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The association of physical health and depressive symptoms in the older population: age and sex differences

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Abstract Physical health and depression are closely related in the elderly. This has been found in both cross-sectional and longitudinal studies. In this study the relation between four aspects of physical health and depressive symptom levels were studied in a community-based sample of older inhabitants of a small town in the Netherlands ($n = 224$). Results indicated that depression as measured with the CES-D is sufficiently different from physical health to be distinguished from it, and that it is sufficiently related to physical health to be relevant for further study. The more subjective measures of physical health used in this study (pain and subjective health) appeared to have a much stronger relation with depression than the more objective health measures (chronic diseases and functional limitations). Physical health and aspects of the social environment such as marital status appeared to have independent effects on mood. In this study these effects were moderated by age and sex. In women and the young-old (55–64) none of the associations between physical health and depression were significant. In men and the old-old (75+) all associations were highly significant.

Introduction

In epidemiological surveys of the elderly, depression is one of the most prevalent psychiatric conditions (Myers et al. 1984). The effect of depression on well-being, autonomy and medical consumption has been demon-

strated in many studies (Craig and van Natta 1978; Gurland 1983; Kennedy et al. 1989). While depression is generally thought to be a treatable disorder, the recognition and provision of adequate treatment has been shown to be poor (Goldberg and Bridges 1988; Copeland et al. 1992; Kirmayer et al. 1993). In both cross-sectional and longitudinal studies different aspects of physical functioning have been found to be closely related to depression in the elderly (Gurland 1983; Murrell et al. 1983; Schulberg and Saul 1985; Berkman et al. 1986; Cole 1990; Kennedy et al. 1989; 1990, 1991). There are many possible routes by which physical health and depression can be thought to affect one another (Gurland et al. 1988). Depression can be thought to be either a part of, caused by, or a cause of declining physical health. Very little is known about the relative significance of different pathways in which physical health and mood are interrelated in community-dwelling elderly.

The aim of this study was to provide further evidence on the way physical health and depressive symptoms interact. The first question we considered was which aspects of physical health have the greatest impact on changes in mood. Some diseases are well known to have a specific aetiological link with depression. Examples are Parkinson's disease (Cummings 1992) and stroke (Eastwood et al. 1989). However, in some community-based studies it has been shown that general aspects of physical functioning are more important correlates of depression than specific diagnosis (Kinzie et al. 1986; Kennedy et al. 1989). For prevention and treatment it is important to know the degree to which the association between depression and physical dysfunctioning is determined by specific diagnosis-related variables such as the type, stage and severity of the physical illness. We compared the importance of these factors to general disease-related factors, such as functional limitations, pain and subjective health experience, in their relation to depression.

Our second question was whether age and sex modify the above relationships. With regard to age, Gurland

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Table 1 Reasons for not participating in the study

Reason	n (%)
Refusal	106 (27 %)
Not interested	63 (16 %)
Taken too much time	8 (2 %)
Bad experience with research	7 (2 %)
Too old to participate	4 (1 %)
Content of the questions	13 (3 %)
Other	11 (3 %)
Too ill	31 (8 %)
Confused/demented	10 (3 %)
In hospital	4 (1 %)
Deaf/blind	4 (1 %)
Other	13 (3 %)
Not contacted	7 (2 %)
Moved, address unknown	1 (0 %)
Not known at address	2 (1 %)
Long vacation	2 (1 %)
Other	2 (1 %)

(1988) suggests a closer association between physical health and depression in the younger-old than in the older-old. Sex differences in coping with changes in physical health are relatively unexplored in the older population. This is probably due to sampling procedures. In most studies random samples of community-dwelling elderly are drawn. This results in a relatively small number of older men in the study populations and makes it difficult to compare men and women through the whole range of 'old-age'.

We examined the relationship between four aspects of physical health and depressive symptom levels in a community-based sample of elderly in the Netherlands. The data presented were gathered in the pilot studies of the Longitudinal Ageing Study Amsterdam (Deeg et al. 1993).

Methods

Population and response

Respondents were recruited from a random sample of the elderly (55–89 years) in Sassenheim, a small town in the Netherlands. In order to be able to study age and sex differences, the sample was stratified by age and sex. The sample consisted of 394 persons of whom 7 had died before they could be contacted. Thus, there were 387 potential respondents of whom 106 (27.4 %) refused to be interviewed, 31 (8.0 %) were too ill to participate and 7 (1.8 %) could not be traced by our interviewers (overall response rate 62.8 %). More detailed information about the reasons given for not participating in the study is given in Table 1. Due to incomplete data, another 19 (4.9 %) respondents were lost to further analysis, leaving a study population of 224. Age and sex were significantly related to response. Non-responders were more often female ($\chi^2 = 5.59$, $df = 1$, $P = 0.02$) and older ($P < 0.001$). Non-response among the older-old was not related to sex. There were no interactions between age, sex and non-response ($P = 0.746$).

Further examination of the reasons for not responding revealed no sex differences in the type of non-response ($\chi^2 = 1.89$, $df = 2$, $P = 0.39$). As was expected, there were age differences in the type of non-response. The average age of those too ill to participate

was significantly higher than in other categories of non-responders ($P = 0.001$). Again, there were no interactions between age, sex and type of non-response ($P = 0.708$).

Interviews were conducted by trained interviewers in the homes of respondents. All interviews were tape-recorded in order to control the quality of the data. Data were collected between November 1991 and March 1992. Following the interview, respondents were asked to complete a written questionnaire. A number of respondents refused or were not able to complete this questionnaire. Depending on the part of the questionnaire, the response ranged from 81 % to 72 %. Not completing written questionnaires was related to age, sex, number of depressive symptoms and marital status. The effect of this selective loss is discussed later.

Measurements

Depressive symptoms were measured using the Centre for Epidemiologic Studies Depression Scale (CES-D). This is a 20-item self-report scale developed to measure depressive symptoms in the community (Radloff 1977). It was chosen because it has been widely used in the elderly (Murrell et al. 1983; Berkman et al. 1986; Blazer et al. 1991) and has good psychometric properties (Himmelfarb and Murrell 1983; Hertzog et al. 1990; Radloff and Teri 1986). The Dutch translation of the CES-D has been shown to have good psychometric properties in two samples of elderly subjects (Beekman et al. 1994). A minimal overlap with symptoms of physical illness is crucial for this study. This overlap has been shown to be very limited in a number of studies (Berkman et al. 1986; Foelker and Shewchuk 1992; Shinar et al. 1986; Devins et al. 1988). In order to facilitate the use of the CES-D in interviews with older persons, we dichotomised the items into 'yes and no' categories. Used in this way the CES-D generates a score between 0 and 20. One important drawback of this procedure is that generally used cutting points for clinically relevant depressive syndromes cannot be used. Our results pertained to the level of depressive symptoms experienced by the respondent and not to depression in a clinical sense.

We included two 'objective' measures of physical health. The first was disease specific and concerned the presence of chronic conditions (CBS 1989). In this paper, we report on findings regarding cerebrovascular accidents (CVA), diabetes, neoplasm, arthritis, chronic respiratory disease (CRD) and cardiovascular diseases (CVD). The other measure was more general, measuring functional limitations (Van Sonsbeek 1988). Pain (Hunt et al. 1981) and subjective health (CBS 1989) were the two 'subjective' aspects of physical health we included. All measures of physical health were based on self-report by the respondents.

Questions regarding depression, chronic diseases and functional limitations were part of the interview, while pain and subjective health were assessed in the written questionnaire. The effects of age and sex were examined in a series of separate analyses. There were a number of possible measures for socioeconomic status. For various reasons it was not possible to use information on variables such as income (30 % missing data) and previous occupation (most older women in the Netherlands have not had any salaried occupation). The level of education was taken as a proxy for socioeconomic status, and was included because it has been significantly associated with depression in a number of studies (Eaton and Kessler 1981; Romaniuk et al. 1983; Murrell et al. 1983). Marital status was significantly associated with age, sex, chronic disease and depression scores. We included it both as a potential confounder of the relation between physical health and depression, and as a crude measure of social support.

Table 2 Description of the population: distribution of demographic and health-related variables by average CES-D score (ANOVA tested for linearity where possible)

	<i>n</i> (%)	Average total CES-D score (SD)	<i>F</i>
Total population	224 (100 %)	2.47 (3.04)	
Age (years)			
55–64	81 (36 %)	1.83	$F_{2,221} = 4.06^*$
65–74	61 (27 %)	2.37	
75–89	82 (37 %)	3.17	
Sex			
Men	111 (49 %)	1.87	$F_{1,222} = 8.82^{**}$
Woman	113 (51 %)	3.05	
Education			
Low	110 (49 %)	2.81	$F_{2,204} = 1.80$
Middle	71 (32 %)	2.04	
High	26 (12 %)	1.93	
Not known	17 (7 %)		
Marital status			
Married	134 (60 %)	1.78	$F_{3,220} = 6.24^{***}$
Widowed	67 (30 %)	3.44	
Divorced	10 (4 %)	4.17	
Never married	13 (6 %)	3.16	
Chronic diseases			
CVA	13 (5.8 %)	3.39	$F_{1,222} = 1.28$
Diabetes	17 (7.6 %)	3.31	$F_{1,222} = 1.40$
Neoplasm	18 (8.0 %)	2.95	$F_{1,222} = 0.49$
Arthritis	49 (22.0 %)	3.40	$F_{1,222} = 6.07^*$
CRD	24 (10.7 %)	2.85	$F_{1,222} = 0.42$
CVD	50 (22.3 %)	2.59	$F_{1,222} = 0.11$
Number of chronic diseases			
0	104 (46 %)	2.05	$F_{3,220} = 6.27^*$
1	79 (35 %)	2.48	
2	31 (14 %)	3.49	
3	10 (5 %)	3.53	
Functional limitations			
No difficulties	85 (38 %)	1.51	$F_{1,193} = 11.94^{**}$
Difficulties	110 (49 %)	2.49	
Unknown	29 (13 %)		
Subjective health			
Very good	26 (11 %)	1.21	$F_{2,178} = 13.17^{***}$
Good	107 (48 %)	1.60	
Fair/poor	48 (21 %)	3.12	
Unknown	43 (19 %)		
Pain			
No symptoms	94 (42 %)	1.34	$F_{1,160} = 12.17^{***}$
Symptom	68 (30 %)	2.72	
Unknown	62 (28 %)		

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$

Data analysis

First, the distribution of the relevant variables in our sample and their association with average depression scores were examined by means of analysis of variance. Where possible, tests for linear associations were performed. Second, Spearman rank correlations between the four aspects of physical functioning used in this study and their correlations with CES-D scores were determined. In this way we obtained a measure for the overlap between depression and the four measures of physical health. In order to detect differences determined by age and gender we repeated the analyses of variance for men and women, and for three age groups separately. Multiple regression was used to study the association of physical health and depression, controlling for age, sex and marital status.

Results

The distribution of demographic and health-related variables in our population is shown in Table 2. The distribution of demographic and health-related variables was influenced by the relatively large number of older-old respondents in our sample. The percentage of respondents who were widowed was relatively high. More than half of our population reported one or more chronic diseases and more than half had functional limitations. Of those replying to the written questionnaire, 42 % had at least one pain symptom. In contrast with this relatively high prevalence of physical dysfunction-

Table 3 Spearman rank correlations between different aspects of physical health and depressive symptoms

	CES-D score	Number of chronic diseases	Functional limitations	Pain	Subjective health
CES-D score	–				
Number of chronic diseases	0.21**	–			
Functional limitations	0.27***	0.39***			
Pain	0.29***	0.47***	0.43***	–	
Subjective health	0.32***	0.49***	0.39***	0.47***	–

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$ **Table 4** Association between depressive symptoms and four aspects of physical health by gender (ANOVA tested for linear associations where possible)

	N		Average CES-D scores		P	
	Men	Women	Men	Women	Men	Women
Number of chronic diseases						
0	48	56	1.06	2.90	< 0.001	0.784
1	40	39	1.69	3.29		
2	19	12	3.79	3.01		
≥ 3	4	6	4.28	3.04		
Functional limitations						
No difficulties	57	28	1.11	2.34	0.04	0.123
Difficulties	42	68	2.11	3.46		
Subjective health						
Very good	15	11	0.69	1.93	< 0.001	0.111
Good	58	49	0.97	2.34		
Fair/Poor	22	26	2.92	3.28		
Pain						
No symptoms	53	41	0.67	2.21	< 0.001	0.171
Symptoms	35	33	2.38	3.08		

Table 5 Association between depressive symptoms and four aspects of physical health by age (ANOVA tested for linear associations where possible). Age categories: I = 55–64; II = 65–74; III = 75–89

	n			Average total CES-D score			P		
	I	II	III	I	II	III	I	II	III
Number of chronic diseases									
0	44	24	31	1.90	1.80	2.48	0.868	0.509	0.047
1	28	17	34	1.66	2.95	2.92			
2	7	9	15	2.44	3.00	4.27			
≥ 3	0	4	6	–	1.56	4.85			
Functional limitations									
No difficulties	43	32	10	1.69	1.60	0.51	0.381	0.052	0.014
Difficulties	34	26	50	2.17	3.18	3.35			
Pain									
No Symptoms	40	32	22	1.54	1.39	0.92	0.917	0.008	0.003
Symptoms	26	20	22	1.59	3.42	3.41			
Subjective health									
Very good	8	8	10	0.76	1.64	1.23	0.078	0.210	0.001
Good	44	37	26	1.54	1.98	1.16			
Fair/poor	20	9	19	2.31	3.36	3.85			

ing, 74 % judged themselves to be in good, or very good, health. It seems that a sizeable part of our population had health problems that had been diagnosed and were accompanied by functional limitations and pain, but these subjects still regarded themselves to be in good health. Table 2 also contains the distribution of average CES-D scores by demographic and health-related variables. Results of bivariate analyses of variance are also

summarised. In our sample there was a linear association between the number of depressive symptoms and age, the number of chronic diseases and subjective health. There were significant associations with gender, marital status, functional limitations and pain. In contrast to other studies, the association with the level of education was not significant. In all further analyses the level of education was therefore dropped. When

chronic diseases were examined separately, mean depression scores were higher than in the total population for all types of chronic diseases. However, the only disease showing a statistically significant association with depression was arthritis. Subjective health and pain were included in the written questionnaire. "Unknowns" were caused by respondents not replying or not fully completing the questionnaire. The questions on pain were placed towards the end of the questionnaire, negatively influencing the response.

A correlation matrix of the relevant variables is shown in table 3. All correlations between depressive symptoms and different aspects of physical functioning were significant. However, the strength of these correlations did not indicate a great amount of overlap between depression and measures of physical health. In all cases the four aspects of physical health had a higher correlation with one another than with depressive symptom scores. This was an indication that depression is not simply a part of declining physical health and that it is correct to distinguish depressive symptoms from physical health measures. On the other hand, a certain degree of association between depression and physical health was confirmed. The correlation coefficients gave a first impression of which aspects of physical functioning were most important. There appeared to be a hierarchy in the correlations: functional limitations, pain and subjective health had increasingly stronger associations with depression than the number of chronic diseases. The more general and subjective aspects of physical health appeared to have a stronger relationship with depression than the disease categories.

The moderating effects of age and sex on the above relationships are examined in Tables 4 and 5. It appeared that both age and sex are crucial in the understanding of the relation between physical health and depression. In the women, we found no significant association between any of the aspects of physical health and depression. The trends were, however, all in the expected direction. In contrast with this, all relationships were highly significant in the men. The moderating effect of age is summarised in Table 5. In the young-old, there was no association between physical functioning and depression. In the old-old, all relationships were significant. Again, the more subjective measures had the strongest associations with depression.

Bringing together all relevant variables in one model was impeded by the nature of our study design. Due to the fairly large number of incomplete written questionnaires, the study population was small in relation to the number of variables, and results would lack sufficient power. A multivariate analysis including age, sex, marital status and only one aspect of physical health was however, feasible. Marital status was associated with all other variables and, therefore, a potential confounder of the relation between physical health and depression. Moreover, taken as a crude measure of social support, marital status represented an important group of determinants of depression.

In a multiple regression model, the effects of age and sex on depressive symptom level disappeared when controlling for marital status and chronic diseases. Marital status and chronic disease had independent effects, which was an indication that they represent different domains of determinants of depression in the elderly. The total variance explained was, however, modest (10%). The variance explained increased when chronic diseases were substituted by either one of the other three aspects of physical health studied. The highest total amount of variance (18%) was explained in the equation with subjective health. This was not surprising, as subjective health had the highest bivariate correlation with CES-D scores ($r = 0.32$).

Discussion

In this paper we studied the relationship between four aspects of physical health and depression in a community-based sample of elderly subjects in the Netherlands. Our main questions were which aspects of physical health have the most impact on mood, and can age and sex modify these relationships. In our sample, the association between specific disease categories and depression scores proved to be very limited. Only arthritis had a statistically significant association with depressive symptoms. Summing the chronic diseases resulted in a more general measure of physical health that showed a significant and linear association with depressive symptoms. Subjective health measures such as pain and subjective health appeared to have much stronger relationships with depressive symptoms than the more objective measures.

In most previous studies the older-old are underrepresented. This applies especially to older men. Studies in which men and women can be compared through advanced age are, therefore, scarce. Our sample was limited in size, but it was convenient for studying age and sex differences because of its stratification. There appeared to be crucial age and sex differences in the interplay between physical health and depression. Men and the old-old appeared to be far more susceptible to changes in mood in the face of physical health problems than women and the young-old. While marital status was a powerful confounder of the relationship between age and sex, and depressive symptoms, the independent effects of physical health were only slightly affected by marital status. Marital status and physical health appeared to represent independent domains of determinants of depression in the elderly.

Because a considerable number of potential respondents did not partake in the study, it was important to examine the non-responders as closely as possible. One might fear that the age and sex differences we found were the result of selective non-response, and did not reflect real differences between age groups and sexes. Non-response was indeed related to both age and sex, but there were no interactions between age, sex and

not responding. Non-response among the older subjects in the study population was higher and more likely to be associated with ill health. Although women had a higher non-response rate, this tendency was the same for all age groups. Furthermore, men and women did not differ in the type of non-response. Therefore, the age and sex differences reported probably reflected true differences in the sample and were not attributable to selection bias. A sizeable number of respondents did not complete the written questionnaires, reducing the number of observations on pain and subjective health. It is to be expected that the associations we aimed to study would be strongest if those who had the most depressive symptoms were included. As not completing questionnaires was related to having more depressive symptoms, we must assume that this loss of respondents weakened the associations we aimed to find.

An important limitation of this study is that all data were based on self-report by the respondents. It was not possible to inspect medical records to confirm the data on physical health. This may have led to misclassification of some respondents. Moreover, objective measures for the severity or stage of the chronic diseases that were reported was not included. These shortcomings probably weakened the associations we aimed to find. However, through their negative cognitions, depressed individuals might be more likely to report negative views on their general state of health. This report bias might have artificially raised the associations between depressive symptoms and the more subjective measures of physical health such as pain and subjective health. The impact of using only self-report data on physical health was therefore likely to be bidirectional. Moreover, the main findings of the study were based on consistent associations between depression and all four aspects of physical health. This strengthens the validity of its findings.

Another important limitation is that in a cross-sectional study such as this one, no causal inferences can be drawn. Longitudinal data are necessary to further unravel the complex interplay between the course of physical health and depressive symptoms.

Despite these limitations we concluded that the association between physical health and depression was highly significant in this older population. Physical impairments are common in the elderly, and they are often associated with elevated depressive symptoms levels. In their review, Gurland et al. (1988) distinguish three basic types of intervention aimed to ameliorate depression associated with physical illness: primary treatment of depression, treatment of physical impairments and interventions that are relevant to both conditions. Examples of the latter two groups of interventions are physical rehabilitation, restoration of functional independence, control of pain and other discomforts, bolstering of social support and cognitive therapy for improving attitudes and coping capacity (Gurland et al. 1988). These types of interventions cannot cure chronic physical illnesses, but they can be expected to have an

effect on the more general and subjective aspects of physical health and on the associated mood changes. The finding that the impact of these aspects of physical health on mood was more salient than the effects of specific diseases is therefore highly relevant for the treatment of depression in the elderly.

The age and sex differences we found in both the prevalence of depressive symptoms and their association with physical health problems illustrated the changing impact of risk factors for depression among the elderly. Older men seemed to be especially at risk, and could be expected to benefit most from interventions aimed to prevent or ameliorate depression associated with a decline in physical health. This illustrates how these findings, if replicated, could guide the further development of programmes aimed at improving the identification and treatment of depression in the community-dwelling elderly.

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