Fatigue and psychosocial distress in the working population. Psychometrics, prevalence and correlates.

ELSEVIER

Journal of Psychosomatic Research 52 (2002) 445–452

Journal of Psychosomatic Research

Fatigue and psychological distress in the working population Psychometrics, prevalence, and correlates

Ute Bültmann[a,*], Ijmert Kant[a], Stanislav V. Kasl[b], Anna J.H.M. Beurskens[a], Piet A. van den Brandt[a]

[a]*Department of Epidemiology, Maastricht University, P.O. Box 616, 6200 MD Maastricht, The Netherlands*
[b]*Department of Epidemiology and Public Health, Yale University School of Medicine, New Haven, CT, USA*

Received 11 October 2000

Abstract

Objective: The purposes of this study were: (1) to explore the relationship between fatigue and psychological distress in the working population; (2) to examine associations with demographic and health factors; and (3) to determine the prevalence of fatigue and psychological distress. **Methods:** Data were taken from 12,095 employees. Fatigue was measured with the Checklist Individual Strength, and the General Health Questionnaire (GHQ) was used to measure psychological distress. **Results:** Fatigue was fairly well associated with psychological distress. A separation between fatigue items and GHQ items was shown. No clear, distinct pattern of associations was found for fatigue vs. psychological distress with respect to demographic factors. The prevalence was 22% for fatigue and 23% for psychological distress. Of the employees reporting fatigue, 43% had fatigue only, whereas 57% had fatigue and psychological distress. **Conclusions:** The results indicate that fatigue and psychological distress are common in the working population. Although closely associated, there is some evidence suggesting that fatigue and psychological distress are different conditions, which can be measured independently.

Keywords: Epidemiology; Fatigue; Psychological distress; Working population; Prevalence; Psychometrics

Introduction

Community and primary care studies have repeatedly shown that fatigue is a common complaint [1–6], and that fatigue may accompany physical [1] as well as psychiatric disorders [1,5,7]. Fatigue that becomes prolonged is reported to be associated with impairments comparable to chronic medical conditions [7], and may affect the individual's performance and functioning in the occupational as well as in the home setting.

The concept and the assessment of fatigue have been subjects of controversy for many years [8,9], and there are still more questions than answers with respect to the status of fatigue. For example, is fatigue conceptually, operationally, and etiologically distinct from psychological distress, or is the overlap between the two constructs so large as to throw in doubt the usefulness of having two separate concepts? Is the natural history of the two different? Are different prevention and treatment strategies applicable? At present, these questions cannot be adequately answered. We do know that studies conducted in the general population [3] and in the primary care setting [5] have shown that fatigue is associated with psychological distress, with observed correlations of .62 and .51. However, the relationship between fatigue and psychological distress may vary across different populations. With respect to the working population, previous research of fatigue and psychological distress was restricted to a specific occupational setting [10], with an observed correlation of .54. Hence, one key issue is whether the available measures of fatigue and the existing measures of psychological distress assess highly similar or sufficiently different underlying concepts in the general working population.

The Maastricht Cohort Study of "Fatigue at work" contributes to this research field with a large-scale epidemiological study in a heterogeneous working sample, in which not only the etiological factors in the onset and

* Corresponding author. Tel.: +31-43-388-2391; fax: +31-43-388-4128.
E-mail address: u.bultmann@epid.unimaas.nl (U. Bültmann).

0022-3999/02/$ – see front matter
PII: S0022-3999(01)00228-8

natural history of fatigue and psychological distress will be investigated but also the measures of fatigue and psychological distress and the constructs themselves will be examined. Within the Maastricht Cohort Study, fatigue is measured with the self-report Checklist Individual Strength (CIS) [11–13]. The General Health Questionnaire (GHQ) is used to assess psychological distress [14,15].

In the present study, we used the baseline data from the Maastricht Cohort Study to describe the relationship between fatigue and psychological distress in the working population, to examine associations with demographic and health factors, and to determine the prevalence of fatigue and psychological distress.

Methods

Study population

In May 1998, a total of 26,978 male and female employees, aged 18–65 years, from 45 Dutch companies and organizations received a letter at home inviting participation and the baseline questionnaire. The letter explained the purpose and the general outline of the cohort study, described how the data would be used, and guaranteed anonymity of responses. The voluntary nature of participation was emphasized. Nonrespondents received a written reminder 2 weeks later. After 6 weeks, a random sample of 600 persistent nonrespondents was asked to complete a brief questionnaire about the reasons for nonresponse; 168 (30%) of the nonrespondents returned this questionnaire.

A total of 12,161 employees completed the baseline questionnaire. Written consent was obtained from all participants. The overall response rate was 45%. Twenty-one questionnaires were discarded from the analysis because of technical reasons; another 45 questionnaires were excluded because an inclusion criterion was not met. The final study population at baseline consisted of 12,095 employees: 8840 (73%) men and 3255 (27%) women. The mean age of the total cohort was 41.0 years (S.D. 8.9) — 42.0 years (S.D. 8.8) in men and 38.0 years (S.D. 8.8) in women. Table 1 shows demographic and health factors for the total cohort at baseline. In a nonresponse analysis, no significant differences were found between respondents and nonrespondents

Table 1
Demographic and health factors for the total cohort (N = 12,095)

	Total (N = 12,095)		Men (N = 8840)		Women (N = 3255)	
	n	%	*n*	%	*n*	%
Age group (years)						
18–25	488	4.0	253	2.9	235	7.2
26–35	3049	25.2	1924	21.8	1125	34.6
36–45	4530	37.5	3318	37.5	1212	37.2
46–55	3510	29.0	2905	32.9	605	18.6
56–65	518	4.3	440	5.0	78	2.4
Educational level						
Primary school	522	4.4	446	5.1	76	2.5
Lower vocational education	1833	15.6	1524	17.6	309	10.1
Lower secondary school	1526	13.0	932	10.8	594	19.4
Intermediate vocational education	2805	23.9	2044	23.6	761	24.8
Upper secondary school	1009	8.6	641	7.4	368	12.0
Upper vocational education	2705	23.1	2047	23.6	658	21.5
University	1335	11.4	1035	11.9	300	9.8
Living alone						
Yes	1227	10.2	840	9.5	387	11.9
No	10,852	89.8	7989	90.5	2863	88.1
Dependent children						
Yes	6459	53.9	4922	56.2	1537	47.7
No	5522	46.1	3835	43.8	1687	52.3
Presence of disease						
Yes	2839	24.2	1987	23.1	852	26.9
No	8914	75.8	6604	76.9	2310	73.1
Health status						
Excellent	1144	9.5	844	9.6	300	9.3
Very good	2653	22.1	2002	22.8	651	20.1
Good	6437	53.6	4661	53.1	1776	55.0
Moderate	1648	13.7	1187	13.5	461	14.3
Bad	124	1.0	81	0.9	43	1.3

on demographic characteristics. Nonrespondents were less likely to report fatigue complaints (42% vs. 55%, $\chi^2 = 11.1$, $P < .05$), sickness absence (21% vs. 39%, $\chi^2 = 21.5$, $P < .05$), and difficulties in work execution due to health complaints (17% vs. 26%, $\chi^2 = 7.75$, $P < .05$). The main reason for nonresponse was "no time to complete the questionnaire" (30%), followed by "nothing would be done with the results" (18%), and "no interest in the study subject" (15%).

Fatigue

Fatigue was measured with the 20-item self-report CIS, which was originally developed for hospital studies of chronic fatigue syndrome [11,12]. The CIS was extensively tested in the clinical setting [16,17], and validated in the working population [13]. It covers several aspects of fatigue, such as severity (eight items), concentration (five items), motivation (four items), and physical activity level (three items), which fit in with the concept of prolonged fatigue. Subjects are instructed to indicate how they felt during the last 2 weeks. The response to each statement is scored on a seven-point Likert scale (*1* = "Yes, that is true" to *7* = "No, that is not true"). Four factor scores can be calculated. Higher scores indicate a higher degree of fatigue, more concentration problems, reduced motivation, or low levels of activity. Moreover, a composite CIS total score (ranging from 20 to 140) can be obtained by adding the individual's scores on the four factors. In the Maastricht Cohort Study, the composite CIS total score was used to measure fatigue. The cut-off point for case classification used in the present study was CIS total > 76. This cut-off was established in a separate pilot study by means of defined samples with differences in fatigue levels [18]. All those employees scoring >76 were considered to be probable fatigue cases.

Psychological distress

Psychological distress was assessed with a Dutch translation of the GHQ (GHQ-12) [14,15]. The GHQ-12 was developed as a screening instrument for detecting minor psychiatric disorders in the general population. Two scoring systems were used for the four-point response scale. The Likert scoring method (0, 1, 2, 3) summed the responses of the 12 items to give a continuous distribution of the scores ranging from 0 to 36. The traditional GHQ scoring method (0, 0, 1, 1) is designed to identify individuals reporting sufficient psychological distress to be classified as probable cases of minor psychiatric disorder. Given a possible range of scores from 0 to 12, the threshold for case classification used in the present study was four or higher. That means that all those employees scoring on four or more of the 12 GHQ items were considered to be cases of psychological distress. The threshold for case classification is high, but comparable to the threshold used in the few other studies in this research field and likely to predict very symptomatic patients.

Demographic and health factors

Demographic items comprised gender, age, educational level, living alone, and dependent children. The questionnaire further included items about the presence of diseases and the general health status. The health status item was adapted from the Dutch version of the SF-36 [19] and is scored on a five-point response scale ("excellent," "very good," "good," "moderate," "bad").

Statistical analysis

In CIS questionnaires with missing data on the subscales "fatigue severity" (two items), "motivation" (one item), and "concentration" (one item), the missing items were replaced with the items means. CIS questionnaires with more than four missing items were excluded from analysis. In GHQ's with missing data on three items or fewer, the missing data were replaced with item means. GHQ's with more than three missing data were excluded from analysis.

Principal component analysis (PCA) was used to investigate the factor structure of the CIS and GHQ-12. The correlation matrix eigenvalues (eigenvalue >1 criterion) and the factor loadings of individual items across factors were used to indicate the acceptability of a factor solution. Varimax rotation was applied to obtain factors approximating simple structure. Further statistical procedures comprised Pearson correlations, Cronbach's α for internal consistency, chi-square statistics, two-sided Student's *t* tests, univariate analysis of variance, and ANCOVA. Multiple comparisons were performed using the Tukey correction. First, we used the Likert scoring of the CIS and the GHQ-12 to (a) determine the distribution of fatigue and psychological distress; (b) conduct a PCA in order to investigate whether the CIS and the GHQ-12 formed separate factors; and (c) explore the associations of the two constructs with demographic and health factors. We then used the simple dichotomy of "noncase" and probable "case" for the CIS and the GHQ-12 to determine the prevalence of fatigue and minor psychiatric disorder and to examine the relation between "fatigue only" and "psychological distress only" cases. The significance level for all statistical tests was fixed at .05. Data were analysed using SPSS 8.0 [20].

Results

Distribution of fatigue and psychological distress in the working population

A total of 236 CIS questionnaires were excluded because of more than four items missing. The mean CIS total score in the 11,859 complete questionnaires was 57.2 (S.D. 23.7). As shown in Fig. 1, CIS total scores had a continuous distribution, ranging from 20 to 140. Overall, 113 GHQ's were excluded because of more than three items missing.

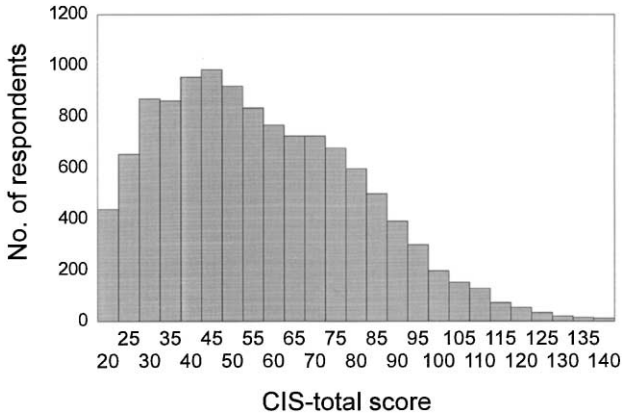

Fig. 1. Distribution of CIS total scores (N=11,859).

The mean GHQ score in the 11,982 complete questionnaires was 11.6 (S.D. 5.4), with scores from 0 to 36. Similar to fatigue, a continuous distribution was found for psychological distress in the working population.

Psychometrics of CIS and GHQ-12

The scores on the CIS total and the GHQ-12 were fairly well correlated (r=.62). The correlations among the four original factors of the CIS and the GHQ-12 were .56 for fatigue severity, .54 for concentration, .49 for motivation, and .34 for physical activity level, respectively. To determine whether the CIS and the GHQ-12 assess different underlying conditions, a PCA with varimax rotation was conducted. For this analysis, the continuous scoring of the items was used. In a first step, the 12 GHQ items and the 20 CIS items, covering the four aspects of fatigue, were analysed. The eigenvalue >1 criterion indicated a five-factor solution. The first factor explained 38% of the variance and consisted of the eight fatigue severity items and two motivation items. The second factor, which explained 8% of the variance, comprised all GHQ items. The third, fourth, and fifth factors consisted of five concentration items, three physical activity items, and two remaining motivation items, respectively, and captured 6%, 4%, and 3% of the variance. The individual items loaded on either one of the four ''CIS'' factors or the ''GHQ'' factor, i.e., no substantial cross-loading was observed between the ''CIS'' factors and the ''GHQ'' factor.

Because of the concept of fatigue (composite CIS), the CIS and GHQ-12 items were analysed in a two-factor solution in a second step. Table 2 shows the varimax rotated factor structure for the two-factor solution. The first factor consisted of the 20 CIS items (Cronbach's α=.93); the second factor comprised the 12 GHQ items (Cronbach's α=.89). Two items of the CIS factor ''concentration'' showed a tendency to load on both factors, though with higher loadings on the CIS (see Table 2). Generally, there was no substantial cross-loading between these two principal factors, which supports the notion of measuring different underlying concepts.

Associations of fatigue with demographic and health factors

The mean CIS total scores for men (57.2; S.D. 23.4) and women (57.1; S.D. 24.4) were highly similar. Age correlated very weakly positively with fatigue in men (r=.03) and very weakly negatively with fatigue in women (r = − .03). As shown in Table 3, among men, employees aged 46–55 years reported significantly higher levels of fatigue than the employees aged 26–35 and the oldest (P<.05), whereas among women, no statistically significant differences in mean CIS scores between the age groups were found. The educational level, when adjusted for age, was only associated with differences in fatigue scores in men. There was a linear trend for declining scores on the CIS with higher educational levels (P<.001). In women, a curvilinear association was observed, with higher fatigue scores on the lower and higher educational levels. In both genders, employees who reported living alone had significant

Table 2
Component matrix for the two-factor solution after varimax rotation (N=11,867)

Questionnaire/item	Factor 1	Factor 2
CIS		
(1) I feel tired	**0.75**	0.17
(2) I feel very active	**0.75**	0.22
(3) Thinking requires effort	**0.51**	0.27
(4) Physically I feel exhausted	**0.71**	0.17
(5) I feel like doing all kinds of nice things	**0.54**	0.18
(6) I feel fit	**0.79**	0.27
(7) I do quite a lot within a day	**0.31**	0.11
(8) When I'm doing something, I can concentrate quite well	**0.53**	0.35
(9) I feel weak	**0.76**	0.22
(10) I don't do much during the day	**0.45**	0.18
(11) I can concentrate well	**0.58**	0.35
(12) I feel rested	**0.77**	0.22
(13) I have trouble concentrating	**0.57**	0.30
(14) Physically I feel I am in a bad condition	**0.73**	0.16
(15) I am full of plans	**0.45**	0.16
(16) I am tired very quickly	**0.78**	0.19
(17) I have a low output	**0.57**	0.24
(18) I feel no desire to do anything	**0.67**	0.27
(19) My thoughts easily wander	**0.53**	0.31
(20) Physically I feel in a good shape	**0.74**	0.16
GHQ-12[a]		
(1) Lost sleep over worry	0.27	**0.54**
(2) Constantly under strain	0.29	**0.53**
(3) Able to concentrate	0.27	**0.67**
(4) Playing useful part in things	0.19	**0.57**
(5) Able to face problems	0.01	**0.52**
(6) Capable of making decisions	0.13	**0.62**
(7) Couldn't overcome difficulties	0.27	**0.69**
(8) Feeling reasonably happy	0.18	**0.75**
(9) Enjoy normal activities	0.23	**0.71**
(10) Unhappy and depressed	0.33	**0.73**
(11) Losing confidence in self	0.28	**0.71**
(12) Thinking of self as worthless person	0.24	**0.64**

[a] GHQ-12, the Dutch translation of the 12-item GHQ. Bold numbers = factor loadings.

Table 3
Crude and adjusted mean CIS total scores for men and women in relation to demographic and health factors; prevalence (%)

Characteristic	Men ($n=8692$) Crude		Women ($n=3167$) Crude		Prevalence (%) Men	Women
Age group (in years)						
	**				**	
18–25	55.1		57.4		18.9	20.3
26–35	56.1		57.7		18.4	23.3
36–45	57.3		56.7		22.1	22.3
46–55	58.4		56.6		23.4	22.5
56–65	55.0		55.8		23.0	20.8
	Crude	Adjusted[a]	Crude	Adjusted[a]		
Educational level (age adjusted)						
		**			**	*
Primary school	63.0	62.7	59.6	60.2	31.7	34.3
Lower vocational education	59.9	60.0	57.8	58.0	26.3	25.9
Lower secondary school	58.8	58.7	57.2	57.4	23.3	25.6
Intermediate vocational education	55.8	55.9	55.5	55.3	19.9	20.8
Upper secondary school	57.5	57.5	55.9	55.8	22.2	17.3
Upper vocational education	55.5	55.5	58.6	58.6	19.7	23.2
University	55.2	55.2	58.3	58.3	16.2	21.4
Living alone						
		**		*	*	*
Yes	60.4	60.9	59.9	60.2	24.6	26.5
No	56.9	56.8	56.6	56.7	21.4	21.8
Dependent children						
Yes	57.1	57.1	56.5	56.8	21.6	22.0
No	57.3	57.3	57.6	57.5	21.6	22.8
Presence of disease						
		**		**	**	**
Yes	68.2	68.1	67.4	67.8	38.0	35.1
No	53.6	53.6	53.1	53.1	16.3	17.6
Health status						
		**		**	**	**
Excellent	38.3	38.2	37.8	37.4	2.8	3.5
Very good	45.0	45.0	46.2	46.0	5.2	9.5
Good	58.8	58.8	57.2	57.4	20.3	20.0
Moderate	82.4	82.8	80.0	80.9	63.4	56.4
Bad	101.8	101.7	102.6	102.7	92.3	90.0

[a] CIS total mean score adjusted for age and educational level.
* $P<.05$ for differences in means between groups/differences in proportions by chi-square statistics.
** $P<.001$ for differences in means between groups/differences in proportions by chi-square statistics.

higher fatigue scores than those employees who did not live alone, when controlled for age and educational level (Table 3).

A total of 2839 (24%) employees reported the presence of a disease (Table 1). Most commonly reported were: chronic back pain ($n=872$, 7%), myocardial infarct and hypertension ($n=611$, 5%), psychological disorder ($n=575$, 5%), and rheumatoid arthritis ($n=513$, 4%). As shown in Table 3, a substantial association was found between fatigue and the presence of a disease, with statistically higher scores on the CIS in employees reporting the presence of a disease ($P<.001$). Among the most commonly reported diseases, the CIS total scores varied from 67.0 for myocardial infarct and hypertension, 68.7 for chronic back pain, and 69.9 for rheumatoid arthritis to 88.7 for psychological disorder. In both genders, employees with a "moderate" or "bad" self-rated health status scored higher on the CIS when adjusted for age and educational level than those with an "excel-

Table 4
Crude and adjusted mean GHQ scores for men and women in relation to demographic and health factors; prevalence (%)

Characteristic	Men ($n=8764$) Crude		Women ($n=3128$) Crude		Prevalence (%) Men	Women
Age group (in years)						
	**					
18–25	11.2		11.6		23.8	25.3
26–35	11.0		11.6		19.6	25.5
36–45	11.6		12.0		22.4	25.6
46–55	11.9		12.2		22.6	27.7
56–65	11.3		11.4		21.5	23.0
	Crude	Adjusted[a]	Crude	Adjusted[a]		
Educational level (age adjusted)						
		**			**	
Primary	12.2	12.0	13.0	12.8	28.3	35.2
Lower vocational	12.2	12.2	11.7	11.6	26.5	24.2
Lower secondary	11.8	11.8	11.7	11.6	22.4	24.2
Intermediate vocational	11.4	11.4	11.5	11.6	21.1	23.8
Upper secondary	11.6	11.6	12.0	12.0	22.8	27.6
Upper vocational	11.2	11.2	12.3	12.3	18.6	29.8
University	10.8	10.8	11.6	11.6	17.5	22.5
Living alone						
		**		**	**	**
Yes	12.5	12.7	12.8	12.8	29.4	34.4
No	11.4	11.4	11.7	11.7	21.1	24.7
Dependent children						
Yes	11.5	11.5	11.8	11.8	21.4	24.5
No	11.5	11.5	11.9	11.9	22.4	27.3
Presence of disease						
		**		**	**	**
Yes	13.4	13.4	13.9	14.0	33.1	38.6
No	10.9	10.9	11.1	11.0	17.9	21.0
Health status						
		**		**	**	**
Excellent	8.8	8.8	8.6	8.5	8.0	10.0
Very good	9.6	9.7	10.1	10.1	10.6	13.5
Good	11.5	11.5	11.8	11.8	20.9	24.5
Moderate	16.0	16.0	15.8	15.8	50.4	53.5
Bad	21.0	20.7	21.5	20.9	77.8	80.0

[a] GHQ total mean score adjusted for age and educational level.
** $P<.001$ for differences in means between groups/differences in proportions by chi-square statistics.

Table 5
Psychological distress among employees reporting fatigue and "caseness" groups (*n*, %)

	Men		Women		Total	
	n	%	*n*	%	*n*	%
Fatigue cases						
Psychological distress	1039	56	434	62	1473	57
No psychological distress	829	44	271	38	1100	43
Caseness distribution of cohort						
F only case	829	10	271	9	1100	9
PD only case	843	10	375	12	1218	10
F + PD case	1039	12	434	14	1473	13
No case	5910	68	2057	65	7967	68

F = fatigue cases based on CIS; PD = psychological distress cases based on GHQ-12.

lent," "very good," or "good" self-rated health status. In all, 2595 (22%) employees had a score above the predefined cut-off for fatigue. The differences found in the proportions of fatigue cases with respect to demographic and health factors are comparable to those found for the continuous scoring (Table 3).

Associations of psychological distress with demographic and health factors

The mean GHQ score was 11.5 (S.D. 5.2) in men and 11.9 (S.D. 5.7) in women. The small difference in means between men and women was found to be statistically significant given the sample size. Age was positively but very weakly correlated with psychological distress in both genders (men: r=.05; women: r=.03). Table 4 shows that among men, employees aged 26–35 reported significantly lower levels of psychological distress than those aged 36–45 and 46–55 years (P<.001). As in fatigue, the GHQ scores did not differ significantly between the age groups among women. Overall, the patterns of associations for educational level, living alone, dependent children, the presence of a disease, as well as for the self-rated health status were similar with those observed in fatigue. A total of 2746 (23%) employees scored above the threshold for psychological distress, with a statistically significant difference in probable cases between women (26%) and men (22%). As Table 4 shows, the differences found in the proportions of psychological distress cases with respect to demographic and health factors were similar to those found for the continuous scoring.

Association of fatigue and psychological distress

Of those employees with prolonged fatigue, 43% reported fatigue only, while 57% reported both fatigue and psychological distress (Table 5). Because of the observed overlap of fatigue and psychological distress expressed by the correlation of .62 between the CIS and the GHQ-12, and the absence of distinct patterns of associations for fatigue vs. psychological distress, the relation between these conditions was also examined in terms of "caseness." Therefore, we allocated the employees to four groups of caseness, based on the simple dichotomy for the CIS and GHQ-12: "fatigue (F) only case," "psychological distress (PD) only case," "fatigue and psychological distress (F + PD) case," and "no case." The prevalence in the total cohort was 9%, 10%, 13%, and 68%, respectively (Table 5).

With respect to the demographic factors, a comparison of "F only cases" and "PD only cases" in men showed that employees reporting fatigue were slightly older (42.8 vs. 41.8 years) than those reporting psychological distress. In women, a difference between "F only cases" and "PD only cases" was observed with respect to the educational level: women with lower educational levels were more likely to report fatigue, whereas women with higher educational levels were more likely to report psychological distress (for each educational level, P<.05). In both genders, the proportion of employees who reported living alone was higher among the "PD only cases" (men: 13%, women: 14%) than among the "F only cases" (men: 8%, women: 10%), whereas "F only cases" (men and women: 37%) were more likely to report the presence of a disease than "PD only cases" (men: 25%, women: 35%); both comparisons were statistically significant in men only (living alone: P<.05; presence of disease P<.001). Overall, a total of 673 employees (6%) were reporting fatigue, without reporting psychological distress and the presence of a disease.

Discussion

The present study showed that fatigue is continuously distributed in the working population and fairly well associated with psychological distress (r=.62). As other authors of community and primary care studies [2,3,6], we found some degree of fatigue in nearly all of the working populations. It has to be noted, however, that while reasonably distributed, there was an excess of the lowest possible fatigue scores, with a small percentage (2%) completely free of symptoms of fatigue (or completely unwilling to acknowledge them). The overall response rate of 45% raised the question of selective participation of employees, which may have biased the results. A nonresponse analysis, however, demonstrated that nonrespondents were less likely to report fatigue and sickness absence. This may have resulted in a slight overestimation of the prevalence of fatigue.

This study, which showed that fatigue and psychological distress were fairly well associated in the general working population, is consistent with the findings of previous studies on the relationship of fatigue and psychological distress conducted in the community, the primary care setting, and among UK National Health Service employees [3,5,10]. Some degree of overlap between prolonged fatigue and psychological distress may be simply explained by the similar items included in the CIS and the GHQ.

The two-factor PCA of the proposed measure of prolonged fatigue (CIS) and the existing measure of psychological distress (GHQ-12) revealed a separation between CIS and GHQ items, suggesting the measurement of different underlying constructs. It should be noted that the five-factor solution produced similar results with respect to the distinction between four "fatigue" factors and one "GHQ" factor. Recently, studies of the relationship between prolonged fatigue states and psychological distress conducted among a community-based sample of twins aged over 50 [21] and in the primary care setting [22] showed a separation between fatigue-related items and those describing anxiety and depression. In both studies, a two-factor solution, with one factor representing fatigue and a second factor representing psychological distress, was found to be most appropriate. It should be kept in mind, however, that a direct comparison of these results with our findings is hindered because of a different conceptualisation and operationalisation of fatigue and psychological distress, and the different settings in which the studies were carried out.

No clear, distinct patterns of associations were found for fatigue vs. psychological distress with respect to demographic and health factors. While most studies [1,3,5,6,10] found more fatigue in women than in men, others [2] as well as the present study found no difference between men and women with respect to fatigue. In previous research, inconsistent findings have been reported regarding age [1–3]. In this study, an extremely low association between age and fatigue was found, identical to the finding in a study of fatigue among the general Norwegian population [6]. The observed relation between the educational level and fatigue in men, with a linear trend towards lower fatigue scores with increasing educational levels, found in the present study agreed with data from Loge et al. [6]. Although previous research showed no or minor effects of marital status on fatigue [2,6], the results of this study indicated more fatigue among employees who reported living alone. This association is consistent with the finding of more fatigue among single individuals in a study among employees of the UK National Health Service [10]. With respect to the relation between psychological distress and demographic factors, a similar pattern of associations was found. For future research on fatigue and psychological distress, these demographic factors should be considered as confounders calling for statistical control in analyses.

A substantial association was found between the self-rated health status and fatigue and psychological distress, respectively. Employees reporting a moderate or bad health status had more fatigue (and psychological distress) compared with those reporting a good, very good, or excellent health status. Most likely, this association means that both high fatigue and high psychological distress contribute to an overall sense of poorer health. It is also possible, however, that those with a poor self-rated health are prone to overreport symptoms of fatigue or psychological distress. The strong association with the presence of a disease found in our study is consistent with findings of previous studies [1,6] and needs to be further examined in the working population. When interpreting these demographic and health associations, another source of bias related to the assessment of exposure and outcome variables has to be kept in mind. In this cross-sectional study, both the independent and the dependent variables are measured by a self-administered questionnaire, which may cause an overestimation of the associations.

Like many medical conditions, fatigue is best viewed as a continuum [8], as opposed to a dichotomy. When using a cut-off point, one may lose important information. For that reason, fatigue (and psychological distress) should be treated as a continuous variable whenever possible. A dichotomy, however, is useful when the prevalence of fatigue has to be compared in different subgroups or when employees have to be selected for treatment. The prevalence found in the working population was 22% for fatigue and 23% for psychological distress. Although different definitions of fatigue, different settings, different response rates, the use of different fatigue questionnaires, and different duration criteria for caseness hinder a direct comparison of prevalence rates, it should be noted that previous studies reported prevalence rates of substantial fatigue varying from 22% (11% for 6 months or longer) in the general Norwegian population [6] and 25% (at least 2 weeks duration) in an Australian primary care study [5] to 38% (18% for 6 months or longer) in a UK community survey [3].

We found a strong association between fatigue and psychological distress in the working population. Among the employees reporting fatigue, 57% reported also psychological distress using caseness definition. Still, when allocated to the caseness groups, "fatigue only" was reported by 9% of the employees. The comparison of "F only cases" vs. "PD only cases" with respect to demographic factors demonstrated some modest differences between these caseness groups. These findings showed (a) that fatigue and psychological distress are important public health problems, which are closely associated in the working population; (b) that there is some evidence suggesting that fatigue and psychological distress are different conditions, which can be measured separately; and (c) that there is no clear distinct pattern of associations for fatigue and psychological distress with demographic and health factors. Hence, an important issue, which has to be addressed in future research, is to determine whether work-related factors, work–family factors, or individual factors play a distinct role in the etiology of fatigue vs. psychological distress in the working population.

Acknowledgments

The Maastricht Cohort Study is part of the Netherlands concerted research action on "Fatigue at work" granted by The Netherlands Organisation for Scientific Research

(NWO). The work presented in this paper was and is currently supported by The Netherlands Organisation for Scientific Research (NWO grant no. 580-02.251). We thank Dr. Helga van den Elzen for initiating and establishing this project and Jos Slangen for his work in data management.

References

[1] Chen MK. The epidemiology of self-perceived fatigue among adults. Prev Med 1986;15:74–81.
[2] David A, Pelosi A, McDonald E, Stephens D, Ledger D, Rathbone R, Mann A. Tired, weak, or in need of rest: fatigue among general practice attenders. BMJ, Br Med J 1990;301:1199–202.
[3] Pawlikowska T, Chalder T, Hirsch SR, Wallace P, Wright DJ, Wessely SC. Population-based study of fatigue and psychological distress. BMJ, Br Med J 1994;308:763–6.
[4] Fuhrer R, Wessely S. The epidemiology of fatigue and depression: a French primary care study. Psychol Med 1995;25:895–905.
[5] Hickie IB, Hooker AW, Hadzi Pavlovic D, Bennett BK, Wilson AJ, Lloyd AR. Fatigue in selected primary care settings: sociodemographic and psychiatric correlates. Med J Aust 1996;164:585–8.
[6] Loge JH, Ekeberg O, Kaasa S. Fatigue in the general Norwegian population: normative data and associations. J Psychosom Res 1998;45:53–65.
[7] Kroenke K, Wood DR, Mangelsdorff AD, Meier NJ, Powell JB. Chronic fatigue in primary care. Prevalence, patient characteristics, and outcome. JAMA, J Am Med Assoc 1988;260:929–34.
[8] Lewis G, Wessely S. The epidemiology of fatigue: more questions than answers. J Epidemiol Community Health 1992;46:92–7.
[9] Chalder T, Berelowitz G, Pawlikowska T, Watts L, Wessely S, Wright D, Wallace EP. Development of a fatigue scale. J Psychosom Res 1993;37:147–53.
[10] Hardy GE, Shapiro DA, Borrill CS. Fatigue in the workforce of National Health Service Trusts: levels of symptomatology and links with minor psychiatric disorder, demographic, occupational and work role factors. J Psychosom Res 1997;43:83–92.
[11] Vercoulen JH, Swanink CM, Fennis JF, Galama JM, van der Meer JW, Bleijenberg G. Dimensional assessment of chronic fatigue syndrome. J Psychosom Res 1994;38:383–92.
[12] Vercoulen JH, Alberts M, Bleijenberg G. De Checklist Individuele Spankracht (CIS) [The Checklist Individual Strength (CIS)]. Gedragstherapie 1999;32:131–6.
[13] Beurskens AJ, Bültmann U, Kant J, Vercoulen JH, Bleijenberg G, Swaen GM. Fatigue among working people: validity of a questionnaire measure. Occup Environ Med 2000;57:353–7.
[14] Goldberg DP, Williams P. A user's guide to the General Health Questionnaire. Windsor: NFER-Nelson, 1988.
[15] Koeter MW, Ormel J. General Health Questionnaire, handleiding Nederlandse bewerking [General Health Questionnaire, manual Dutch version]. Lisse: Swets and Zeitlinger, 1991.
[16] Vercoulen JH, Hommes OR, Swanink CM, Jongen PJ, Fennis JF, Galama JM, Van der Meer JW, Bleijenberg G. The measurement of fatigue in patients with multiple sclerosis. A multidimensional comparison with patients with chronic fatigue syndrome and healthy subjects. Arch Neurol 1996;53:642–9.
[17] Vercoulen JH, Swanink CM, Fennis JF, Galama JM, Van der Meer JW, Bleijenberg G. Prognosis in chronic fatigue syndrome: a prospective study on the natural course. J Neurol, Neurosurg Psychiatry 1996; 60:489–94.
[18] Bültmann U, De Vries M, Beurskens AJ, Bleijenberg G, Vercoulen JH, Kant J. Measurement of prolonged fatigue in the working population: determination of a cutoff point for the Checklist Individual Strength. J Occup Health Psychol 2000;5:411–6.
[19] Aaronson NK, Muller M, Cohen PD, Essink Bot ML, Fekkes M, Sanderman R, Sprangers MA, Te Velde A, Verrips E. Translation, validation, and norming of the Dutch language version of the SF-36 Health Survey in community and chronic disease populations. J Clin Epidemiol 1998;51:1055–68.
[20] SPSS. Base 8.0 for Windows user's guide. Chicago: SPSS, 1998.
[21] Kirk KM, Hickie IB, Martin NG. Fatigue as related to anxiety and depression in a community-based sample of twins aged over 50. Soc Psychiatry Psychiatr Epidemiol 1999;34:85–90.
[22] Koschera A, Hickie I, Hadzi-Pavlovic D, Wilson A, Lloyd A. Prolonged fatigue, anxiety and depression: exploring relationships in a primary care sample. Aust NZ J Psychiatry 1999;33:545–52.