

Work factors as predictors of persistent fatigue: a prospective study of nurses' aides

W Eriksen



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Objectives: To identify work factors that predict persistent fatigue in nurses' aides.

Methods: The sample comprised 5547 Norwegian nurses' aides, not on leave when they completed a mailed questionnaire in 1999. Of these, 4645 (83.7%) completed a second questionnaire 15 months later. The outcome measure was the occurrence of persistent fatigue, defined as having felt "usually fatigued" or "always fatigued" in daytime during the previous 14 days.

Results: In respondents without persistent fatigue at baseline, medium and high work demands, heavy smoking, being single, and having long term health problems were associated with increased risk of persistent fatigue at follow up. Medium and high rewards for well done work, medium levels of leadership fairness, and regular physical exercise were associated with reduced risk of persistent fatigue at follow up. In respondents with persistent fatigue at baseline, medium and high levels of positive challenges at work, high support from immediate superior, medium feedback about quality of one's work, and changes of work or work tasks that resulted in less heavy work or lower work pace were associated with increased odds of recovery (no persistent fatigue at follow up). Working in a nursing home and being intensely bothered by long term health problems were associated with reduced odds of recovery.

Conclusions: High demands and lack of rewards at work may cause persistent fatigue in nurses' aides. Reduction of demands, adequate feedback, and mental stimulation in the form of support and positive challenges may facilitate recovery in those who have persistent fatigue. Leaders in the health services may be in a position to regulate factors that influence the level of fatigue in nurses' aides.

Correspondence to:
Dr W Eriksen, Institute of
General Practice and
Community Medicine,
University of Oslo, PO Box
1130 Blindern, 0318 Oslo,
Norway; w.b.eriksen@
samfunnsmed.uio.no

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Persistent fatigue is a common complaint, with prevalence rates between 10–20% in the general population.^{1,2} It may have a strong negative impact on people's work ability,^{3,4} is a risk factor of occupational accidents,⁵ and may have disruptive effects on private social life.

Persistent fatigue is an unspecific, subjective symptom, which may be evoked by physical and psychiatric disorders, sleep disturbances, pregnancy, psychosocial stress, and lack of physical exercise.^{1,6–9} Its biological basis is often unclear, though.

The relationship between work factors and the occurrence of severe or persistent fatigue has been examined in several cross sectional studies^{10–19} and a few prospective studies.^{7,20,21} In these studies, fatigue was related to shift work,²¹ long working hours,¹⁴ high demands,^{7,10,11,13,16,17,19} low control,^{7,11,17} low social support,^{7,11,13,18,20} and frequent exposure role conflicts at work.¹⁰

In nurses or mixed nursing personnel, fatigue has been associated with shift work schedule and long working hours, as well as high demands, low autonomy, and low social support at work.^{14,16–18} However, there are very few studies, if any, with focus on nurses' aides (assistant nurses). Nurses' aides represent the main providers of practical patient care in the health services. Their place in the organisational hierarchy and the demands to which they are exposed differ from those of registered (graduate) nurses. Nurses' aides are often sick listed, and fatigue may be part of the explanation.^{3,22,23} There is a call for studies that could identify predictors of persistent fatigue in this large occupational group.

Another important question is how working conditions influence the prognosis of people with persistent fatigue. Very few studies, and none in nursing personnel, have addressed this issue.²⁴ In a study of a mixed working population in the Netherlands,²⁴ Huibers *et al* found that

absence of conflicts with colleagues predicted onset of recovery in workers with severe fatigue who were not sick listed.

The main objective of the present study was to identify physical, psychological, social, and organisational work factors that predict persistent fatigue in nurses' aides. In addition, we wanted to identify work factors that predict recovery in nurses' aides with persistent fatigue.

METHODS

Subjects

Nursing personnel in Norway include two large occupational groups: registered nurses and certified nurses' aides. In addition, a smaller group of unlicensed assistive nursing personnel have no formal training and often hold temporary jobs. The number of vocationally active nurses' aides was estimated as approximately 55 000 in 1999 (Norwegian Union of Health - and Social Workers, personal communication). About 50 000 of these, mainly certified nurses' aides, were members of the Norwegian Union of Health and Social Workers (the Union).

During the last week of October, 1999, 12 000 nurses' aides were randomly selected from the Union's member list, and were mailed a questionnaire. After one reminder, 7478 (62.3%) consented to participate in the study and completed the questionnaire. The criteria for inclusion in the present study were: (1) being vocationally active and not on leave because of illness or pregnancy; (2) working more than 18 hours per week—that is, more than half time job; and (3) having answered the question about fatigue. The first criterion was fulfilled by 6485 participants, among whom 5563 also met the second criterion, and 5547 fulfilled all three criteria. Of these 5547 nurses' aides, who comprised the sample of the present study, 4645 (83.7%) completed a second questionnaire and answered the question about

fatigue 15 months later. Informed written consent was given by the participants.

Outcome measure

At baseline and at follow up, the respondents were asked, "During the previous 14 days—how did you feel during the day?" There was a checklist with the following optional answers: "always fit", "usually fit", "varied between fit and fatigued", "usually fatigued", and "always fatigued". Persistent fatigue was operationally defined as reporting "usually fatigued" or "always fatigued".

Responses to this question about fatigue have been shown to have good predictive validity in nurses' aides.^{3 22 23} Reporting usually or always fatigued—that is, persistent fatigue—was a strong predictor of all-cause sickness absence, sickness absence attributed to airway infections, and sickness absence attributed to low back pain, also after adjustments for affective symptoms, sleep complaints, musculoskeletal pain, demographic characteristics, tasks of caring nature during the leisure time, and work factors.

The outcome measures of the present study were (1) occurrence of persistent fatigue at follow up in respondents without persistent fatigue at baseline, and (2) occurrence of recovery—that is, no persistent fatigue at follow up in respondents with persistent fatigue at baseline.

Measures of working conditions

At baseline, a series of work factors were measured. Type of ward (12 optional answers, for example, psychiatric department) as well as hours of work per week and frequency of night shift ("never", "sometimes", "rather often", and "very often") were recorded.

Psychological, social, and organisational work factors were measured with questions from the General Nordic Questionnaire for Psychological and Social factors at Work (QPSNordic).²⁵ Responses were scored on Likert five-point frequency scales (from (1) "never or very seldom" to (5) "very often or always"), except responses to the question about exposure to bullying, which had only two response options (yes and no) after a precise definition of the concept. Quantitative work demands were assessed by four questions (work piles up, have to work overtime, have to work in rapid pace, have too much to do). Positive challenges were assessed by three questions (work is challenging in a positive way, see the work as meaningful, job requires that you acquire new knowledge and skills). Role conflicts were measured with three questions (have to do things that you feel should be done differently, are given assignments without adequate resources, receive incompatible requests from two or more people). Control of work pace was measured with three questions (can set your own work pace, can decide when to take a break, can set your own working hours). Participation in important decisions was assessed by three questions (can choose which method to use for doing your work, can influence the amount of work, can influence decisions that are important for your work). Social support from immediate superior was assessed by three questions (gives support and help when needed, willing to listen, appreciates your achievements). Fairness of immediate superior's leadership was measured with three questions (distributes the work fairly and impartially, treats the workers fairly and equally, the relationship between you and your superior is a source of stress). Rewards for well done work (money or encouragement) was measured with one question. Feedback about the quality of one's work was also measured with one question. Three aspects of the social climate were assessed (encouraging and supportive, distrustful and suspicious, relaxed and comfortable). Exposure to threats or violence was measured with one question. The work factors that were

measured with more than one question (for example, quantitative work demands) were expressed as indices, calculated as the sum of the item scores divided by the number of items (questions). These means (all had range from 1.00 to 5.00) were then divided into quintiles for analysis. The internal consistency (Cronbach's alpha) of the indices were in the range of 0.68 to 0.88, except the index of control over work pace (0.57).

Exposure to heavy physical work was measured with three questions exploring the frequency of moving patients manually in the bed, frequency of lifting or supporting patients manually between bed and chair, and frequency of lifting, carrying, or pushing heavy objects. The first two questions were translations of questions developed and validated by British scientists.²⁶ The participants also reported the extent their job required physical endurance.²⁵

At follow up, the respondents were asked whether they had changed work or work tasks after they completed the first questionnaire. Those who answered "yes" were asked to mark on a list what kind of consequences this change had had on their work situation (eight not mutually exclusive optional answers).

Measures of background factors

At baseline, age, gender, marital status, pregnancy, number of preschool children, special tasks of a caring nature during leisure time (for example, caring for handicapped child or old relatives), daily consumption of cigarettes, physical leisure time activities, mastery of work, personal commitment to the work unit, and health problems were recorded. The measurement of physical leisure time activities has been described in detail elsewhere.⁸ Perceived mastery of work and commitment to the work unit were measured with indices from the QPSNordic.²⁵ The question about long term health problems was worded: "Do you have any kind of long term or chronic health problem (for instance, asthma, arthritis, chronic pain)?" Optional answers were: "no such problem"; "yes, but it does not bother me"; "yes, it bothers me somewhat"; "yes, it bothers me a lot". The level of affective symptoms (anxiety and depression) during the previous 14 days was assessed by a shortened version of the Hopkins Symptom Checklist, the SCL-5.²⁷

Theoretical basis

Clinical experience with mental and physical diseases indicates that persistent fatigue may be due to central nervous disturbances as well as pathological processes in tissues outside the central nervous system. However, the exact mechanism, that is, the biological correlate of fatigue, is often unclear, even in the case of clear-cut diseases like cancer. There are reasons to suspect, however, that a variety of mechanisms may be involved, including disturbances in circulation and oxygen supply (for example, anaemia, and heart and lung disease), and hormonal and neuroimmunological processes (for example, hypothyreosis, multiple sclerosis, postviral fatigue syndrome).

Many patients with persistent fatigue do not have any known disease or any biological disturbance that can be measured objectively with available instruments. However, on the basis of findings in epidemiological studies, linking fatigue to high demands and psychological stress, one may suspect that some kind of wear-out reactions and/or complex psychodynamic processes could be involved. For example, it is conceivable that long term and intense mental or physical activity, inadequate sleep and rest, and lack of positive mental stimuli (for example, task variations, positive challenges, encouragement) could elicit wear-out reactions characterised by persistent fatigue. Psychoanalytic experience

Table 1 Baseline characteristics of respondents and dropouts

Characteristics at baseline	Respondents		Dropouts		Row %
	n	Column %	n	Column %	
Age (years)					
<25	66	1.4	50	5.5	43.1
25–29	220	4.7	89	9.9	28.8
30–34	299	6.4	94	10.4	23.9
35–39	579	12.5	117	13.0	16.8
40–44	965	20.8	161	17.8	14.3
45–49	999	21.5	152	16.9	13.2
50–54	886	19.1	127	14.1	12.5
55–59	446	9.6	69	7.6	13.4
60–64	160	3.4	35	3.9	17.9
>64	24	0.5	8	0.9	25.0
Gender					
Female	4461	96.0	856	95.1	16.1
Male	184	4.0	44	4.9	19.3
Marital status					
Married or cohabiting	3732	80.4	689	76.6	15.6
Single	908	19.6	210	23.4	18.8
Physical leisure activity at least once a week previous 3 months					
No	1158	25.0	235	26.1	16.9
Slow walks only	843	18.2	177	19.7	17.4
Other than slow walks	2634	56.8	487	54.2	15.6
Daily consumption of cigarettes (cigarettes/day)					
0	2616	57.3	458	52.1	14.9
1–9	1059	23.2	210	23.9	16.5
10–19	813	17.8	191	21.7	19.0
20 or more	77	1.7	20	2.3	20.6
Long term health problems (any kind)					
No problem	3028	65.9	586	65.6	19.4
Yes, but not bothered	341	7.4	82	9.2	15.8
Yes, somewhat bothered	897	19.5	168	18.8	14.8
Yes, a lot bothered	328	7.1	57	6.4	16.2
Fatigue					
Always fit	165	3.6	26	2.9	13.6
Usually fit	1438	31.0	253	28.0	15.0
Varied between fit and fatigued	2351	50.6	470	52.1	16.7
Usually fatigued	613	13.2	139	15.4	18.5
Always fatigued	78	1.7	14	1.6	15.2
Quantitative work demands					
1 (lowest quintile)	1097	23.7	199	22.1	15.4
2	552	11.9	104	11.6	15.9
3	1155	24.9	199	22.1	14.7
4	1069	23.1	219	24.4	17.0
5	759	16.4	178	19.8	19.0
Rewards for well done work					
Very little or not at all	1907	41.7	388	43.9	16.9
Rather little	798	17.4	165	18.7	17.1
Some	1096	24.0	193	21.8	15.0
Rather much	619	13.5	116	13.1	15.8
Very much	155	3.4	22	2.5	12.4
Fairness in the leadership of immediate superior					
1	1002	21.6	238	26.6	19.2
2	479	10.3	108	12.1	18.4
3	1437	31.0	239	26.7	14.3
4	511	11.0	96	10.7	15.8
5	1202	26.0	213	23.8	15.1

As not all participants answered all questions, the numbers do not always match the total sample size.

indicates that suppressed, aggressive feelings may manifest themselves as somatic symptoms and complaints.

Against this background, we concluded that any factor, at work or in private life, that could influence level of activity and rest, elicit interpersonal conflicts and aggressive feelings, or provide positive mental stimuli would be relevant for examination. Work demand factors were considered relevant, because they may represent positive stimuli and influence level of mental and physical activity. Exposure to role conflicts may cause frustration, sustained arousal, and sleep problems. A poor social climate in the work organisation, and exposures to aggression at work, such as bullying, threats, and violence may elicit long term interpersonal conflicts and aggressive feelings, and may also lead to

sustained arousal and sleep deprivation. Social support, feedback, rewards, fairness in leadership, autonomy, and participation in decisions at work may give positive stimuli, and they may moderate demands and therefore influence activity. A low level of these same factors, such as unfair leadership and lack of rewards, may evoke aggression. Perceived mastery of work and commitment to the work unit may give positive stimuli. Living together with a partner, and engaging in tasks of a caring nature in leisure time may give positive stimuli, but may also elicit aggression and interpersonal conflicts. Smoking may influence peripheral circulation and oxygen supply. Physical exercise may increase people's ability to endure high activity, and may give positive stimuli.

Statistical analyses

Statistical analyses were conducted with the Statistical Package for Social Sciences (SPSS) version 11.0. Pearson χ^2 test and logistic regression analysis were used to explore associations between baseline characteristics and the occurrence of fatigue at follow up. Because the number of male respondents was very low, separate analyses for men and women were not conducted.

The logistic regression models were built in a traditional way, seeking the most parsimonious model that still explains the data. Age, gender, and all relevant variables that were related to the dependent variables with a p value below 0.05 in univariate analyses were included in an automatic forward stepwise logistic regression analysis. When the univariate analyses yield many candidates for the model, as they did in this study, an automatic stepwise procedure may be appropriate.²⁸ The criteria for inclusion and exclusion during the automatic analytic process were $p=0.05$ and $p=0.10$, respectively, for the overall variables in likelihood ratio tests. Associations between the overall variables (scales) and the outcome measure were considered statistically significant when p values were lower than 0.05. The fit of the models was assessed by Hosmer-Lemeshow test and overall rate of correct classification.

The following factors were considered relevant for inclusion in the logistic regression models, and were tested in χ^2 tests for association with the outcome measures: work characteristics at baseline and change in work or work tasks during successive 15 months, mastery, commitment, age, gender, marital status, pregnancy, number of preschool children, engagement in special tasks of a caring nature during leisure time, physical leisure time activity, consumption of cigarettes, and long term health problems.

The psychological state factor “level of affective symptoms” was not entered in the main models because it was considered to be an intermediary factor between work factors and fatigue. However, as affective symptoms also may reflect psychological traits, supplementary analyses were conducted with level of affective symptoms also entered as covariate.

RESULTS

Characteristics of respondents and dropouts

Table 1 shows baseline characteristics of the sample. The majority were middle aged, married or cohabiting women. Some differences were seen between those who filled in both questionnaires (hereafter referred to as respondents) and those who dropped out between baseline and follow up (dropouts).

At follow up, 707 respondents reported that they had changed work or work tasks after having completed the first questionnaire. The consequences these changes had had on the work situation were: “more heavy tasks” (151 respondents), “less heavy tasks” (308 respondents), “higher work pace” (204 respondents), “lower work pace” (216 respondents), “more support and encouragement” (229 respondents), “less support and encouragement” (68 respondents), “other consequences” (252 respondents), and “no consequences” (67 respondents).

Number of cases

Of the 3954 respondents without persistent fatigue at baseline, 422 (10.7%) reported persistent fatigue at follow up. Of the 691 respondents with persistent fatigue at baseline, 377 (54.6%) did not report persistent fatigue at follow up (had recovered).

Predictors of persistent fatigue

In univariate analyses of respondents without persistent fatigue at baseline, a series of factors—work factors as well as

background factors—were associated with the occurrence of persistent fatigue at follow up (data not shown). These factors were entered in a forward stepwise logistic regression analysis, and are shown in table 2 (the factors in the final equation, as well as the factors that were not retained in the final equation and listed below the bottom line).

In the forward stepwise logistic regression analysis (table 2), quantitative work demands that corresponded with next highest (OR = 1.69), and highest quintile of the index (OR = 2.36), changes in work or work tasks between

Table 2 Factors related to persistent fatigue at follow up in respondents without persistent fatigue at baseline

Factors	OR (95% CI)	p Value*
Quantitative work demands		<0.001
1 (lowest quintile)	1.00	
2	1.35 (0.87–2.10)	
3	1.39 (0.97–2.00)	
4	1.69 (1.18–2.43)	
5	2.36 (1.61–3.46)	
Rewards for well done work		0.009
Not at all or very little	1.00	
Rather little	0.79 (0.57–1.09)	
Some	0.59 (0.43–0.81)	
Rather much	0.68 (0.46–0.99)	
Very much	0.50 (0.21–1.18)	
Fairness of immediate superior’s leadership		0.002
1 (lowest quintile)	1.00	
2	1.11 (0.75–1.66)	
3	0.72 (0.53–0.99)	
4	0.47 (0.28–0.78)	
5	1.01 (0.72–1.42)	
Change of work or work tasks between baseline and follow up that resulted in increased work pace		0.007
No	1.00	
Yes	1.95 (1.23–3.09)	
Marital status		0.038
Married or cohabiting	1.00	
Single	1.35 (1.02–1.78)	
Daily consumption of cigarettes (cigarettes/day)		0.010
0	1.00	
1–9	1.33 (1.01–1.76)	
10–19	1.29 (0.94–1.75)	
20 or more	2.98 (1.47–6.04)	
Physical leisure time activity		0.003
No	1.00	
Only slow walks	0.74 (0.52–1.04)	
Other than slow walks	0.62 (0.48–0.82)	
Long term health problems of any kind		<0.001
No	1.00	
Yes, but it does not bother me	1.23 (0.78–1.94)	
Yes, it bothers me somewhat	1.81 (1.38–2.39)	
Yes, it bothers me a lot	3.27 (2.19–4.90)	
How did you feel during the day previous 14 days		<0.001
Always fit	1.00	
Usually fit	2.36 (0.73–7.70)	
Varied between fit and fatigued	5.10 (1.59–16.33)	

The final equation in a forward stepwise logistic regression analysis, with likelihood ratio test used as the criterion for determining variables to be removed from the model (n = 3280).

*p Values from likelihood ratio test if term (overall variable) removed. The covariates not retained in the final equation were age, gender, special tasks of a caring nature in leisure time, frequency of supporting patients between bed and chair, frequency of handling heavy objects at work, the extent the work required physical endurance, feedback about quality of one’s work, exposure to role conflicts, control of important decisions at work, control of work pace, support from immediate superior, commitment to the work unit, mastery of work, social climate in the work unit, changes of work or work tasks between baseline and follow up that resulted in more heavy work, less support, and consequences not specifically mentioned in the checklist.

The overall rate of correct classification of the dependent variable (predicted outcome compared with the observed outcome) was estimated as 89.4%. Hosmer and Lemeshow test: $\chi^2=6.711$; $p=0.568$.

baseline and follow up that resulted in increased work pace (OR = 1.95), smoking 20 cigarettes per day or more (OR = 2.98), being single (OR = 1.35), being somewhat (OR = 1.81) and much bothered by long term health problems (OR = 3.27), and varying between feeling fit and fatigued at baseline (OR = 5.10) were associated with increased risk of persistent fatigue at follow up. Reporting more than very little rewards for well done work (ORs from 0.79 to 0.50) and engaging in physical leisure time activities other than slow walks at least once a week (OR = 0.62) were associated with or tended to be associated with reduced risk of persistent fatigue at follow up. There was a U-shaped relationship between level of fairness in immediate superior's leadership and the risk of persistent fatigue with medium (OR = 0.72) and next highest quintiles of the index (OR = 0.47) being associated with reduced risk. When baseline level of affective symptoms were also entered in the analysis together with the other covariates, the associations between work factors and lifestyle factors and the risk of fatigue turned out only slightly weaker and still significant (data not shown).

Predictors of recovery

In univariate analyses of respondents with persistent fatigue at baseline, a series of factors (work factors as well as background factors) were associated with the occurrence of recovery at follow up (data not shown). These factors were entered in a forward stepwise logistic regression analysis, and are shown in table 3.

In the forward stepwise logistic regression analysis (table 3), levels of positive challenges at work that corresponded with the medium (OR = 2.16), next highest (OR = 1.47), and highest quintile of the index (OR = 1.88), change of work or work tasks between baseline and follow up that resulted in less heavy work (OR = 2.40), and change of work or work tasks between baseline and follow up that resulted in lower work pace (OR = 3.50) were associated with or tended to be associated with increased odds of recovery. There was a U-shaped relationship between level of support from immediate superior and risk of recovery, with the highest quintile of the index tending to be associated with increased odds of recovery (OR = 1.63). There was a hump-shaped relationship between level of feedback and the risk of recovery, with next lowest, medium, and next highest levels being associated with or tending to be associated with increased odds of recovery (ORs from 1.58 to 1.96). Working in a nursing home (OR = 0.65), always feeling fatigued at baseline (in contrast to usually feeling fatigued) (OR = 0.34), and being a lot bothered by long term health problems of any kind (OR = 0.49) were associated with reduced odds of recovery. When baseline level of affective symptoms were also entered in the analysis together with the other covariates, the association between positive challenges and the odds of recovery were the same, whereas support from immediate superior and feedback about quality of one's work were not retained in the final equation (data not shown).

DISCUSSION

In this 15 month prospective study of nurses' aides, work demands, rewards, and leadership fairness, as well as marital status, lifestyle, and long term health problems were associated with the risk of developing persistent fatigue. In nurses' aides with persistent fatigue, positive challenges in the job, support from superior, feedback about quality of one's work, and type of ward, as well as changes of work or work tasks that resulted in lower work demands were associated with the odds of recovery.

Table 3 Factors related to recovery in respondents with persistent fatigue at baseline

Characteristics at baseline	OR (95% CI)	p Value*
Positive challenges in the job		0.021
1 (lowest quintile)	1.00	
2	1.11 (0.70–1.77)	
3	2.16 (1.27–3.69)	
4	1.47 (0.83–2.61)	
5	1.88 (1.06–3.35)	
Support from immediate superior		0.006
1 (lowest quintile)	1.00	
2	0.84 (0.53–1.32)	
3	0.45 (0.24–0.85)	
4	0.85 (0.49–1.47)	
5	1.63 (0.88–3.02)	
Feedback about quality of one's work		0.032
Never or very seldom	1.00	
Rather seldom	1.96 (1.19–3.22)	
Sometimes	1.58 (0.98–2.56)	
Rather often	1.63 (0.91–2.94)	
Very often or always	0.75 (0.31–1.79)	
Working in a nursing home		0.011
No	1.00	
Yes	0.65 (0.46–0.91)	
Change of work or work tasks between baseline and follow up that resulted in reduced work pace		0.014
No	1.00	
Yes	3.50 (1.24–9.82)	
Change of work or work tasks between baseline and follow up that resulted in less heavy work		0.036
No	1.00	
Yes	2.40 (1.03–5.55)	
Long term health problems of any kind		0.014
No	1.00	
Yes, but it does not bother me	0.63 (0.28–1.41)	
Yes, it bothers me somewhat	0.73 (0.49–1.09)	
Yes, it bothers me a lot	0.49 (0.32–0.77)	
How did you feel during the day previous 14 days		<0.001
Usually fatigued	1.00	
Always fatigued	0.34 (0.19–0.60)	

The final equation in a forward stepwise logistic regression analysis, with likelihood ratio test used as the criterion for determining variables to be removed from the model (n = 663).

*p Values from likelihood ratio test if term (overall variable) removed. The covariates not retained in the final equation were age, gender, change of work or work tasks between baseline and follow up that resulted in more support, and change of work or work tasks between baseline and follow up that had consequences not specifically mentioned in the checklist.

The overall rate of correct classification of the dependent variable (predicted outcome compared with the observed outcome) was estimated as 63.7%. Hosmer and Lemeshow test: $\chi^2 = 7.603$; $p = 0.473$.

Methodological considerations

The response rate at baseline was not optimal (62%). The Union's member list also included retired people, and contacts during the data collection gave the impression that non-working subjects were not motivated to participate in the study. Hence, the true response rate in vocationally active subjects was probably higher. The number of dropouts between baseline and follow up was low (16%), but there were some differences between respondents and dropouts with respect to demographic characteristics, work factors, and smoking. There was hardly any difference between respondents and dropouts with respect to baseline level of fatigue.

A healthy worker selection, due to the fact that unhealthy people may have avoided specific high exposure jobs or changed to lower exposure jobs before entering the study, may have resulted in underestimation of associations

between work factors and fatigue. However, the prospective design probably reduced the impact of this effect.

There is no standard way to assess fatigue.²⁹ In a recent study, De Vries *et al*²⁹ compared six different questionnaires, finding that all these instruments measured an identical, unidimensional construct. For the present study, we chose a single item instrument which had been constructed for use in a survey of the general population in Ullensaker, a Norwegian municipality. We found this instrument interesting, because analyses of the data from Ullensaker showed (W Eriksen, unpublished results) that the question was easily understood and gave responses that were strongly correlated with responses to the COOP/Wonca charts, which are valid measures of physical, emotional, and social functional ability.³⁰ During recent years, this question about fatigue has also been shown to have good predictive validity, and persistent fatigue as assessed in the present study is a strong and independent predictor of sickness absence in nurses' aides.^{3 22 23} With only one item, the psychometric reliability is not optimal, though. Moreover, the responses will hinge closely on the interpretation of the particular words that are used.³¹ On the other hand, the consequences of random error of measurement are reduced when using a large sample size.³² The proportion of respondents that were found to have persistent fatigue at baseline (15%) was within the range of prevalence rates for severe or persistent fatigue found in studies where comprehensive questionnaires were used.^{2 11} The proportion of respondents without persistent fatigue at baseline who had developed persistent fatigue 15 months later was 10.7%, whereas Bültman *et al* found 12 month cumulative incidence of severe fatigue to be 9.7% in men and 13.5% in women.⁷ Some investigators have come to the conclusion that the concept of fatigue may have several dimensions, such as physical and emotional fatigue.³³ On the other hand, the study of De Vries *et al* did not support the idea of a multilevel construct in an occupational (predominantly healthy) population.²⁹ In a recent clinical study, Naschitz *et al* found strong correlations between an unidimensional fatigue scale and scales measuring the cognitive, physical, and social impact of fatigue.³⁴

The validity and reliability of self-reported work factors have been explored and discussed by several authors.³⁵⁻³⁷ Some authors have found high correlations³⁵ and others have found fair or modest correlations^{36 37} between "objective" and self-reported information on psychosocial work environment. Few psychological aspects of the work situation may be measured objectively, though. Intermethod surveys indicate that self-reports have acceptable validity for gross activities in the job.^{26 38 39} The questions in the present study that were used to assess the frequency of patient handling were found to have good validity in a British study.²⁶ The scales that were used to measure psychological, social, and organisational work factors have been found to have good construct and predictive validity as well as good internal consistency and test-retest reliability.²⁵ The test-retest reliabilities, expressed as Pearson's correlation coefficients, were higher than 0.70 for most of the instruments.

Information about changes in the work situation was collected at follow up, and may have been influenced by the respondents' health at this point of time. Hence, the associations between changes of work and fatigue do not represent prospective relationships.

Predictors of persistent fatigue

There was a positive dose-response relationship between quantitative work demands and the risk of developing fatigue. Besides, changes in work or work tasks between baseline and follow up that resulted in increased work pace also predicted fatigue. One explanation may be that fatigue is

evoked when the amount of occurrences, circumstances, and conditions that require acting or responding during the day exceeds people's mental capacity of handling such impulses. Two prospective studies have examined work demands as potential predictors of fatigue.^{7 20} In one of these, a positive association was found.⁷ In the other, no association was seen after adjustments for other factors.²⁰

Medium and high levels of rewards for well done work (financial as well as non-financial rewards) were associated with reduced risk of fatigue. There were signs of a negative dose-response relationship. Van der Ploeg and Kleber found no association between financial rewards and the risk of developing severe fatigue in ambulance personnel.²⁰ It is one of the basic beliefs in western culture that efforts will be rewarded, and when no rewards are given, aggression may be evoked. As subordinates may have difficulties confronting superiors openly, aggression may be suppressed and perhaps transformed into a feeling of fatigue. The effort-reward imbalance model maintains that health problems are evoked if people feel that the rewards they obtain for their work are low in relation to the effort they have invested.⁴⁰

Medium and high levels of leadership fairness were associated with reduced risk of fatigue, but the one fifth of the sample who reported highest fairness did not differ from those who reported low fairness. Like lack of rewards for well done work, unfair leadership may cause silent aggression among subordinates, but the reason why respondents reporting highest leadership fairness had the same risk of fatigue as those with low fairness is unclear.

The social situation of singles (more loneliness, less support) could perhaps contribute to their increased risk of fatigue. Loge *et al* found increased prevalence of chronic fatigue in widows and separated women.²

The increased risk of fatigue among heavy smokers could perhaps be due to vasoconstriction and high concentration of carboxyhaemoglobin in the blood, which could reduce oxygen supply and inhibit cellular respiration in skeletal muscles. Bültman *et al* found only a non-significant tendency towards higher risk of fatigue among smokers, but as they did not measure the daily consumption of cigarettes, they could not examine effects of heavy smoking.⁹

The relationship between physical leisure time activity and the risk of fatigue has been described and discussed in detail elsewhere.⁸ As expected, respondents who were bothered by long term health problems, and those who reported that they varied between feeling fit and feeling fatigued at the outset, were more likely to develop persistent fatigue.

Predictors of recovery

Medium and high levels of positive challenges and very high support from immediate superior predicted recovery in those who were bothered by persistent fatigue at baseline, perhaps because these factors involve mental stimulation. Medium levels of feedback about the quality of one's work was also a predictor of recovery, whereas very high levels were not. One explanation may be that adequate feedback is necessary for coping successfully with challenges, whereas a lot of feedback may be perceived as a disturbingly high focus on performance. There was a low recovery rate among aides working in nursing homes, perhaps because many nursing homes in Norway are characterised by understaffing, high turnover, and a relatively large number of untrained personnel. Finally, the study suggests that nurses' aides with persistent fatigue may recover more easily if they make changes in work or work tasks that result in lower demands. As expected, the aides who were most bothered by health problems and fatigue were less likely to recover.

Main messages

- High demands and lack of rewards at work may cause persistent fatigue in nurses' aides.
- Reduction of demands, adequate feedback, and mental stimulation in the form of support and positive challenges may facilitate recovery in those who are bothered by persistent fatigue.

Policy implications

- It is essential that leaders in the health services give rewards for well done work as well as adequate support and feedback, and that they put more emphasis on creating a work situation that is challenging in a positive way.
- More personnel are needed at some work sites.

Confounding

The results may have been influenced by background factors for which we were not able to control. Among the potential confounders are personality factors, such as neuroticism, and work factors other than the ones measured here.

CONCLUSIONS

High demands and lack of rewards at work may cause persistent fatigue in nurses' aides. Reduction of demands, adequate feedback, and mental stimulation in the form of support and positive challenges may facilitate recovery in those who are bothered by persistent fatigue. Leaders in the health services may be in a position to regulate factors that influence the level of fatigue in nurses' aides. Nurses' aides themselves may contribute by engaging in physical exercise and avoiding heavy smoking.

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Author's affiliations

W Eriksen, Institute of General Practice and Community Medicine, University of Oslo, Norway; Division of Mental Health, Norwegian Institute of Public Health, Oslo, Norway

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