ORIGINAL ARTICLE

Effect of sporting activity on absenteeism in a working population

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Objectives: To determine the effects of sporting activity on absenteeism in a working population.
Methods: Data were used from a prospective cohort study in a working population with a follow up period of 3 years and were collected with yearly questionnaires or collected from company records. Complete data on absenteeism, sporting activity, and potential confounders were collected for 1228 workers. ANOVA was used to test differences in frequency and duration of absenteeism, correlations were computed to measure the association between number of sporting years (divided by age) and frequency and duration of absenteeism, and survival analysis, according to the Cox proportional hazards model, was used to test differences in relative risk at absenteeism and recovery. All analyses were adjusted for age, gender, smoking, and alcohol consumption, and were stratified for employees with sedentary and with more active jobs.
Results: ANOVA showed a statistically significant higher mean duration of absenteeism among employees not practicing sports, of approximately 20 days over a period of 4 years. The survival analysis showed an increased relative risk at absenteeism (relative risk (RR) 1.09; confidence interval (CI) 1.01 to 1.18) and a decreased relative risk at recovery (RR 0.90; CI 0.85 to 0.95) for employees not practicing sports. The effect of sporting activity is larger in employees with sedentary work. No associations were found between number of sporting years and absenteeism.
Conclusion: Employees practicing sports take sick leave significantly less often than their colleagues not practicing sports, while their periods of sick leave are shorter, especially when their work is sedentary.

The health benefits of physically active behaviour are undisputed. Physical activity reduces the risk of a number of chronic diseases and has a positive effect on their progression.[1] If carried out to a sufficient degree and in a responsible manner, physical activity extends an individual's life span by 1 year on average.[2] As well as the effects on health, a physically active lifestyle can have positive work related effects such as reduced employee turnover,[3] less job stress,[4] and an increase in work satisfaction.[5] Finally, another important work related effect of physical activity could be reduced illness related absenteeism. This effect has also been described.[3 6–8]

Indications for the effects of physical activity on absenteeism have previously been mostly based on results from transversal or intervention studies. As the present study uses data from a prospective cohort study of a working population with a follow up period of 3 years, more valid conclusions could be drawn about the effects of physical activity. Since participation in sport is one of the most important sources of physical activity, the aim of this study was to determine the effects of sporting activity on the absenteeism of employees.

The effect of sporting activity is probably dependent on both the amount of previous sporting activity and the amount other physical activity, especially at work. Employees who perform physically demanding work are likely to derive less benefit from further physical activity than employees whose work is primarily sedentary. Therefore, the influence of the length of time over which sport has been practiced has been studied, as well as the influence of the type of work (sedentary versus more active).

METHODS

Study population

Data were used from a large prospective cohort study, the Study on Musculoskeletal Disorders, Absenteeism, Stress and Health (SMASH). The main purpose of this study was to determine work related risk factors for musculoskeletal disorders, with a focus on low back, neck, and shoulder problems. The baseline measurement was taken in 1994 with three follow up measurements in 1995, 1996, and 1997. Data were collected using questionnaires, video observations, and company records on absenteeism. The study population consisted of 1742 employees aged 18–59 years, who had been employed in their current job for at least 1 year, and who were working 24 h per week or more. They were employed at 34 companies in the industrial, administrative, and service sectors.

Absenteeism

Data on illness related absenteeism were provided by 21 of the 34 participating companies and were collected annually. Total duration and frequency were calculated over the 4 years of the study; a distinction was made between very short term sick leave (1–2 days), short term sick leave (3–7 days), medium long term sick leave (8–21 days), and long term sick leave (more than 22 days).

Independent variable: sport

Data were assessed with the questionnaires at baseline and at first and second follow up. The subjects were asked which physically demanding sports they had practiced during their life (at baseline) or in the last 12 months (at follow up). They were then asked about the frequency (number of hours per week and number of months per year) and, during the baseline measurement, the duration (period in years) of participation. Sports that were not physically demanding were excluded.

Two dichotomous variables were calculated for the analysis of variance. One variable related to the sporting activity in the year preceding baseline measurement and indicated whether

one had practiced sport during that period. The lower limit was once a week for at least 4 months. The other variable was constructed to distinguish employees who had never practiced sport from those who had.

To examine the effect of the duration of participation in sport, a variable was included indicating the number of years that an individual had practiced sport in his or her entire life. The lower limit mentioned above, once a week for at least 4 months, was applied here as well.

In the survival analysis, employees who had never practiced sport were distinguished from those who had. Furthermore, a variable was used referring to sporting activity in the year preceding the period of sick leave. A distinction was made between employees who had practiced sport during this year and those who had not, with the lower limit of once a week for at least 4 months.

Other independent variables

Confounders included in this study were age, gender, smoking, and alcohol consumption. Data on these variables were assessed at baseline measurement only using the questionnaire. The following question was asked: ''Do you smoke or have you ever smoked?'', to which the respondent could reply with ''now'', ''used to'', or ''never''. Alcohol consumption was ascertained by the question: ''How many glasses of alcohol do you usually drink per week?''. In the analysis, a distinction was made between employees who drank more than 20 glasses a week and those who did not.

The analyses were stratified for sedentary work and more active work. Data on these variables were assessed with questionnaires during all measurements. A distinction was made between employees who stated during all measurements that they did a lot of sedentary work and those who stated at least once that they did sedentary work only ''seldom'' or ''now and then''.

Statistical analysis

Means were calculated for duration of sick leave in days and for frequency of periods of sick leave of different durations over the total period monitored. ANOVA was used to test whether the means of those who practiced sport differed significantly from the means of those who did not. Confounders were included as covariates. Correlations were calculated of the number of years that an individual had practiced sport with duration and frequencies of periods of sick leave. As the number of sporting years correlates closely to age, this number was first divided by the employee's age.

Subsequently, a survival analysis was carried out in accordance with the Cox proportional hazards model.[9] Two models were constructed to examine the differences between those who did and those who did not practice sport. Adjustments were made for the confounders mentioned above. The dependent variable in the first model (reporting sick model) is the time preceding a sick report, while in the second model (recovery model) it is the time preceding the recovery report for individuals who have reported sick. Account had to be taken of the fact that most people contributed several of these reports to the analysis. This was achieved by correcting with a grouped jack knife method the standard errors in the Cox model for the effect of the correlation between outcomes for a single person.[10]

Only data on absenteeism occurring in the period following the baseline measurement were used. When there were no data about the sporting activity in a particular year, the periods of absenteeism in the subsequent year were not included in the analysis.

The calendar was used for the time axis in the reporting sick model. This enabled automatic correction for possible seasonal and ''day of the week'' effects on sick reports. The time since reporting sick was used for the time axis in the recovery model because the chance of a recovery report depends to a great extent on how long an individual has already been sick.

When checking the proportional hazard assumption it appears that the effect of sport on the chance of recovery decreases greatly as the duration of the period of sick leave increases; the effect was most noticeable during the first 5 days. For this reason, the recovery model was split into a model for the chance of recovery during the first 5 days and a model for that chance on day 6 and thereafter.

Finally, in all analyses it was investigated whether the type of work (sedentary or not) influences the relationship between sporting activity and absenteeism. Therefore, a subgroup analysis was carried out for two groups of employees: those who stated in all measurements that they did a lot of sedentary work and those who did not.

RESULTS

Background characteristics

Table 1 shows the relationship between the various background variables measured at baseline and the categories of sporting activity. The results show that sporting individuals did sedentary work more often than those who did not practice sport. Sporting individuals smoked less and were slightly younger.

Absenteeism

Table 2 shows the differences in frequency and duration of absenteeism between those who practiced sport and those who did not, adjusted for age, gender, alcohol consumption, and smoking. The results show that there was little difference in the total frequency of absenteeism. However, the difference in total duration of absenteeism shows that employees practicing sports were on sick leave significantly less. This can also be deduced from the differences in the frequencies of the medium long and long term sick leave on the one hand, and short term sick leave on the other.

No relation was found between the number of years that an individual had practiced sport and absenteeism (results not shown). The number of sporting years did not correlate significantly with the frequency or duration of the periods of sick leave.

The stratification for sedentary work shows that the differences between those who practiced sport and those who did not were larger in the group who stated that they did a lot of sedentary work. As such, the difference in duration of sick leave in days is statistically significant only in this group. It is also striking that in this group those who had ever practiced sport had periods of short term sick leave significantly more often than those who had never practiced any sport. However, this is more than compensated for by the lower frequency of their periods of middle long and long term sick leave. Over a period of 4 years, those who practiced sport are absent on sick leave for an average of almost 25 days less than those who did not practice any sport and more than 50 days less than employees who had never practiced any sport.

Even after the stratification there appears to be little or no association between the number of years that an individual had practiced sport and the different categories of absenteeism (results not shown). In the group of employees doing a lot of sedentary work a significant negative correlation was found between the number of years that an individual had practiced sport and the frequency of long term sick leave and the total amount of sick leave taken. However, the correlation coefficients are quite low: -0.16 and -0.19.

The results of the survival analysis are presented in table 3. The results show that those who did not practice sport have a

Table 1 Type of work and background characteristics

	Sporting activity			
	Baseline, %		Lifetime, %	
	Did not practice sport, 55% (n = 795)	Practiced sport, 45% (n = 655)	Never practiced sport, 16% (n = 251)	Practiced sport, 84% (n = 1321)
Type of work				
Sedentary, always very	23	40	10	29
Background characteristics				
Alcohol consumption >20 glasses/week	8	6	8	7
Smoking				
Used to	24	29	16	26
Smokes now	46	35	56	41
Female gender	31	30	28	31
Age (mean)	37	35	39	35

slightly greater chance of a period of sick leave and generally recover less quickly. This concurs with the small difference in frequency of sick leave and the larger difference in duration of sick leave as shown in table 2. The analysis shows a difference between recovery during the first 5 days and recovery after the 5th day. The difference between those who practiced sport and those who did not is most evident during the first 5 days of sick leave. However, employees who have never practiced sport continue to have a significantly lower chance of recovery after 5 days of sick leave than employees who have once practiced sport.

The stratification for employees who did/did not do a lot of sedentary work shows that the differences between those who practiced sport and those who did not are larger in the group that did a lot of sedentary work. This concurs with the results in table 2.

DISCUSSION

From the results of this study it can be concluded that sporting activity has a favourable effect on absenteeism: employees who participate in sporting activity had less sick days. These results correspond with earlier cross sectional studies,[7 11 12] although Steinhard *et al* only found a favourable effect in men. In the present study, no gender differences were found.

To a certain extent these results agree with systematic reviews with respect to the effectiveness of physical activity programs at worksites. Most studies suggest that such programs can contribute to a reduction in absenteeism, although strong evidence is still lacking due to the methodological shortcomings of the studies and inconsistencies between the studies.[13 14] Naturally, the relationship between physical activity and work related health outcomes does not guarantee a favourable outcome for physical activity programs.

From the survival analysis, it appears that the positive effect could be attributed largely to a faster recovery, particularly within the first 5 days of sick leave. A plausible explanation is that participation in sports enhances individual physical capacities, thus facilitating a quick recovery. Since the health effects of physical activity may become more pronounced in the longer term (for example, less chronic disease), it would be interesting to monitor the effects on absenteeism during a longer follow up. One might expect that the effects seen would be even more pronounced in the

Table 2 Mean duration and frequency of sick leave

	Sporting activity			
	Baseline		Lifetime	
All	Did not practice sport	Practiced sport	Never practiced sport	Practiced sport
	59% (n = 723)	41% (n = 505)	12% (n = 138)	88% (n = 980)
Frequency of very short term sick leave (1–2 days)	1.47	1.74*	1.43	1.60
Frequency of short term sick leave (3–7 days)	3.28	3.03	2.98	3.17
Frequency of medium long term sick leave (8–21 days)	1.61‡	1.15	1.74†	1.29
Frequency of long term sick leave (>22 days)	0.80*	0.67	0.92*	0.71
Frequency of total sick leave	7.14	6.59	7.08	6.77
Total duration of sick leave (in days)	94.72‡	74.52	109.10†	81.44
Always a lot of sedentary work	Did not practice sport	Practiced sport	Never practiced sport	Practiced sport
	45% (n = 157)	55% (n = 189)	5% (n = 16)	95% (n = 305)
Frequency of very short term sick leave (1–2 days)	1.65	1.79	0.51	1.80*
Frequency of short term sick leave (3–7 days)	3.17	2.90	1.49	3.08*
Frequency of medium long term sick leave (8–21 days)	1.20†	0.76	1.66*	0.84
Frequency of long term sick leave (>22 days)	0.60	0.44	0.70	0.49
Frequency of total sick leave	6.61	5.89	4.37	6.22
Total duration of sick leave (in days)	76.36*	52.20	112.76*	59.25
Not always sedentary work	Did not practice sport	Practiced sport	Never practiced sport	Practiced sport
	64% (n = 566)	36% (n = 316)	15% (n = 122)	85% (n = 675)
Frequency of very short term sick leave (1–2 days)	1.42	1.69	1.58	1.51
Frequency of short term sick leave (3–7 days)	3.30	3.12	3.12	3.23
Frequency of medium long term sick leave (8–21 days)	1.71*	1.40	1.74	1.50
Frequency of long term sick leave (>22 days)	0.85	0.82	0.93	0.81
Frequency of total sick leave	7.28	7.03	7.37	7.04
Total duration of sick leave (in days)	99.89	87.74	106.59	91.83

*p<0.05; †p<0.005; ‡p<0.0005.

Table 3 Relative risk of sick leave and recovery

	Number of events in crude/adjusted analyses	Crude RR (95% CI)	Adjusted RR* (95% CI)
All			
Sick leave			
Did not practice sport recently	6671/6306	1.09 (1.01 to 1.18)‡	1.09 (1.01 to 1.18)‡
Never practices sport	5656/5452	1.02 (0.88 to 1.17)	1.05 (0.91 to 1.21)
Recovery			
Did not practice sport recently	6635/6267	0.88 (0.83 to 0.93)¶	0.90 (0.85 to 0.95)¶
Never practices sport	5618/5413	0.84 (0.77 to 0.91)¶	0.85 (0.77 to 0.93)¶
Recovery in the first 5 days			
Did not practice sport recently	3338/3160	0.78 (0.72 to 0.85)¶	0.82 (0.75 to 0.89)¶
Never practices sport	2874/2774	0.74 (0.63 to 0.87)¶	0.77 (0.65 to 0.91)§
Recovery after the 5th day			
Did not practice sport recently	3828/3604	0.97 (0.91 to 1.04)	0.98 (0.92 to 1.05)
Never practices sport	3175/3058	0.87 (0.79 to 0.95)§	0.86 (0.77 to 0.95)§
Always a lot of sedentary work			
Sick leave			
Did not practice sport recently	1409/1359	1.25 (1.06 to 1.47)‡	1.16 (0.99 to 1.37)†
Never practices sport	1272/1237	1.31 (0.95 to 1.79)†	1.31 (0.97 to 1.78)†
Recovery			
Did not practice sport recently	1411/1361	0.79 (0.70 to 0.89)¶	0.85 (0.75 to 0.96)‡
Never practices sport	1273/1238	0.66 (0.55 to 0.80)¶	0.70 (0.57 to 0.88)§
Recovery in the first 5 days			
Did not practice sport recently	796/765	0.67 (0.57 to 0.80)¶	0.72 (0.61 to 0.85)¶
Never practices sport	732/712	0.49 (0.32 to 0.75)§	0.53 (0.34 to 0.81)§
Recovery after the 5th day			
Did not practice sport recently	732/718	0.93 (0.80 to 1.07)	1.00 (0.86 to 1.16)
Never practices sport	645/625	0.78 (0.60 to 1.01)†	0.82 (0.62 to 1.10)
Not always sedentary work			
Sick leave			
Did not practice sport recently	5231/4916	1.04 (0.95 to 1.13)	1.05 (0.97 to 1.15)
Never practices sport	4362/4193	0.97 (0.83 to 1.13)	1.00 (0.85 to 1.17)
Recovery			
Did not practice sport recently	5194/4876	0.92 (0.86 to 0.98)‡	0.93 (0.88 to 1.00)‡
Never practices sport	4323/4153	0.89 (0.81 to 0.97)‡	0.90 (0.81 to 0.99)‡
Recovery in the first 5 days			
Did not practice sport recently	2533/2386	0.84 (0.76 to 0.92)¶	0.88 (0.80 to 0.97)‡
Never practices sport	2135/2055	0.81 (0.69 to 0.96)‡	0.86 (0.71 to 1.03)†
Recovery after the 5th day			
Did not practice sport recently	3073/2876	0.99 (0.92 to 1.07)	0.98 (0.91 to 1.06)
Never practices sport	2515/2418	0.89 (0.81 to 0.98)‡	0.87 (0.78 to 0.97)‡

CI, confidence intervals; RR, relative risk.
*Adjustments were made for age, gender, alcohol consumption and smoking; †p<0.10; ‡p<0.05; §p<0.005; ¶p<0.0005.

longer term. Unfortunately, such data are difficult to obtain due to the increasing dropout of study participants and companies supplying data on sick leave.

The analyses indicate that the effects of participation in sporting activity are particularly relevant for those with sedentary jobs. This is plausible enough: in non-sedentary jobs, the work itself already contributes significantly to the total amount of physical activity, and so the contribution of sporting activity during leisure time is less important in those groups. It should make no difference whether daily physical activity is taken during leisure time or during work. Encouraging exercise in leisure time thus appears particularly important for employees with less physically demanding work activity, for example, sedentary jobs. This implies that increasing company fitness is especially important in banking, insurance, IT, and administration.

It is surprising that no effect was found for the duration of practicing sports: one would expect that the effects would be more pronounced with a longer or more intense history of sport participation, but no such effect was found. One explanation is that the measurement was not accurate enough (self reported history), and another is that it is not the intensity or duration of sports participation, but simply an active lifestyle that accounts for the effects found.

Another question, which remains to be answered, is the role of the intensity of the physical activity performed. In our analysis, the data concerned participation in sports, physical activities with a relatively high intensity. Since physical activity of moderate intensity can induce significant favourable health effects,[1] it would be interesting to analyse whether moderate intensive physical activity influences absenteeism in the same favourable way as the more vigorous exercise in sporting activity. For the time being, it seems appropriate to recommend that more intense physical activity should be encouraged as a means to reduce absenteeism.

What is already known on this topic

Physically activity confers many health benefits including reducing the risk of chronic disease.

What this study adds

A significantly higher mean duration of absenteeism was found among employees not practicing sports compared to those who practiced sports.

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REFERENCES

1 **US Department of Health and Human Services (USDHHS)**. *Physical activity and health: a report of the Surgeon General*. Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, 1996.
2 **Bouchard C**. Physical activity, fitness and health: overview of the Consensus Symposium. In: Quinney AH, Gauvin L, Wall T, eds. *Towards active living*. Champaign IL: Human Kinetics, 1994.
3 **Cox M**, Shephard RJ, Corey P. Influence of an employee fitness programme upon fitness, productivity and absenteeism. *Ergonomics* 1981;**24**:795–806.
4 **Norris R**, Carroll D, Cochrane R. The effects of aerobic and anaerobic training on fitness, blood pressure, and psychological stress and well-being. *J Psychosom Res* 1990;**34**:367–75.
5 **Rosenfeld O**, Tenenbaum G, Ruskin H, *et al.* Behavioural modifications following a physical activity programme in the Israeli pharmaceutical industry. *Aust J Sci Med Sport* 1990;**22**(4):93–6.
6 **Blair SN**, Smith M, Collingwood TR, *et al.* Health promotion for educators: impact on absenteeism. *Prev Med* 1986;**15**:166–75.
7 **Jacobson BH**, Aldana SG. Relationship between frequency of aerobic activity and illness-related absenteeism in a large employee sample. *J Occup Environ Med* 2001;**43**(12):1019–25.
8 **Kerr JH**, Vos MCH. Employee fitness programmes, absenteeism and general well-being. *Work Stress* 1993;**7**:179–90.
9 **Cox DR**. Regression models and life-tables. *J R Stat Soc* 1972;**B34**:187–220.
10 **Therneau TM**, Grambsch PM. *Modeling survival data: extending the Cox model*. New York: Springer, 2000.
11 **Steinhardt M**, Greenhow L, Stewart J. The relationship of physical activity and cardiovascular fitness to absenteeism and medical care claims among law enforcement officers. *Am J Health Promot* 1991;**5**(6):455–60.
12 **Hildebrandt VH**, Bongers PM, Dul J. Sportparticipatie van werknemers, gezondheidsklachten en ziektegedrag bij problematiek van het bewegingsapparaat [Participation in sporting activities, health complaints and sickness behaviour with musculoskeletal symptoms]. *Tijdschr Toegep Arbowet* 1996;**9**(1):2–9.
13 **Shephard RJ**. Worksite fitness and exercise programs: a review of methodology and health impact. *Am J Health Promot* 1996;**10**(6):436–52.
14 **Proper KI**, Staal BJ, Hildebrandt VH, *et al.* Effectiveness of physical activity programs at worksites with respect to work-related outcomes. *Scand J Work Environ Health* 2002;**28**(2):75–84.