HOSPITALIZATIONS AMONG TEACHERS IN DENMARK, 1981–1997

HARALD HANNERZ, KAREN ALBERTSEN and FINN TÜCHSEN

Department of Epidemiology and Surveillance
National Institute of Occupational Health
Copenhagen, Denmark

Abstract. It is a common notion that teachers constitute a group at high risk of occupational stress, but the potential health consequences of the assumed high stress levels are still poorly illuminated. The aim of the present study was to investigate morbidity among Danish teachers.
Cohorts of Danish teachers of primary, secondary and vocational schools, aged 20–59 years in 1981, 1986, 1991 and 1994, were formed to calculate age standardized hospitalization ratios (SHRs) and time trends (1981–1997) for a large variety of diagnostic aggregations.
Statistically significantly low SHRs for the major disease categories: neoplasms, diseases of the nervous, circulatory, respiratory, digestive and musculoskeletal systems were found both for men and women. We also found significantly low SHRs for the aggregated diagnostic group "injury and poisoning" in men and for diseases of the nervous system and sense organs in women.
Age standardized hospitalization rates with respect to diseases observed in practically all systems and organs of the body were statistically significantly lower among teachers compared with other economically active people of Denmark.

Key words:
Hospitalization ratio, Occupational medicine, Surveillance system

INTRODUCTION

Teacher stress has been studied for more than 60 years and with time the importance of the problem has apparently received increasing recognition [1–34]. Although some papers have toned down the teacher stress problem [35–36], the general notion seems to be that teachers experience considerable stress in the workplace, and that such a stress has obvious implications for their physical and mental health status, as well as performance [18].

The main sources of teacher's occupational stress has been summarized as students' misbehaviour, poor relationship with colleagues, principal and parents, time management, lack of personal recognition, and work overload [37]. It has been claimed that the potentially pathogenic nature of the physiological and biochemical changes that accompany teacher stress may not only lead to psychosomatic symptoms (e.g. peptic ulcers) but to even more chronic symptoms such as coronary heart disease and mental ill health [13,16,27]. Absenteeism, job dissatisfaction, intention to leave the profession, inability to relax or "switch off" after work, tension, emotional and physical drainage at the end of school day, and sleeplessness are examples of other frequently mentioned consequences [8,38].

Because numerous studies on samples from Great Britain, the USA, Australia and New Zealand have found that approximately one third of teachers indicate that teaching is stressful or extremely stressful [18], the problem has come to be viewed as a universal concern, and proposals for future studies are frequently presented in terms of action not only at school levels but also at government levels [17].

Due to the tradition, in the teacher stress research community, of not using non-teacher control groups it is still inconclusive whether teachers are in fact more stressed than other occupation groups [13]. Furthermore, there are only a few studies in which objective health measures have been used. "Not only do the psychological sciences need this type of data but also do employers who are considering investing substantial financial resources in stress management interventions or organizational change" [15]. The question of whether teaching compared with other occupations should be regarded as hazardous to health, especially with regard to stress-related diseases, would therefore also be inconclusive.

Recently, the national work environment authorities in Denmark, as well as in Sweden have selected the work environment at school as an area of special attention. The aim of the present study was to elucidate the disease pattern among teachers in Denmark through the use of data from the national hospitalization registry.

MATERIALS AND METHODS

The database

Since the mid 1980s, a series of cohort studies of hospitalizations among economically active people in Denmark, have been performed at the Danish National Institute of Occupational Health. The information base for these studies is the Occupational Hospitalization Register (OHR), which is a research register with individual level data on occupations, hospitalizations, and dates of migrations and deaths. All men and women in Denmark, aged 20–59 years in January 1981, 1986, 1991 and 1994 are included and classified according to their most important occupation at that time. The information has been recorded by linkage of the population census of Denmark to the National In-patient Register, the Death Register and the Employment Classification Module (ECM). The ECM contains yearly information on economic activity, and classification of occupation and industry. The occupational code is an extended classification of the International Standard Classification of Occupations (ISCO), the 1968 version, which also includes self-employed persons. The industrial code is a national extension of the International

Standard Classification of all Economic Activities (ISIC), the 1968 version. The National In-patient Register provides information on more than 99% of all admissions to Danish hospitals and it is updated every year. The Personal Identification Number (PIN) from the National In-patient Register was used in the cross-linking procedure and for information on gender, date and year of birth.

For various purposes these cohorts have been followed-up for hospitalizations due to a variety of diseases. The outcomes have been first admissions with the studied disease as principal discharge diagnosis. Each time a specific study has been performed; a table with persons at risk, person years at risk, and the number of hospitalizations by occupation, gender and five-year age-group have been saved and stored in the database. Currently the database holds information from 75 follow-up studies of hospitalizations in 36 different diagnostic groups.

Age and gender as parts of the PIN are recorded practically without errors. The completeness and accuracy of these data are evidenced by the fact that the matching of various registers on the PIN was complete in 100%. Misclassifications in the ECM are negligible among the public sector employees [39]. Since most teachers in Denmark are employed in the public sector, the validity of the occupational code in this particular group should be satisfactory.
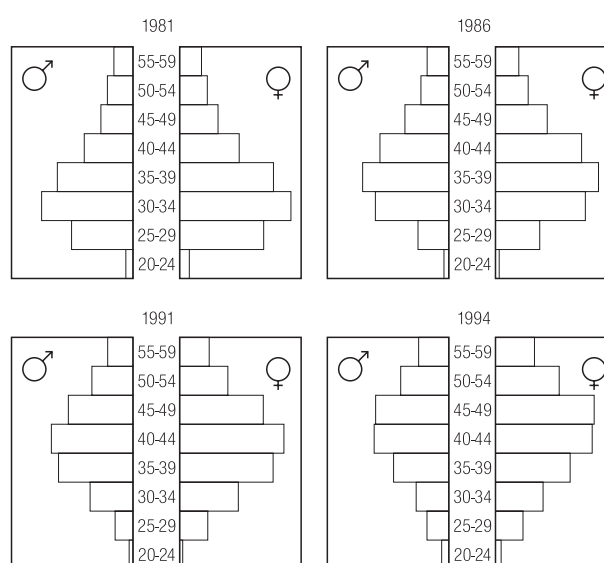
Fig. 1. Teachers' gender and age distribution by calendar year. The left and right symbols denote males and females, respectively.

Demographic data for the teachers

The total number of male teachers employed in primary, secondary or vocational schools in January 1981, 1986, 1991 and 1994 was 35 150, 39 345, 36 929 and 40 542, respectively. The corresponding numbers of female teachers were 42 620, 46 356, 46 707 and 52 610. The age and gender distributions of the cohorts are given in Fig. 1.

Statistical analyses

Standardized hospitalization ratios (SHRs), in the latest available time-period, were calculated for all of the available diagnoses. The SHR was obtained by dividing the observed number of hospitalizations by the expected number, and then multiplying this ratio by 100. The expected number was based on the corresponding sex and age-specific hospitalization rates for all employed people in Denmark.

Data on some diagnostic groups have been collected for several disjoint time periods. It was therefore possible to evaluate time trends with respect to the SHRs for these diseases. Hence we calculated average annual change rates for SHRs of the following diseases: ischemic heart disease, acute myocardial infarction, cerebrovascular disease, varicose veins of lower extremities, chronic obstructive pulmonary disease, chronic bronchitis, asthma, gastric ulcer, duodenal ulcer, gastritis, arthrosis of the hip, prolapsed cervical disc and prolapsed lumbar disc. Since hospitalizations are rare in comparison with the number of persons at risk, an appropriate way to model time trends of SHRs is by a log-linear Poisson regression with the expected number of discharges as an offset [40]. As time we used the distance in years between the midpoints of the follow-up periods in each of the cohorts. We estimated the parameters using SAS (SAS-institute Inc.), Proc Genmod and we calculated the large-sample 95% confidence intervals (CI) using the estimated standard errors.

RESULTS

Ssignificantly low SHRs for the major disease categories: neoplasms, diseases of the nervous, circulatory, respiratory, digestive and musculoskeletal systems were found both for men (Fig. 2) and women (Fig. 3). Furthermore, we found significantly low SHRs for the aggregated diagnostic group "injury and poisoning" in men and for diseases of the nervous system and sense organs in women. As seen in the figures, the disease patterns among the males and females had a lot more similarities than differences. Both genders had a strikingly lower SHRs for malignant neoplasm of the respiratory organs (a cancer related to tobacco smoke) than for neoplasm of colon and for all of neoplasms. They also shared the same characteristics of low SHRs for chronic obstructive pulmonary diseases and for stress-related diseases, ischemic heart disease, peptic ulcer and acute gastritis. Both genders also had significantly low SHRs for back injuries and significantly high SHRs for ruptures in ligaments and muscles, and neither of the genders differed from the average with respect to infectious and parasitic diseases.

The results from the time trend assessments are given in Tables 1–3. As seen in Table 1, the only statistically significant changes in SHRs were a decreasing trend for asthma among men and an increasing trend for ischemic heart disease among women.

DISCUSSION

In the present study we found that the age standardized hospitalization rates with respect to diseases observed in practically all systems and organs of the body were significantly lower among teachers compared with other economically active people of Denmark. Furthermore, the advantageous health situation among teachers seemed to be quite stable during the time spanned by the study.

We used hospitalizations as a proxy measure for the underlying morbidity. Hence, it has to be kept in mind, that the health status was assessed only with regard to pathologies that usually require hospitalization. Studies of this kind are often associated with referral bias arising from social and geographical differences in the tendency to consult hospitals for medical care [41]. The health care in Denmark is, however, free of charge and emergency hospitals are geographically distributed in a way that hospital care can be promptly reached by any citizen. It was shown that for ischemic heart disease only the hospital
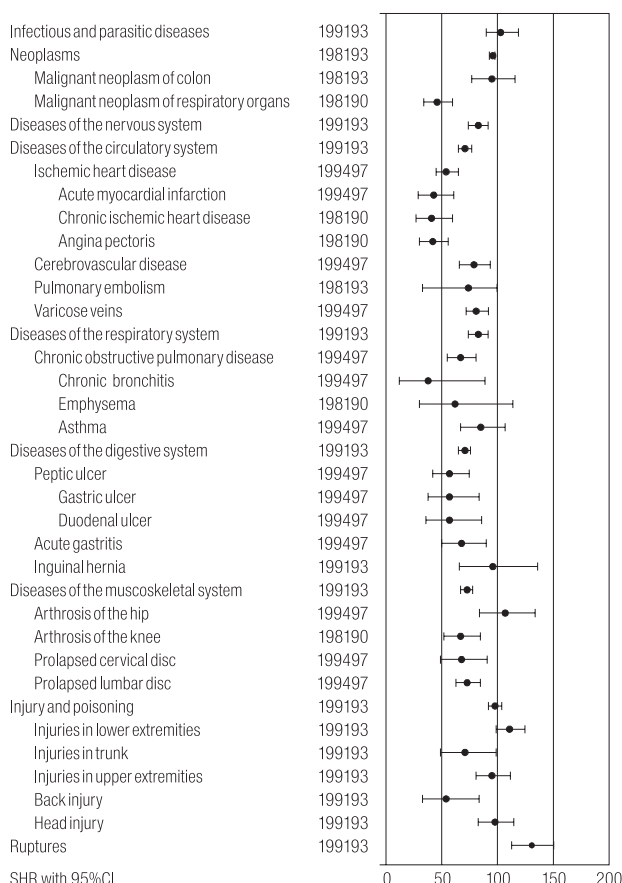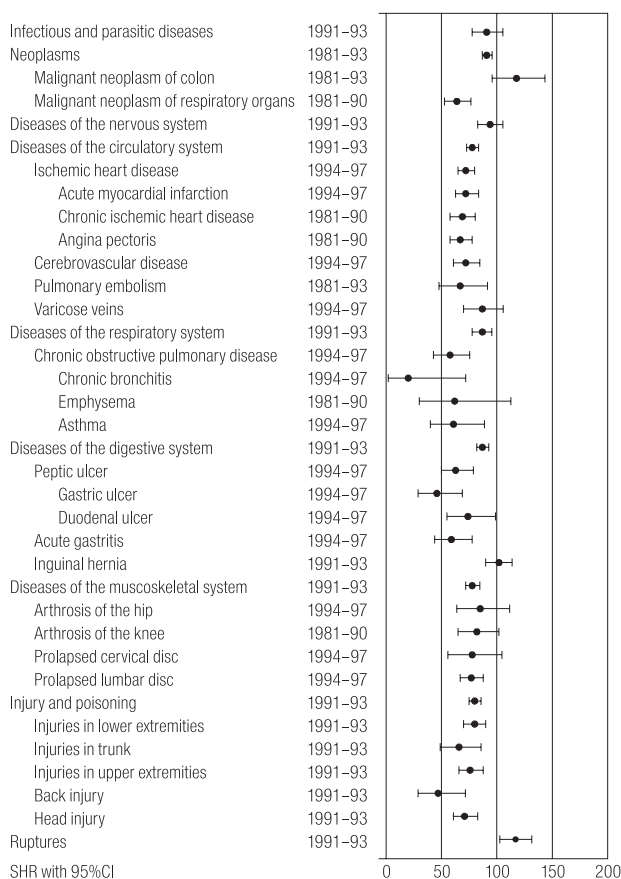
Fig. 2. Age standardized hospitalization ratio (SHR) with 95% confidence interval (CI), for a variety of diagnoses in male teachers in Denmark.

Fig. 3. Age standardized hospitalization ratio (SHR) with 95% confidence interval (CI), for a variety of diagnoses in female teachers in Denmark.

Table 1. Average annual change rate with 95% confidence interval (CI) of age standardized hospitalization ratios (SHRs) among teachers in Denmark

Diagnosis	Time span	Average annual change rate (%) with 95% CI			
		Men		Women	
Ischemic heart disease	1981–97	-0.26	(-1.45, 0.92)	3.57	(0.72, 6.42)
Acute myocardial infarction	1981–97	-0.78	(-2.31, 0.75)	0.55	(-3.53, 4.63)
Cerebrovascular disease	1981–97	-1.71	(-3.78, 0.30)	1.13	(-1.28, 3.44)
Varicose veins	1991–97	-1.59	(-10.35, 7.28)	1.39	(-4.14, 7.05)
Chronic obstructive pulmonary disease	1981–97	-2.08	(-4.62, 0.46)	-1.81	(-3.81, 0.20)
Chronic bronchitis	1981–97	-3.05	(-9.52, 3.43)	0.56	(-5.15, 6.26)
Asthma	1981–97	-4.60	(-9.24, -0.31)	-0.07	(-2.94, 2.70)
Gastric ulcer	1981–97	-2.90	(-6.49, 0.68)	2.76	(-1.25, 6.77)
Duodenal ulcer	1981–97	1.93	(-0.80, 4.66)	0.57	(-3.84, 4.98)
Acute gastritis	1981–97	-0.66	(-3.32, 2.00)	0.28	(-2.95, 3.52)
Arthrosis of the hip	1981–97	0.29	(-3.18, 3.77)	-0.03	(-3.04, 2.98)
Prolapsed cervical disc	1981–97	2.47	(-1.88, 6.78)	-0.82	(-4.91, 3.15)
Prolapsed lumbar disc	1981–97	-0.11	(-1.62, 1.39)	0.30	(-5.14, 12.64)

Table 2. Age standardized hospitalization ratios (SHRs) with 95% confidence interval (CI) in male teachers in Denmark

Diagnosis	Time period	No. of cases	SHRs	95% CI
Ischemic heart disease	1981–85	287	75	67–84
	1986–90	344	69	62–76
	1991–93	218	68	59–77
	1994–97	390	72	65–80
Acute myocardial infarction	1981–85	218	79	69–90
	1986–90	232	71	63–81
	1991–93	129	68	57–81
	1994–97	180	72	63–84
Cerebrovascular disease	1981–90	298	86	77–96
	1991–93	96	77	63–95
	1994–97	141	72	61–85
Varicose veins	1991–93	79	92	73–114
	1994–97	98	87	70–106
Chronic obstructive pulmonary disease	1981–85	91	76	61–94
	1986–90	93	76	62–93
	1991–93	40	67	48–91
	1994–97	50	58	43–76
Chronic bronchitis	1981–85	25	50	32–74
	1986–90	23	52	33–79
	1991–93	9	45	21–86
	1994–97	2	20	2–72
Asthma	1981–90	126	96	81–115
	1994–97	26	61	40–89
Gastric ulcer	1981–85	53	61	46–80
	1986-90	62	62	48–80
	1991–93	17	38	22–61
	1994–97	23	46	29–69
Duodenal ulcer	1981–85	83	65	52–80
	1986–90	69	53	41–67
	1991–93	51	89	66–117
	1994–97	47	74	55–99
Acute gastritis	1981–85	81	65	52–81
	1986–90	104	62	52–76
	1991–93	44	63	46–84
	1994–97	49	59	44–78
Arthrosis of the hip	1981–85	30	83	56–118
	1986–90	45	76	55–101
	1991–93	26	70	46–102
	1994–97	53	85	64–112
Prolapsed cervical disc	1981–90	49	61	45–80
	1994–97	43	78	56–105
Prolapsed lumbar disc	1981–85	211	82	72–94
	1986–90	222	71	62–81
	1991–93	180	84	73–97
	1994–97	191	77	67–88

Table 3. Age standardized hospitalization ratios (SHRs) with 95% confidence interval (CI) in female teachers in Denmark

Diagnosis	Time period	No. of cases	SHRs	95% CI
Ischemic heart disease	1981–85	38	41	29–56
	1986–90	43	31	22–42
	1991–93	48	47	35–63
	1994–97	115	54	45–65
Acute myocardial infarction	1981–85	26	44	29–64
	1986–90	26	34	22–50
	1991–93	22	46	29–70
	1994–97	32	43	29–61
Cerebrovascular disease	1981–90	182	71	61–82
	1991–93	53	56	42–73
	1994–97	124	79	66–94
Varicose veins	1991–93	184	77	67–89
	1994–97	239	81	72–92
Chronic obstructive pulmonary disease	1981–85	129	89	75–105
	1986–90	109	66	55–80
	1991–93	78	81	64–101
	1994–97	105	67	55–81
Chronic bronchitis	1981–85	23	52	33–78
	1986–90	20	44	27–68
	1991–93	19	71	43–112
	1994–97	5	38	12–89
Asthma	1981–90	171	86	74–99
	1994–97	74	85	67–107
Gastric ulcer	1981–85	28	37	25–54
	1986–90	46	50	37–67
	1991–93	17	41	24–66
	1994–97	27	57	38–84
Duodenal ulcer	1981–85	29	49	33–70
	1986–90	32	44	30–62
	1991–93	13	37	20–63
	1994–97	23	57	36–86
Acute gastritis	1981–85	50	62	46–82
	1986–90	68	52	40–65
	1991–93	25	43	28–63
	1994–97	48	68	50–90
Arthrosis of the hip	1981–85	40	114	82–155
	1986–90	49	93	69–123
	1991–93	35	108	75–150
	1994–97	72	107	84–134
Prolapsed cervical disc	1981–90	63	73	56–94
	1994–97	44	68	49–91
Prolapsed lumbar disc	1981–85	172	70	60–81
	1986–90	204	68	59–78
	1991–93	138	68	58–80
	1994–97	174	73	63–85

staff was conspicuously subject to the referral bias [41]. For occupational groups, other than hospital staff, we expect that the effect of this type of bias will be slight also for other diseases. Another classic confounder is the healthy worker effect [42]. To reduce this effect all economically active people were used as a standard in the present study, and all estimates were based on the follow-up of a fixed population for at least three years.

As mentioned in the Introduction section, most of the earlier studies in this field have pointed out that work-related stress is a considerable problem among teachers. It is known that stress conditions and subsequent job strain may play a major role in the etiology of several diseases such as ischemic heart disease [43,44], gastric ulcer [45,46], duodenal ulcer and gastritis [47]. Yet, all of the SHRs for these a priori stress-related diseases were significantly low among the teachers. Our results therefore appear to be at odds with the general notion in the teacher stress research community. We had only information about inpatient treatment and we cannot exclude the possibility that the disease pattern would differ if outpatient treatment and visits to general practitioners would have been included in the analyses. The results of few studies that have used health measures to compare teachers with the working population at large do not seem to contradict the present findings. In a study of work-related cancer [48], it was shown that the incidence of "all cancers" was significantly low among teachers in all Nordic countries. Like in our study, the incidence of smoking-related cancers was especially low, while the incidence of malignant neoplasm of colon did not differ from the average in any of the countries. A Danish study of mortality in 1970–80 [49], reported standardized mortality ratios (SMR) for all causes, neoplasms, cardiovascular diseases, other diseases and injuries among teachers. The mortality rates among male teachers were lower than average in all categories under study. Female mortality was lower than average in all categories except neoplasms. Another Danish study [50] found low (although not statistically significant) odds ratios for clinically diagnosed diseases, poor self-rated health, and reduced work ability among teachers.

Thus there seem to be some evidence, that the teaching profession is in fact a healthy group compared with the general population, and this holds for both stress-related diseases and other diseases. How can it be then that the literature on stress suggests that teachers should be a highly stressed occupation group? Of course, the answer may, in part, lie in the missing use of non-teacher control groups in these studies. The teachers might be highly stressed, but the population at large might be even more stressed. This may be part of the explanation, but other possible explanations should also be considered.

First, one has to take notice of the sample. It might be that the quality of the physical and psychosocial work environment in Danish schools is exceptionally high. It has been indicated that the types of school that catalyze the development of stress-related phenomena in teachers are: "large urban schools with overcrowded classrooms that are physically run down or dirty and lacking staff and equipment; schools that are highly bureaucratic with no management teams; and schools that lack social support among teachers and lack administrative support of teachers' efforts" [19]. Comparing schools internationally it might appear that Danish schools belong to the better part.

Second, it might be that the health of teachers is unaffected, although they do perceive high levels of stress, many conflicts and low social support at work [50]. In a recent review paper [51], it was stated that confidence in the conclusion that occupational stress and burnout are associated with poor health in teachers are weakened by "serious methodological and conceptual difficulties that pervade this area of research. In particular, reliance on cross-sectional retrospective designs, exclusive dependence on self-report measures, and failure to adopt a theoretical framework as a guide for empirical investigations". Due to methodological problems it would therefore be inconclusive, if there is actually a link between stress and ill health among teachers.

A third possible explanation of the apparent disagreement in the results might be that an average teacher does not in fact perceive higher levels of negative stress than the general working population. Due to the tradition, in the teacher stress research community, of not using non-

teacher control groups, the view that teaching is a high-stress occupation might appear to be exaggerated [14]. Additionally, there might be a reluctance to conclude anything contrary to the general belief in the stress research community, with a resultant bias towards selective publishing of positive findings.

Regardless of the conclusion of the above mentioned discussions, it remains to be explained, why the health of the Danish teachers seems to be so much better than the health of the general working population in Denmark.

It is well known that mental disorders are associated with health problems [52–56]. It is also well known that positive mental health is critical for teachers because of their position and authority they hold in the classroom and the possible influence they have on the students [2]. For the sake of pupils, people with obvious mental disorders should therefore not be allowed to enter the profession. Hence, the teaching profession might be associated with a positive selection bias with regard to health. For the same reason, it might be that the attrition from the profession is harsh too. It would be difficult to continue working as a teacher, unless you enjoy good mental health. Perhaps many teachers change to another occupation before the age of retirement. However, Fig. 1 showing the age distribution of the sample does not suggest that the attrition rate from the profession is unusually high in Denmark. The age profiles show a steadily development, where the work force is evidently older than it used to be. This could of course be related to hiring practices or other phenomena, but for the present, there is practically no unemployment among well educated teachers in Denmark.

Beside these possible selection mechanisms, it is obvious that there are certain qualities associated with the job as a teacher that might have a protective effect. First of all, the job is associated with a high degree of control, and also with high degree of skill discretion, meaningfulness and possibilities for involvement. All might work as health protective factors. Teachers do have high skill discretion and a high degree of influence on planning of their own work [50], and they are as well demanded to perform a high degree of control over the pupils. These possibilities to exert control at work would be expected to increase the general competencies and confidence of the teachers in their own efficacy to perform control over their life-situation, and thereby influence their own health. In other words, the teaching activity might teach the teachers to develop better coping skills. This interpretation is in agreement with the finding of many studies that it is an inexperienced teacher who is particularly stressed by his or her job [38,57]. According to a recent state-of-the-art paper [58], nine studies carried out since 1989 have shown that low control is associated with an increased risk for cardiovascular diseases, whereas high job demands contribute to a decreased risk for these pathologies. Furthermore, teachers are expected to be "good examples" for the pupils. This may prevent them from indulging in unhealthy life style activities, such as smoking and high alcohol consumption. A low smoking rate among teachers is in accordance with the finding that the incidence of smoking-related diseases is significantly lower in this occupation group [59,60].

Long holidays and few working hours are often mentioned as an advantage of the teaching profession. Even if the weekly hours of work during non-holiday seasons are presumably the same for most teachers and for people in other professions [2], there is still a high degree of freedom connected with long time periods away from the job. This has been shown to be a protective measure against accumulation of negative stress [61].

In conclusion, diseases that require hospitalization are generally less frequent among teachers than among the rest of the working population, and it is hypothesized that at least part of this phenomenon might be due to health promoting factors associated with the work itself.

CONCLUSIONS

Age standardized hospitalization rates of diseases observed in practically all systems and organs of the body were statistically significantly lower among teachers compared with other economically active people of Denmark. The advantageous health situation was quite stable in the time span of 1981–1997.

Especially low relative rates were observed for stress- and smoking related diseases.

At least part of the health advantage might be due to health promoting factors associated with the work itself.

REFERENCES

1. Mäkinen R. *Teacher's work, well-being, and health* [dissertation]. Jyväskylä Studies in Education, Psychology and Social Research; 1982. p. 46.

2. Miller DF, Wiltse J. *Mental health and the teacher*. J Sch Health 1979; 49: 374–7.

3. Needle RH, Griffin T, Svendsen R, Berney C. *Teacher stress: sources and consequences.* J Sch Health 1980; 50: 96–9.

4. Belcastro PA, Gold RS. *Teacher stress and burnout: implications for school health personnel*. J Sch Health 1983; 53: 404–7.

5. Golaszewski TJ, Milstein MM, Duquette RD, London WM. *Organizational and health manifestations of teacher stress: a preliminary report on the Buffalo Teacher Stress Intervention Project.* J Sch Health 1984; 54: 458–63.

6. Soh KC. *Locus of control as a moderator of teacher stress in Singapore.* J Soc Psychol 1986: 126: 257–8.

7. DeFrank RS, Stroup CA. *Teacher stress and health: examination of a model*. J Psychosom Res 1989; 33: 99–109.

8. Watts WD, Short AP. *Teacher drug use: a response to occupational stress.* J Drug Educ 1990; 20: 47–65.

9. Schonfeld IS. *Psychological distress in a sample of teachers.* J Psychol 1990; 124: 321–38.

10. Kelley BC, Gill DL. *An examination of personal/situational variables, stress appraisal, and burnout in collegiate teacher coaches*. Res Q Exerc Sport 1993; 64: 94–102.

11. Borg MG, Riding RJ. *Teacher stress and cognitive style*. Br J Educ Psychol 1993; 63: 271–86.

12. Hunter P, Houghton DM. *Nurse teacher stress in Northern Ireland.* J Adv Nurs 1993; 18: 1315–23.

13. Pither RT, Fogarty GJ. *Symposium on teacher stress. Occupational stress among vocational teachers.* Br J Educ Psychol 1995; 65: 3–14.

14. Pithers RT. *Teacher stress research: problems and progress.* Br J Educ Psychol 1995; 65: 387–92.

15. Cooper CL. *Life at the chalkface – identifying and measuring teacher stress.* Br J Educ Psychol 1995; 65: 69–71.

16. Boyle GJ, Borg MG, Falzon JM, Baglioni AJ Jr. *A structural model of the dimensions of teacher stress*. Br J Educ Psychol 1995; 65: 49–67.

17. Cockburn AD. *Primary teacher's knowledge and aquisition of stress relieving strategies.* Br J Educ Psychol 1996; 66: 399–410.

18. Pithers RT, Soden R. *Scottish and Australian teacher stress and strain: a comparative study.* Br J Educ Psychol 1998; 68: 269–79.

19. Farber BA. *Treatment strategies for different types of teacher burnout.* J Clin Psychol 2000; 56: 675–89.

20. Borg MG. *Occupational stress in British educational settings.* Educ Psychol 1990; 10: 103–26.

21. Borg MG, Falzon JM. *Coping actions used by Maltese primary school teachers.* Educ Res 1990; 32: 50–8.

22. Borg MG, Falzon JM. *Stress and job satisfaction among primary school teachers in Malta.* Educ Rev 1989; 41: 271–9.

23. Borg MG, Riding RJ, Falzon JM. *Stress in teaching: a study of occupational stress and its determinants, job satisfaction and career commitment among primary school teachers*. Int J Psychol 1991; 11: 59–75.

24. Brenner SO, Sörbom D, Wallius E. *The stress chain: a longitudinal confirmatory study of teacher stress, coping and social support*. J Occup Psychol 1985; 58: 1–13.

25. Capel SA. *The incidence of and influences on stress burnout in secondary school teachers.* Br J Educ Psychol 1987; 57: 279–88.

26. Kyriacou C. *Teacher stress and burnout: an international review.* Educ Res 1987; 29: 146–52.

27. Kyriacou C, Sutcliffe J. *A model of teacher stress*. Educ Studies 1978; 4: 1–6.

28. Kyriacou C, Sutcliffe J. *Coping actions and occupational stress among school teachers*. Res Educ 1980; 24: 57–61.

29. Perlberg A, Keinan G. *Sources of stress in academy – the Israeli case.* Higher Educ 1986; 15: 73–8.

30. Smilansky J. *External and internal correlates of teacher's satisfaction and willingness to report stress.* Br J Educ Psychol 1984; 54: 84–92.

31. Smith M, Bourke S. *Teacher stress: examining a model based on context, workload, and satisfaction.* Teach Teacher Educ 1992; 8: 31–46.

32. Starnaman SM, Miller KI. *A test of causal model of communication and burnout in the teaching profession.* Commun Educ 1992; 41: 40–53.

33. Tellenback S, Brenner SO, Löfgren H. *Teacher stress: exploratory model building*. J Occup Psychol 1983; 56: 19–33.

34. Turk DC, Meeks S, Turk LM. *Factors contributing to teacher stress: implications for research, prevention and remediation*. Behav Counsel Quart 1982; 2: 3–25.

35. Hiebert B, Farber I. *Teacher stress: a literature review with a few suprises*. Can J Educ 1984; 9: 14–27.

36. Milstein MM, Farkas J. *The over-stated case of educator stress*. J Educ Adminis 1988; 26: 232–49.

37. Dussault M, Deaudelin C, Royer N, Loiselle J. *Professional isolation and occupational stress in teachers*. Psychol Rep 1999; 84: 943–6.

38. Kyriacou C, Pratt J. *Teacher stress and psychoneurotic symptoms*. Br J Educ Psychol 1985; 55: 61–4.

39. Bach E. *Validation of the occupational hospitalization register: an occupational epidemiological monitoring system*. [Thesis]. Copenhagen: National Institute of Occupational Health; 1998 [in Danish].

40. Tüchsen F, Endahl LA. *Increasing inequality in ischaemic heart disease morbidity among employed men in Denmark 1981–93: the need for a new preventive policy*. Int J Epidemiol 1999; 28: 640–4.

41. Tüchsen F, Andersen O, Olsen J. *Referral bias among health workers in studies using hospitalization as a proxy of the underlying incidence rate*. J Clin Epidemiol 1996; 7: 791–4.

42. Weed DL, Tyroler HA, Shy C. *The healthy worker effect in actively working communications workers*. J Occup Med 1987; 4: 335–9.

43. Marmot MG. *Does stress cause heart attacks?* Postgrad Med J 1986; 62: 683–6.

44. Belkic K, Savic C, Theorell T, et al. *Mechanisms of cardiac risk among professional drivers*. Scand J Work Environ Health 1994; 20: 73–86.

45. Sugisawa A, Uehata T. *Onset of peptic ulcer and its relation to work-related factors and life events: a prospective study*. J Occup Health 1999; 40: 22–31.

46. Räihä I, Kemppainen H, Kaprio J, et al. *Lifestyle, stress, and genes in peptic ulcer disease: a nationwide twin cohort study*. Arch Intern Med 1998; 158: 698–704.

47. Sonnenberg A. *Factors which influence the incidence and course of peptic ulcer*. Scand J Gastroenterol Suppl 1988; 155: 119–40.

48. Andersen A, Barlow L, Engeland A, Kjćrheim K, Lynge E, Pukkala E. *Work-related cancer in the Nordic countries*. Scand J Work Environ Health. 1999; 25 Suppl 2: 1–116.

49. Andersen O. *Mortality and occupation 1970–80*. Copenhagen: Statistics Denmark; 1985.

50. Borg V, Burr H. *Work environment and health among Danish wage earners*. Copenhagen: National Institute of Occupational Health; 1998 [in Danish].

51. Guglielmi R, Tatrow K. *Occupational stress, burnout, and health in teachers: A methodological and theoretical analysis*. Rev Educ Res 1998; 68: 61–99.

52. Amaddeo F, Bisoffi G, Bonizzato P, Micciolo R, Tansella M. *Mortality among patients with psychiatric illness. A ten-year case register study in an area with a community-based system of care*. Br J Psych 1995; 166: 783–8.

53. Babigian HM, Odoroff CL. *The mortality experience of a population with psychiatric illness*. Amer J Psychiatry 1969; 126: 470–80.

54. Hannerz H, Borgĺ P. *Mortality among persons with a history as psychiatric inpatients with functional psychosis*. Soc Psychiatry Psychiatr Epidemiol 2000; 35: 380–7.

55. Harris EC, Barraclough B. *Excess mortality of mental disorder*. Br J Psychiatry 1998; 173: 11–53.

56. Baxter DN. *The mortality experience of individuals on the Salford Psychiatric Case Register*. Br J Psychiatry 1996; 168: 772–9.

57. Beach DR, Levine M, Goldberg S. *Teacher discussion groups: a community mental health approach*. Int J Soc Psychiatry 1973; 19: 102–9.

58. Kristensen TS. *Challenges for research and prevention in relation to work and cardiovascular diseases*. Scand J Work Environ Health 1999; 25: 550–7.

59. Leigh JP. *Occupations, cigarrette smoking, and lung cancer in the epidemiological follow-up to the NHANES I and the California Occupational Mortality Study*. Bull N Y Acad Med 1996; 73: 370–97.

60. Levin LI, Silverman DT, Hartge P, Fears TR, Hoover RN. *Smoking patterns by occupation and duration of employment*. Am J Ind Med 1990; 17: 711–25.

61. Kinnunen U. *Teacher stress over an autumn term: relationships between subjective stress and catecholamine excretion at night rest*. Scand J Psychol 1987; 28: 293–303.