ill and healthy, respectively). Additionally, patients with coexisting depressed mood and physical disease visited the doctor’s practice significantly more often. Having depressed mood significantly increases the likelihood for more doctor visits (IRR = 1.5, CI = 1.3–1.7) and longer hospital stays (IRR = 1.9, CI = 1.6–2.3). In participants with somatic comorbidities the risk is even greater (IRR = 1.6, CI = 1.3–2, for the number of doctors visits and IRR = 2, CI = 1.4–2.9, for the number of days in the hospital).

Conclusions: results suggest that patients with depressed mood had increased use of health-care services overall, particularly those with somatic comorbidities.

Keywords: depressed mood, somatic comorbidities and health service utilisation

Introduction

Depression and self-neglect in older adults is an increasing problem in health-care management and delivery. Depression is known to be associated with self-neglecting behaviour and not complying with medical advice [1], but this is not well defined in older adults. Self-neglect is characterised by profound inattention to health and hygiene and was recently shown to be associated with lower levels of physical function [2] and increased risk of mortality [3].

Depression has been found to have a high prevalence in elderly primary care patients: major depression has been estimated at 6.5–9% [4, 5], and minor depression at 10–20% [6, 7]. Major and minor depression in older adults have been shown to be associated with increased perception of unexplained physical symptoms such as headache and dizziness [8], and increased functional impairment [9].

Several studies have examined the impact of depression on medical utilisation in elderly primary care patients. Patients underwent screening in two studies with the Center for Epidemiologic Studies Depression Rating Scale: those studies found that patients with clinically significant depressed mood had significantly higher total ambulatory medical costs for periods of 9 months [10] and 4 years [11]. A recent study also showed that elderly patients diagnosed by their primary care physician as having depression had increased total ambulatory costs and combined ambulatory and inpatient costs compared with control subjects during a 1-year period [12].

These three studies have left several questions unanswered. Because the older persons may be less likely to seek mental health or primary care services for depression, it is unclear whether high use of medical care would be found if the studies were based on the entire population enrolled in the health-care plan rather than on those who visited clinics.

It has been recently shown that comorbid depression is significantly associated with lower health states in respondents with chronic conditions in comparison to having chronic conditions, including multiple chronic conditions, without depression [13]. The present investigation used a population-based sample of 3,938 adults 64–94 years of age to examine whether depressed older adults have a higher use of health-care services than patients without depression. We also examined whether depression increased the effect on higher use of health-care services depending on chronic medical disease.

Methods

Setting

We investigated depression, self-neglect behaviour and somatic comorbidities in 3,938 participants of the KORA-Age study. KORA-Age study is a follow-up of all participants aged 64–94 of the MONICA/KORA surveys S1–S4.
Participants

The KORA-Age study involves a health questionnaire administered to all participants of the MONICA/KORA cohort who were born between 1 January 1915 and 31 December 1943 (n = 4,565; response rate = 76%); a telephone interview to determine multi-morbidity and mental health status of the participants (n = 4,127; response rate = 69%), and medical examinations and clinical interviews with a sub-sample of the cohort (n = 1,079; response rate = 54%). From the 3,942 participants who responded themselves to the telephone interview, a total of 3,938 answered the depression questionnaire and were included in the present study. Interviews and examinations were carried out between September 2008 and November 2009.

Outcome variable

Health-care utilisation: doctors visits and hospital days

Utilisation of health care was assessed via self-report. Items for doctors visits read as follows: ‘In the last 3 months, did you consult any physician (excluding dentist)?’ (if yes) ‘How often did you consult a physician in the last 3 months?’ Likewise, the number of inpatient days was estimated, using the following items: ‘In the last 12 months, have you been hospitalised at all?’ and (if yes) ‘In sum, how many days or weeks have you been hospitalised in the last 12 months?’

Covariates

Depression

Depression was measured in the telephone interview by the Geriatric Depression Scale (GDS-15) from Sheikh and Yesavage [16]. This scale comprises 15 items with yes/no answers. The maximal score is 15 points, where 0–5 indicates normal, 6–10 light to moderate depression and 11–15 severe depression. In the present investigation, participants with scores above 5 were considered to suffer from depressed mood.

Self-neglect behaviour

Self-neglect behaviour was characterised by either the tendency to skip a meal (never/almost never, sometimes, often, almost everyday), not to do any physical activity or not to follow through on planned activities. One item from the Risk evaluation for eating and nutrition, Version II (SCREEN II) was used to evaluate the tendency to skip a meal [17]. As an instrument to assess physical activity three questions were used, which have already been used in previous MONICA/KORA studies [18]. Participants were classified as active if they regularly participated in sports in summer and winter, and if they were active for at least 1 h a week in either season. One item from the Resilience Scale 11 [19] was used to assess whether participants follow through on planned activities or not. All questions were asked in the telephone interview.

Somatic comorbidities

Presence of self-reported somatic chronic diseases (respiratory, gastrointestinal, heart, neurological, kidney and/or liver diseases, arthritis/rheum, cancer, stroke or diabetes mellitus) was determined in the telephone interview or health questionnaire through a modification of the Chaudhry questionnaire [20]. Somatic comorbidity was defined as more than one of those diseases present in a participant.

Clinical variables

Use of medication, self-perceived poor health (very good, good, fair and bad) and pain/discomfort (not at all, some and extreme) were self-reported and documented in the health questionnaire.

Statistical analysis

Age was stratified in 5-year categories with the last two groups being joined together due to the small number of participants in these groups. Differences in health service utilisation were analysed in participants with depressed mood and without adjusting for age (in five groups) either with the Mann–Whitney U test for continuous variables with two groups or with the Kruskal–Wallis test for continuous variables with more than two groups. Bonferroni correction was applied for multiple testing (16 comparisons; P-value of <0.003).

Differences in percentages of self-neglect behaviour, somatic comorbidities and health behaviours in participants with and without depressed mood were analysed with the \( \chi^2 \) test.

Differences in length of health service utilisation were analysed in participants with depressed mood and without adjusting for disease (in two groups: chronic disease vs. healthy) with Mann–Whitney \( U \) test for continuous variables.

The distribution of the visits to the doctor is positively skewed. The negative binomial regression model fitted better than did the Poisson model (\( \chi^2 = 2,840, P < 0.0001 \), showing substantial overdispersion). We also checked the appropriateness of the negative binomial regression model compared with zero-inflated negative binomial regression,
using the Vuong test ($v = 26.37, P < 0.0001$). Therefore, negative binomial regression analysis was used to test for association between depressed mood and the increased numbers of doctors’ appointments. The distribution of the days in hospital is also positively skewed. The negative binomial regression model fitted better than did Poisson model ($\chi^2 = 39,656, P < 0.0001$, showing substantial over-dispersion). We also checked the appropriateness of the negative binomial regression model compared with zero-inflated negative binomial regression, using the Vuong test ($v = -43.87, P < 0.0001$). Therefore, zero-inflated negative binomial regression analysis was used to test for association between depressed mood and the increased numbers of days in hospital. The strength of the associations was calculated with incidence rate ratios (IRRs). The model included the effect of depressed mood, sex, age and number of somatic comorbidities. Furthermore, separate negative binomial regression analyses were done for participants with and without somatic comorbidities adjusting for sex and age. Analysis was conducted in SAS version 9.2 (SAS Institute Inc., Cary, NC, USA).

**Results**

**Medical care use**

Depressed mood participants visited more often the doctor during the last 3 months (Figure 1a, $Z = 8.9; P < 0.0001$) and stayed longer hospitalised in the last year (Figure 1b, $Z = 5.19; P < 0.0001$) than those without depressed mood. This is true when subdividing the sample in 5-year age groups for doctors’ visits for all participants except those in the 80–84 years old group (all $P < 0.003$). Visited doctors were: general practitioner (84.3%), oculist (29.7%), orthopaedist (17.6%), urologist (12.4%), dermatologist (11.5%), otolaryngologist (10.3%), radiologist (9.5%), cardiologist

![Figure 1](image-url)
(8.5%), neurologist (7%), specialist in internal medicine (6.3%), gynaecologist (6.3%), surgeon (2.8%) and other doctors, i.e. psychiatrist (2%). With Bonferroni correction for multiple testing, there were no differences in specialists visited between depressed and non-depressed participants ($P < 0.003$).

For hospital stay remains significant in the age groups 64–69 and 70–74 ($P < 0.01$). In participants with no depressed mood, with increasing age raises as well the number of visits to the doctor ($P < 0.0001$); whereas no differences in the service utilisation for different age groups were found in participants with depressed mood. No differences were found either for non-depressed or depressed participants in the number of days in hospital for different age-groups.

**Sample description**

Population demographics and clinical characteristics were compared for participants with or without depressed mood (Supplementary data are available in *Age and Ageing* online). Fourteen per cent of the participants ($n = 541$) were classified as having depressed mood. Increased self-neglecting behaviours and medical comorbidities in participants with depressed mood were observed. Depressed participants were less likely to be males and married. Participants with depressed mood perceived themselves less healthy and had an increased medication use. Pain and memory loss complaints were as well more often reported by the depressed participants. No significant differences were observed in the self-neglect behaviour ‘often skip meals’. When stratifying the sample in two age groups (64–75 and >75) in order to see if the age differences explained the health differences, similar results were found. The only difference between age groups was found in younger participants; there was no difference in sex distribution according to depression; and in older participants there was no difference in stroke incidence among depression groups.

**Disease adjustment**

Among participants who went to the doctor during the last 3 months ($n = 3,185$), those with depressed mood went more often to the doctor in the last 3 months than those without irrespective of having a chronic condition or not (Figure 2, $Z = 6.3; P < 0.0001$ and $Z = 1.9; P = 0.03$, respectively, for ill and healthy). Those ill went more often to the doctor irrespective of depressed mood or not (Figure 2, $Z = -10.14; P < 0.0001$ and $Z = -4.25; P < 0.0001$, respectively, for non-depressed and depressed). Additionally, the interaction chronic condition * depression is highly significant (Kruskal–Wallis = 183.9, $P < 0.0001$).

In participants with medical disease, the GDS-15 may have a lower specificity. Therefore, we repeated the analysis in a sensitivity analysis using a higher cut-off for GDS-15 ($\geq 10$). Essentially, similar results were obtained: participants with depressed mood went more often to the doctor if they were healthy ($P = 0.0003$). No differences were found for ill participants ($P = 0.27$). Those ill went more often to the doctor irrespective of depressed mood or not ($P < 0.0001$ and $=0.008$, respectively, for non-depressed and depressed).

**Determinants of medical care use**

Having depressed mood significantly increases the likelihood for an increased number of doctor visits (IRR = 1.46, 95% CI = 1.27–1.69, $P < 0.0001$) and hospital stays (IRR = 1.9, 95% CI = 1.55–2.32, $P < 0.0001$). Having no somatic comorbidities causes a slight decrease in the significance of depressed mood on the number of doctor visits (IRR = 1.22, 95% CI = 0.99–1.50); whereas having somatic comorbidities increases the strength and significance of this association (IRR = 1.64, 95% CI = 1.33–2.03). Having no somatic comorbidities increases the significance of depression on the length of hospital stay (IRR = 3.41, 95% CI = 1.96–5.93) (Table 1).

**Discussion**

The results of the present study revealed that elderly participants who suffer from depressed mood showed self-neglecting behaviour more often than non-depressed participants. Additionally, they used health-care services more often; not only out- but also in-patient resources. Furthermore, patients with coexisting depressed mood and somatic comorbidities visited doctors’ practices and hospitals significantly more often.
Table 1. Depressed mood and visits to the doctor in the last 3 months/hospital stay in the last year as modelled by multivariate negative binomial regression models, before and after stratification for somatic comorbidities

<table>
<thead>
<tr>
<th>Variable</th>
<th>All participants</th>
<th>No comorbidities</th>
<th>Somatic comorbidities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IRR (95% CI)</td>
<td>P</td>
<td>IRR (95% CI)</td>
</tr>
<tr>
<td>Visitor to the doctor last 3 months&lt;sup&gt;b&lt;/sup&gt;</td>
<td>$n = 3938$</td>
<td>$n = 1570$</td>
<td>$n = 2368$</td>
</tr>
<tr>
<td>Age (continuous)</td>
<td>1.01 (1.00–1.01)</td>
<td>0.0006</td>
<td>1.02 (1.01–1.03)</td>
</tr>
<tr>
<td>Female</td>
<td>1.12 (1.05–1.19)</td>
<td>0.0007</td>
<td>1.15 (1.03–1.29)</td>
</tr>
<tr>
<td>Depression</td>
<td>1.46 (1.27–1.69)</td>
<td>&lt;0.0001</td>
<td>1.22 (0.99–1.50)</td>
</tr>
<tr>
<td>Number somatic comorbidities</td>
<td>1.32 (1.26–1.37)</td>
<td>&lt;0.0001</td>
<td>–</td>
</tr>
<tr>
<td>Depression * number comorbidities</td>
<td>0.91 (0.84–0.98)</td>
<td>0.01</td>
<td>–</td>
</tr>
<tr>
<td>Hospital stay last year&lt;sup&gt;a&lt;/sup&gt;</td>
<td>$n = 3938$</td>
<td>$n = 1570$</td>
<td>$n = 2368$</td>
</tr>
<tr>
<td>Age (continuous)</td>
<td>1.01 (0.99–1.02)</td>
<td>0.3</td>
<td>1.03 (1.00–1.06)</td>
</tr>
<tr>
<td>Female</td>
<td>1.31 (1.13–1.53)</td>
<td>0.0005</td>
<td>1.29 (0.94–1.76)</td>
</tr>
<tr>
<td>Depression</td>
<td>1.90 (1.55–2.32)</td>
<td>&lt;0.0001</td>
<td>3.41 (1.96–5.93)</td>
</tr>
<tr>
<td>Number somatic comorbidities</td>
<td>1.21 (1.13–1.29)</td>
<td>&lt;0.0001</td>
<td>–</td>
</tr>
</tbody>
</table>

<sup>a</sup>Somatic comorbidities: respiratory, gastrointestinal, heart, neurological, kidney and/or liver diseases, arthritis/rheum, cancer, stroke or diabetes mellitus.

<sup>b</sup>Covariates: age (as a continuous variable), sex, depressed mood, number of somatic comorbidities and the interaction depressed mood * number of somatic comorbidities.

There are a number of possible explanations for the present finding of a significant increase of medical service utilisation in depressed participants with somatic comorbidities. First, depressive somatic symptoms could mask physical pathology, which then goes undiagnosed, remains undetected and requires longer correcting. This explanation is related to the psychopathology of depression. Healthy individuals may report physical symptoms relatively early; depressed patients may delay reporting of symptoms [21]. Different degrees of physical disease severity may account for differences in medical care utilisation, and severe physical disease may occur more frequently in depression. Contrarily, depression could have been made more severe in the group with physical disease.

A further issue to be taken into account relates to differential patient compliance with medical treatment. A decrease in compliance with medical treatment will increase hospital stay and the number of doctor visits. There is known, decreased patient motivation for treatment compliance due to hopelessness in depressed participants [22]. Depression is associated with medication non-adherence in outpatients with coronary heart disease, which likely contributes to adverse cardiovascular outcomes in depressed patients [22]. Even low levels of depressive symptomatology are associated with non-adherence of important aspects of diabetes self-care. Interventions aimed at alleviating depressive symptoms, which are quite common, could result in significant improvements in diabetes self-care [23]. Unfortunately, we were not able to assess the impact of medication non-adherence in this cohort.

Our data regarding depression and self-neglect behaviour, although in the expected direction, is in some ways conflicting with the other findings. If individuals with depression are neglecting themselves, why is their health-care utilisation so high? Possible explanations are that they use health care because they are sicker, as suggested by Burnett J et al. [24]. It has been also suggested that uncontrolled pain produced by disease leads to depression [25]. Another possibility is that the inclusion of mental health services in the outcome measure confounds the effect. The latter is not probable, due to the small number of participants who could go to mental health services (in our sample, up to 2%).

The present study has several important strengths. Foremost, it is a population-based sample, in which healthy and ill participants were included, with well-defined health outcomes, and inclusion of an exhaustive list of relevant covariates. Some limitations, however, need to be addressed. Technical limitations of the study include the potential inaccurate characterisation of hospital types. Stays in psychiatric hospital are usually longer than in other facilities. Besides, the severity of medical disease could confound the relation between depression and health-care utilisation. However, the appropriate investigation of this question opens a new perspective which cannot be undertaken in our epidemiologic setting. The important effect of disease severity in the literature is on its mortality risk [26], and other aspects of medical use such as frequency and type of prescriptions or the quality of life would be needed to appropriately investigate this issue. To do so would have required more specific clinical and medical records information which we do not have access to. However, in order to account at least partially for the confounding effect, we have taken into account the number of self-reported diseases. Moreover, the Chaudhry questionnaire as a method of classifying comorbidity is composed of a list of severe comorbid diseases [20].

The present study demonstrates that the comorbidity of depression and physical disease is associated with longer hospital stays as well as more frequent doctor visits.
Elderly participants with depressed mood had significantly increased likelihood for more doctor visits and longer hospital stays.

Conflict of interest
None declared.

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Supplementary data
Supplementary data mentioned in the text is available to subscribers in Age and Ageing online.

References
Falls incidence underestimates the risk of fall-related injuries in older age groups: a comparison with the FARE (Falls risk by Exposure)

Astrid Etman1, Gert Jan Wijhuisen1, Marieke J. G. van Heuvelen2, Astrid Chorus1, Marijke Hopman-Rock1,3

1TNO The Netherlands Organization for Applied Scientific Research, Leiden, The Netherlands
2Centre of Human Movement Sciences, University Medical Center Groningen, University of Groningen, Groningen, The Netherlands
3Body@Work, Research Center Physical Activity, Work and Health, TNO VU University Medical Center, van der Boechorststraat 7, Amsterdam, The Netherlands

Address correspondence to: G. J. Wijhuisen, TNO, PO Box 2215, 2301 CE Leiden, The Netherlands. Tel: (+31) 888666201; Fax: (+31) 888660610. Email: gertjan.wijhuisen@tno.nl

Abstract

Background: up till now, the risk of falls has been expressed as falls incidence (i.e. the number of falls or fallers per 100 person-years). However, the risk of an accident or injury is the probability of having an accident or injury per unit of exposure. The FARE (Falls risk by Exposure) is a measure for falls risk which incorporates physical activity as a measure of exposure. The objective of this study was to compare falls incidence and the FARE when expressing the age-related risk of fall-related injuries.

Methods: data of 21,020 community-dwelling elderly aged ≥55 years (60.3% women) obtained from a national survey (2000–05) were used to compare incidence of fall-related injuries and the FARE. In order to compare both measures, risk ratios (of both outcome measures) were calculated for each age group. Hierarchical regression analyses (linear versus exponential model) were conducted to check the best model fit when expressing falls risk by age for the total study population and for men and women separately.

Results: the risk of fall-related injuries, calculated on the basis of the incidence of fall-related injuries, showed a linear relationship with age, whereas the risk calculated on the basis of fall-related injuries corrected for exposure (falls risk by exposure, FARE) showed an exponential relationship. Calculations on the basis of the incidence of fall-related injuries underestimated the risk of fall-related injuries in people aged 70 years and older, and especially in women.

Conclusion: calculation of the risk of fall-related injuries based on the incidence of these injuries underestimates the risk of such injuries relative to that calculated on the basis of the FARE. FARE-based calculations enable the early identification of people at high risk of falls and provide a more sensitive outcome measure for studies evaluating falls prevention interventions.

Keywords: physical activity, falls injury risk, elderly, age, gender