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RESEARCH REPORT

Depression and early retirement: prospective population based study in middle aged men

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Background: Mental depression is an important health problem in many countries. It reduces productivity at work and is the fastest increasing reason for early retirement.

Methods: This study followed up a Finnish cohort of 1726 men from 1984 to 2000. Depression was assessed at baseline by HPL depression score. Pension records were obtained from the national pension registers. Cox's regression analysis was used to estimate the associations of depression with the risk of all disability pensions combined, separately for different causes of disability, and non-illness based pension.

Results: During the follow up, 839 men (48.6%) received a disability pension. A total of 142 men (16.9% of all disability pensions) retired because of mental disorder and of these, 75 (52.8%) because of depression. After adjustment for the potential confounders, men in the highest third of depression score had an increased risk of non-illness based pension (RR 1.86 95% CI 1.37 to 2.51) and disability pension attributable to mental disorders (RR 2.74, 95% CI 1.68 to 4.46), chronic somatic diseases (RR 1.68, 95% CI 1.05 to 2.71), cardiovascular diseases (RR 1.61, 95% CI 1.12 to 2.32). The mean age of retirement for men with a high and low depression score was 57.6 years (SD 3.87) and 59.1 years (SD 3.65) ($p < 0.001$) respectively.

Conclusions: A high depression score predicted disability attributable to any cause, especially mental disorders, and non-illness based pensions. Depressed people retired on average 1.5 years younger than those without depression. Further studies are needed to elucidate the pathways of how mental depression leads people to seek retirement pension.

M ental disorders have become the most common reason for disability pensions in Finland. This is mainly attributable to an increase of depression as a cause of disability. The increase was threefold in Finland between 1987 and 1995.[1]

It has been observed that depressive symptoms in childhood predict psychiatric problems in young adults,[2] and on the other hand, work capability in young adulthood seems to be associated with long term prognosis of working capacity.[3] Because depression is frequently under-recognised or misdiagnosed in primary care, and depressive patients do not receive appropriate treatment in time[4] it may increase the number of early pensions in later life.

Economic costs caused by depression in lost workdays seem to be as great or even greater than expenses related to many other common medical conditions. A combination of depression and another disease seems to be especially costly.[5] Depressive patients show reduced productivity and tend to use abundance of healthcare services, which further increases the economic burden on the society.

Comparatively little is known about the complex temporal relations among behaviour, affect, motivation, and pathophysiology to account for the association between depression and mortality. Little is also known about factors associated with early retirement attributable to major depression. There are no previous prospective population based studies on the association between depression and the risk of early retirement. The aim of this study was to investigate whether depression is a risk factor for later early pension in a representative population based sample of middle aged men from eastern Finland.

METHODS
Subjects
The subjects were the participants of the Kuopio ischaemic heart disease risk factor study (KIHD), which is a population study investigating risk factors for chronic diseases such as cardiovascular diseases and related outcomes.[6] The subjects of the KIHD study are a randomly selected sample of men who were living in the town of Kuopio or the surrounding rural communities in eastern Finland. The men were 42, 48, 54, or 60 years old at baseline examinations from March 1984 to December 1989. Of the 3235 eligible men, 2682 (82.9%) participated. In this study men who had retired before baseline (n = 898), had died during the follow up (n = 29), or did not fill in the questionnaire (n = 29) were excluded. The final study population included 1726 men, of whom 91.7% (n = 1582) were full time workers, 1.2% (n = 30) were part time workers, 5.6% (n = 97) were unemployed, and 1.0% (n = 17) were temporarily laid off from work at baseline.

Assessment of depression
At baseline the subjects filled in a series of psychological questionnaires. In assessment of depressive symptoms we used the HPL (Human Population Laboratory) depression score that has previously used in the longitudinal Alameda county study.[7] For the HPL depression score, a set of 40 items ostensibly relating to depression (mood disturbance, negative self concept, loss of energy, problems with eating and sleeping, trouble with concentration, psychomotor retardation, agitation) were selected from a larger pool of questionnaire items dealing with varied aspects of psychological distress.[7] These 40 items were then rated independently by 10 clinical researchers (psychiatrists and psychologists) in terms of their presumed usefulness in ascertaining whether a subject was depressed. From their ratings, half of the items were eliminated. The homogeneity of the remaining set of items was assessed by item-total correlations and measures of internal consistency reliability. From these results, two of

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Abbreviations: KIHD, Kuopio ischaemic heart disease risk factor study; HPL, Human Population Laboratory

Table 1 Depression score and background factors

	Depression score				Whole study population
	Low (n = 567)	Medium (n = 559)	High (n = 600)		
	Mean (SD)	Mean (SD)	Mean (SD)	p Value	Mean (SD)
Age (y)	51.3 (5.2)	51.7 (5.1)	52.4 (4.7)	0.001	51.8 (5.0)
Body mass index (kg/m^2)	26.4 (3.2)	26.7 (3.3)	26.9 (3.7)	0.03	26.7 (3.4)
Alcohol (g/week)	58.2 (78.4)	73.2 (118.5)	92.9 (162.1)	0.000	75.1 (126.1)
Smoking (cigarettes/day)	3.8 (8.3)	5.2 (9.5)	7.0 (11.2)	0.000	5.4 (9.8)
Maximal oxygen uptake (ml/kg/min)	2.67 (0.61)	2.54 (0.59)	2.38 (0.58)	0.000	2.53 (0.60)
Education	**Proportion (%)**	**Proportion (%)**	**Proportion (%)**		**Proportion (%)**
High school or above (n = 147)	9.2	9.5	7.0	0.000	8.5
Middle school (n = 655)	44.7	37.0	32.5		38.0
Elementary school or less (n = 923)	46.1	53.5	60.5		53.5
Occupation					
Farmer (n = 331)	18.2	19.4	20.7	0.019	19.5
Blue collar worker (n = 627)	32.4	36.6	41.4		36.9
White collar worker (n = 743)	49.4	44.0	38.0		43.7
Illness (at baseline)					
Musculoskeletal* (n = 745)	27.8	31.1	41.1	0.000	43.2
Cardiovascular† (n = 870)	26.4	30.5	43.1	0.000	50.4
Mental‡ (n = 67)	11.9	20.9	67.2	0.000	3.9
Other chronic disease§ (n = 581)	27.9	30.5	41.7	0.000	33.7

*Includes back problems and osteoarthritis. †Includes coronary heart disease, cardiac insufficiency, hypertension, claudication, and stroke. ‡Includes mental disorders. §Includes chronic bronchitis, bronchial asthma, farmer's lung or other pneumoconiosis, lung tuberculosis, diabetes, epilepsy, liver or pancreatic diseases, cancer, and rheumatoid arthritis.

the 20 items were eliminated. A score is generated by assigning one point for each ''often'' or ''never'' response (whichever is appropriate). The remaining 18 items inquired whether a subject felt depressed or very unhappy, lonely or remote from other people, on top of the world, too tired even to do things they normally enjoy, pleased about accomplishing something, bored, too restless to sit still long, left out even in a group, excited or interested in something, vaguely uneasy without knowing why, or if the subject found it difficult to feel close to others. Also subject's poor appetite, trouble getting to sleep or staying asleep, leisure time enjoyment, satisfaction with performance, difficulty to relax, bothering about getting tired in a short time, or having less energy than other people was asked. These items have item-total correlations ranging from 0.18 to 0.45 and acceptable internal consistency reliability. Coefficient α was 0.71. The HPL 18 item index showed a correlation coefficient of 0.66 with the Beck depression inventory[8] in an outpatient clinical population.[7] This correlation is about as high as can be expected based on the reliability of these two instruments. After the sum score of items was calculated, the score was categorised into thirds (low, medium, high) for further analyses.

Assessment of early retirement

The cohort was linked to the pension registers of the Social Insurance Institution, the Central Pension Security Institute, and some smaller pension institutions covering all the pensions of these subjects from baseline until the 31 May 2000. The Social Insurance Institution is responsible for the basic social security provision for disability of every Finnish citizen from the age of 16 to 65 years, whereas the Central Pension Security Institute is the statutory central body of the private sector pension institutions.

When a person becomes disabled, the first step is to claim sickness allowance. A disability pension is applied if the disability continues for more than 300 working days. Another way to retire with a disability is an individual early retirement pension. In addition to disability, this requires a long working history and at least 56 years of age. In this study, disability pension includes both regular disability pensions and individual early retirement pensions. Eligibility

for both pensions requires a comprehensive medical certificate written by an attending physician and approved by an expert adviser on behalf of the Social Insurance Institution and the Central Pension Security Institute. For this study, the first diagnosis in the medical certificate made by the attending physician was regarded as the main cause of disability.

In addition to these disability pensions, there are many non-illness based early pensions available in Finland. Through these it is possible to retire without disability before the normal retirement age (65 years), usually with lower compensation. An unemployment pension requires that the applicant has reached the age of 60 years and has been continuously unemployed for at least 500 days. For farmers aged 55 to 64 years, two separate retirement programmes exist in which disability is not required: pension after giving up farming, and pension after transferring the farm to a descendant. A part time pension may be granted for workers at the age of 56 years with the employer's agreement. In this study the non-illness based pension includes all these forms of pensions: unemployment pension, farmers' two kinds of early pensions, and part time pension.

Assessment of other variables

Age and education were assessed by a questionnaire at the beginning of the study. Education was categorised for the analyses as ''high school or above'', ''middle school'', and ''elementary school or less''. Body weight and height were measured in light indoor clothing at baseline. Body mass index was calculated by dividing body weight in kilograms by the square of body height in metres.[9] Alcohol consumption during the past 12 months was assessed by a self administered questionnaire.[10] The number of cigarettes smoked per day was measured by a questionnaire.[11 12] Cardiorespiratory fitness was assessed by a respiratory gas exchange analysis during a maximal, symptom limited exercise tolerance test.[13] Disease status was determined as a part of a two day examination at the beginning of the study, including medical history, physical examination, a battery of laboratory tests, electrocardiogram, and the exercise tolerance test.[14] The three disease categories used were: musculoskeletal disorders (including lower back problems and osteoarthritis),

Table 2 Baseline characteristics

	Disability retirees (n = 839) Percentages or mean (SD)	Non-illness based retirees (n = 329) Percentages or mean (SD)	Working men and old age retirees (n = 560) Percentages or mean (SD)	p Value for difference between groups
Age	52.5 (4.1)	53.9 (2.9)	49.4 (6.3)	0.000
Body mass index (kg/m^2)	26.9 (3.6)	26.6 (3.5)	26.4 (3.1)	0.047
Alcohol (g/week)	76.0 (119.4)	72.0 (155.9)	75.6 (116.0)	0.881
Smoking (cigarettes/day)	5.7 (9.9)	5.1 (9.6)	5.1 (9.9)	0.493
Maximal oxygen uptake (ml/kg/min)	30.3 (7.3)	31.8 (7.2)	34.4 (7.4)	0.000
Education				
High school or above (n = 147)	5.8	5.5	14.4	0.000
Middle school (n = 661)	36.7	33.4	42.5	
Elementary school or less (n = 946)	57.4	61.1	43.1	
Illness (n = 1611)				
Musculoskeletal* (n = 757)	49.0	43.5	34.2	0.000
Cardiovascular† (n = 883)	58.6	51.4	37.5	0.000
Mental‡ (n = 68)	4.4	4.0	3.0	0.433

*Includes back problems and osteoarthritis. †Includes coronary heart disease, cardiac insufficiency, hypertension, claudication, and stroke. ‡Includes mental problems and mental illnesses diagnosed by a physician.

cardiovascular diseases (including coronary heart disease, chronic heart failure, hypertension, claudication, and stroke), and mental disorders. Minor disease groups were not analysed separately.

Statistical methods

The end point during the follow up was defined as the date when the early pension was awarded, whatever was the reason for the pension, or when a person began to receive an old age pension, or the end of the follow up on 31 May 2000, whichever came first. Other outcomes were censored. The analysis was two step: firstly we analysed the risk of leaving from work life on any type of early pension. Then we focused on disability and calculated the risk in different categories of disability. The association between depression and early retirement was analysed using Cox's regression analysis adjusting for possible confounders. Men in the lowest third of depression score were compared with men in the middle and highest third. The results were expressed as risk ratios (RR) and their 95% confidence intervals.[15]

Age, education, maximal oxygen uptake, alcohol consumption, smoking, body mass index, and the most prevalent baseline diseases (musculoskeletal disorders, cardiovascular diseases, mental disorders, and other chronic illnesses) were added into the model as potential confounding variables. Age, maximal oxygen uptake, alcohol consumption, smoking, and body mass index were used as continuous variables and other confounders were categorised. SPSS 10.0 for Windows was used for statistical analyses.

RESULTS

Characteristics of the subjects

Main illness categories, smoking, and alcohol consumption were directly associated, and maximal oxygen uptake and education were inversely associated with the depression score (table 1). Men who retired because of disability and men who

were granted a non-illness based pension were older, less educated, and had a lower maximal oxygen uptake. The disability retirees had more illnesses, and non-illness based retirees had fewer illnesses at the baseline compared with those who kept working until 65 years of age or who were still working at the end of the follow up (table 2).

Retirement during the follow up

During the follow up, 839 (48.6%) men were awarded a disability pension and 329 men (19.1%) got a non-illness based pension. The mean age at the time of retirement was 58.2 (SD 3.88) years. Only 273 (32.1%) of 1755 men had retired at the official retirement age of 65 years. The main reasons for disability were musculoskeletal disorders (n = 330, 39.3%), cardiovascular diseases (n = 237, 28.2%), mental disorders (n = 142, 16.9%), and other diseases (n = 130, 15.5%). Of those who had retired because of mental disorders, a total of 75 men (52.8%) retired because of depression. At the end of the follow up, 287 (16.6%) men were still working.

Depression score and the risk of retirement

The range of the depression score was from 0 to 13, and the mean score for the whole cohort was 1.71 (SD 1.98).

Mean depression score was 1.91 (SD 1.98) among disability retirees, 1.80 (SD 2.04) among non-illness based pension retirees, 1.29 (SD 1.75) among unretired men, and 1.40 (SD 1.78) among old age retirees. The mean age of retirement for those with high depression score was 57.6 years (SD 3.87); for those with low depression score it was 59.1 years (SD 3.65). This difference was significant (p<0.001). The mean age of retirement was 56.7 years (SD 4.04) among those who retired because of a mental illness.

After adjustment for age, men in the highest third of the depression score had a 1.8 times higher risk of early retirement attributable to any reason than men in the lowest

Table 3 Relative risk (RR) of early pensions by depression score. Cox's regression modelling. Adjusted for age.

Depression score	All disability pensions (n = 861) RR (95% CI)	Mental disorder (n = 118) RR (95% CI)	Musculoskeletal disorder (n = 342) RR (95% CI)	Cardiovascular disease (n = 236) RR (95% CI)	Other reason for disability (n = 165) RR (95% CI)	Non-illness based pension (n = 331) RR (95% CI)
III tertile	1.89 (1.58 to 2.25)	3.63 (2.36 to 5.59)	1.74 (1.29 to 2.33)	2.24 (1.61 to 3.11)	1.98 (1.28 to 3.06)	1.85 (1.39 to 2.47)
II tertile	1.18 (1.01 to 1.40)	1.39 (0.89 to 2.17)	1.28 (0.99 to 1.64)	1.25 (0.91 to 1.70)	1.04 (0.67 to 1.57)	1.17 (0.90 to 1.52)
I tertile	1.0	1.0	1.0	1.0	1.0	1.0

Table 4 Relative risk (RR) of early pensions by depression score. Cox's regression modelling. Adjusted for age, education, occupation, body mass index, alcohol consumption, smoking, maximal oxygen uptake, and chronic diseases at baseline

Depression score	All disability pensions (n = 861) RR (95% CI)	Mental disorder (n = 118) RR (95% CI)	Musculoskeletal disorder (n = 342) RR (95% CI)	Cardiovascular disease (n = 236) RR (95% CI)	Other reason of disability (n = 165) RR (95% CI)	Non-illness based pension (n = 331) RR (95% CI)
III tertile	1.43 (1.21 to 1.79)	2.74 (1.68 to 4.46)	1.40 (1.01 to 1.95)	1.61 (1.12 to 2.32)	1.68 (1.05 to 2.71)	1.86 (1.37 to 2.51)
II tertile	1.06 (0.89 to 1.26)	1.32 (0.83 to 2.10)	1.17 (0.89 to 1.53)	1.07 (0.76 to 1.51)	0.93 (0.60 to 1.45)	1.04 (0.78 to 1.37)
I tertile	1.0	1.0	1.0	1.0	1.0	1.0

third. Most depressive men had a 3.6-fold risk of early retirement because of mental disorders, a 1.7-fold risk because of musculoskeletal disorders, a 2.2-fold risk because of cardiovascular diseases, and a 1.9-fold risk because of other chronic somatic diseases. They also had a 1.8 times higher risk of retirement because of other reasons than diseases (table 3). After adjustment for age, education, occupation, body mass index, alcohol consumption, smoking, maximal oxygen uptake, and chronic diseases at baseline, the risks were 1.4-fold, 2.7-fold, 1.4-fold, 1.6-fold, 1.6-fold, and 1.8-fold, respectively (table 4).

DISCUSSION

A high depression score, measured in the beginning of the follow up, was an independent predictor of early retirement. In addition to disability that was specifically attributable to mental disorders, depression significantly predicted all disability pensions combined, as well as non-illness based pensions. Depressed subjects ended up in a disability pension on average 1.5 years earlier than those without depression.

Depression was measured by using a questionnaire. Although the measure is somewhat crude, it is well validated,[7] and it has been used to examine the association of depression with various outcomes.[16–20] In this study we did not define depression as a clinical entity, or diagnosis, but rather as a dimensional characteristic. Despite this, it predicted clinical depression, as measured by disability pensions awarded because of mental disorders. On the other hand, self reported mental disorders at baseline may not comprehensively catch all psychiatric morbidity, so adjustment for this variable may have left room for some residual confounding.

The size of this cohort is fairly large and represents middle aged men, at least in eastern Finland. Unfortunately, no women were included at that time, so the results can be generalised only to men. A prospective study design and a long follow up enables the assessment of causality at least to some extent. The measure of retirement is comprehensive and reliable because the pension data come from the pension institutions covering all Finnish citizens. The pension data are accurate when all disability pensions are considered as a whole, but things are not as clear with respect to various disease specific pensions. The reason for this is that disability is seldom caused by just one disease; usually it is an outcome of many interrelated health problems.

Several studies have shown that depression potentially causes disability and decreases functional ability.[4 21–33] In these studies depression and disability were associated with the physical and social disability as well as difficulties in coping mechanisms and motivation. However, little is known about risk factors for early retirement attributable to depression even if psychological distress has been observed to predict disability pension.[34] Our study was the first prospective study to actually examine the relations between depression and early retirement, measured with the comprehensive pension register data.

Roberts et al[35] concluded that healthy older adults with normal functional capacity are not at a greater risk for depression than younger adults, but the age related effects on depression are attributable to physical health problems and related disability. A stronger relation has been observed between aging and physical symptoms than between aging and depressive symptoms.[36] Instead, a direct association has been found between depression and chronic physical illnesses,[26] cardiovascular diseases,[37 38] Parkinson's disease,[39] and musculoskeletal disorders.[40] In this study, depression was associated with an increased risk of disability pensions attributable to mental disorders, as well as attributable to somatic chronic diseases. Depression may increase feelings of pain and inhibit coping with some chronic diseases. Also non-compliance with medical recommendations, as well as the presence of other risk factors such as smoking, alcohol overuse, or reduced physical activity among depressive persons may lead to a physical illness or an existing illness may worsen, which then may cause disability or even disability pension. In our study, depression also increased the risk of non-illness based pensions. One explanation to this may be the lack of energy and motivation to work because there is no feeling of satisfaction. Also reduced coping mechanisms may result in a situation in which demands at work are too exhausting.

These findings are potentially important, especially for experts in occupational health services, because depression is known to be commonly under-recognised or misdiagnosed in primary care.[4] The early recognition of depression is extremely important because childhood depressive symptoms predict psychiatric problems in young adults,[2] work capacity of young depressive adults is associated with their long term prognosis of working capacity[3] and hence untreated depression even in childhood may lead to an early retirement in later life. As the HPL scores predicted mental disorders as the final cause of disability, and as clinical depression forms the largest diagnostic category in this group, HPL scores can be seen to predict actual clinical depression as a disability diagnosis. This is no surprise, however; more interesting is to notice how the high HPL score often precedes disability pensions that manifest themselves through somatic diagnoses.

Depression has been shown to be an important public health problem causing society large expenses in lost work days, and especially so if another common illness is connected to it.[5] In our study depression associated with increased risk of early retirement, and depressed subjects retired at a significantly younger age than those without depression. The findings suggest that depression, and its consequences, may be even more expensive for society than has previously been expected. This sends an important message to the policy makers.

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REFERENCES

1 **Salminen J**, Saarijärvi S, Raitasalo R. Depression and disability pension in Finland. *Acta Psychiatr Scand* 1997;**95**:242–3.
2 **Aronen E**, Soininen M. Childhood depressive symptoms predict psychiatric problems in young adults. *Can J Psychiatry* 2000;**45**:465–70.
3 **Pelkonen M**, Marttunen M, Pulkkinen E, *et al.* Disability pensions in severely disturbed in-patient adolescents. Twenty-year prospective study. *Br J Psychiatry* 1998;**172**:159–63.
4 **Lecrubier Y**. Depressive illness and disability. *Depressive illness and disability* 2000;**10**:439–43.
5 **Druss B**, Rosenheck R, Sledge W. Health and disability costs of depressive illness in a major U.S. corporation. *Am J Psychiatry* 2000;**157**:1274–8.
6 **Salonen J**. Is there a continuing need for longitudinal epidemiologic research?—the Kuopio ischaemic heart disease risk factor study. *Ann Clin Research* 1988;**20**:46–50.
7 **Kaplan G**, Roberts R, Camacho T, *et al.* Psychosocial predictors of depression. Prospective evidence from the human population laboratory studies. *Am J Epidemiol* 1987;**125**:206–20.
8 **Beck ACHW**, Mendelson M, *et al.* An inventory for measuring depression. *Arch Gen Psychiatry* 1961;**4**:461–71.
9 **Lakka H**, Lakka T, Tuomilehto J, *et al.* Hyperinsulinemia and the risk of cardiovascular death and acute coronary and cerebrovascular events in men. *Arch Intern Med* 2000;**160**:1160–8.
10 **Kauhanen J**, Kaplan G, Goldberg D, *et al.* Beer binging and mortality: results from the Kuopio ischaemic heart disease risk factor study, a prospective population based study. *BMJ* 1997;**315**:846–51.
11 **Tiihonen J**, Pesonen U, Kauhanen J, *et al.* CYP2A6 genotype and smoking. *Mol Psychiatry* 2000;**5**:347–8.
12 **Salonen J**, Nyyssönen K, Tuomainen T, *et al.* Increased risk of non-insulin dependent diabetes mellitus at low plasma vitamin E concentrations: a four year follow up study in men. *BMJ* 1995;**311**:1124–7.
13 **Lakka T**, Laukkanen J, Rauramaa R, *et al.* Cardiorespiratory fitness and the progression of carotid atherosclerosis in middle-aged men. *Ann Intern Med* 2001;**134**:12–20.
14 **Krause N**, Lynch J, Kaplan G, *et al.* Predictors of disability retirement. *Scand J Work Environ Health* 1997;**23**:403–13.
15 **Rothman K**, Greenland S. *Modern epidemiology.* 2nd ed. Hagerstown, MD: Lippincott-Raven, 1998.
16 **Linn M**, Hunter K, Linn B. Self-assessed health, impairment and disability in Anglo, black and Cuban elderly. *Med Care* 1980;**18**:282–8.
17 **Linn M**, Linn B, Skyler J, *et al.* The importance of self-assessed health in patients with diabetes. *Diabetes Care* 1980;**3**:599–606.
18 **Ostlin P**. Occupational history, self reported chronic illness and mortality: a follow up of 25,586 Swedish men and women. *J Epidemiol Community Health* 1990;**44**:12–16.
19 **Nitz N**, Garrard J, Rolnick S, *et al.* Self-assessment of changes in health status by depressed and non-depressed elderly. *Abstract Book of Association of Health Services Research* 1998;**15**:190–1.
20 **Nordström D**, Vierkant R, Layde P, *et al.* Comparison of self-reported and expert-observed physical activities at work in a general population. *Am J Ind Med* 1998;**34**:29–35.
21 **Broadhead W**, Blazer D, George L, *et al.* Depression, disability days, and days lost from work in a prospective epidemiologic survey. *JAMA* 1990;**264**:2524–8.
22 **Conti D**, Burton W. The economic impact of depression in a workplace. *J Med* 1994;**36**:983–8.
23 **Hays R**, Wells K, Sherbourne C, *et al.* Functioning and well-being outcomes of patients with depression compared with chronic general medical illnesses. *Arch Gen Psychiatry* 1995;**52**:11–19.
24 **Olfson M**, Fireman A, Weissman M, *et al.* Mental disorders and disability among patients in a primary care group practice. *Am J Psychiatry* 1997;**154**:1734–40.
25 **Schonfeld W**, Verboncoeur C, Fifer S, *et al.* The functioning and well-being of patients with unrecognized anxiety disorders and major depressive disorder. *J Affect Disord* 1997;**43**:105–19.
26 **Armenian H**, Pratt L, Gallo J, *et al.* Psychopathology as a predictor of disability: a population-based follow-up study in Baltimore, Maryland. *Am J Epidemiol* 1998;**148**:269–75.
27 **Simon G**, Katon W, Rutter C, *et al.* Impact of improved depression treatment in primary care on daily functioning and disability. *Psychol Med* 1998;**28**:693–701.
28 **Ormel J**, Von Korff M, Oldehinkel A, *et al.* Onset of disability in depressed and non-depressed primary care patients. *Psychol Med* 1999;**29**:847–53.
29 **Penninx B**, Leveille S, Ferrucci L, *et al.* Exploring the effect of depression on physical disability: longitudinal evidence from the established populations for epidemiologic studies of the elderly. *Am J Public Health* 1999;**89**:1346–52.
30 **Lin E**, VonKorff M, Russo J, *et al.* Can depression treatment in primary care reduce disability?: a stepped care approach. *Arch Fam Med* 2000;**9**:1052–8.
31 **Oslin D**, Streim J, Katz I, *et al.* Change in disability follows inpatient treatment for late life depression. *J Am Geriatr Soc* 2000;**48**:452–3.
32 **Simon G**, Revicki D, Heilingenstein J, *et al.* Recovery from depression work productivity, and health care costs among primary care patients. *Gen Hosp Psychiatry* 2000;**22**:153–62.
33 **Kivelä S**, Pahkala K. Depressive disorder as a predictor of physical disability in old age. *J Am Geriatr Soc* 2001;**49**:290–6.
34 **Manninen P**, Heliövaara M, Riihimäki H, *et al.* Does psychological distress predict disability? *Int J Epidemiol* 1997;**26**:1063–70.
35 **Roberts R**, Kaplan G, Shema S, *et al.* Does growing old increase the risk for depression? *Am J Psychiatry* 1997;**154**:1384–90.
36 **Dening T**, Chi L, Brayne C, *et al.* Changes in self-rated health, disability and contact with services in a very elderly cohort: a 6-year follow-up study. *Age Ageing* 1998;**27**:23–33.
37 **Booth-Kewley S**, Friedman H. Psychological predictors of heart disease: a quantitative review. *Psychol Bull* 1987;**101**:343–62.
38 **Aromaa A**, Raitasalo R, Reunanen A, *et al.* Depression and cardiovascular diseases. *Acta Psychiatr Scand,* 1994;**377**:77–82.
39 **Schuurman A**, van den Akker M, Ensinck K, *et al.* Increased risk of Parkinson's disease after depression: a retrospective cohort study. *Neurology* 2002;**58**:1501–4.
40 **Leino P**, Magni G. Depressive and distress symptoms as predictors of low back pain, neck-shoulder pain, and other musculo-skeletal morbidity: a 10-year follow-up of metal industry employees. *Pain* 1993;**53**:89–94.