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Prevalence of Physical Activity among the Working Population and Correlation with Work-Related Factors: Results from the First German National Health Survey

Sven SCHNEIDER[1] and Simone BECKER[2]

[1]Department of Orthopaedic Surgery and [2]Institute for Sociology, University of Heidelberg, Germany

Abstract: Prevalence of Physical Activity among the Working Population and Correlation with Work-Related Factors: Results from the First German National Health Survey: Sven SCHNEIDER, *et al.* Department of Orthopaedic Surgery, University of Heidelberg, Germany—This paper investigates levels of engagement in physical activity (PA) among the total German working population and for specific subgroups. The first national health survey for the Federal Republic of Germany was conducted from October 1997 to March 1999. The following study is based on a representative net sample of 3,323 employed persons aged 18 to 69. Bivariate methods and multiple logistic regression analyses were used to investigate the relationship between PA and workplace and occupational factors in addition to social and lifestyle-specific correlates. Four out of 10 gainfully employed persons (39.2%) do not engage in sport. Those with physically strenuous jobs and frequent overtime work are significantly less likely to engage in leisure-time PA. Non-manual workers, and younger, unmarried workers are particularly likely to have an active lifestyle. Our study population did not correspond to the popular image of the recreational athlete as an abstinent, "ascetic" individual: The subgroups of non-smokers and teetotalers contained significantly fewer athletes than the corresponding reference groups. The present paper is the first to publish representative data on PA in the working population since German reunification in 1990. The data show that workers with a high risk of morbidity are those least likely to engage in leisure-time PA (manual workers with below-average educational qualifications from lower socioeconomic groups). The significant accumulation of socially depriving living conditions and lifestyle deficits among inactive subjects shows that one-off preventive measures intended to motivate sporting activity are likely to be ineffective in these subgroups of the population. We therefore advocate continuous exercise programs near the workplace involving exercise training suited to the particular occupation, dietary advice, relaxation techniques and occupational medical care. *(J Occup Health 2005; 47: 414–423)*

Key words: Occupational health, Lifestyle, Social support, Profession, Sports, Physical activity, Socioeconomic factors, Health behavior, Population characteristics

Workforce health is of growing importance to corporate and other employers in the wake of economic globalization and an unrelenting pressure to cut costs. A healthy workforce means lower labor costs and higher productivity. First and foremost, though, preservation and restoration of health is of increasing importance to employees themselves. In view of the global trend toward high unemployment figures, temporary job contracts, higher taxes and declining state social security systems, health-related occupational disability often has serious consequences for workers and their families. Studies from all over the world show that employees from economically deprived lower socioeconomic groups are more prone to develop acute and chronic illness[1–5]. This underlines the importance of preventive measures enabling workers to stay healthy.

Engagement in sport is a comparatively low-cost preventive intervention and flexible in its implementation. The preventive impact of sporting activity on health is manifold[6]. Sport in the sense of leisure-time physical activity lowers the risk of numerous diseases—including cardiovascular disease, type 2 diabetes, osteoarthritis, osteoporosis and some kinds of cancer[7, 8] and reduces risk factors for poor health such as obesity and hypertension[7, 9–11], not counting the positive impact of

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Correspondence to: S. Schneider, Orthopaedische Universitaetsklinik Heidelberg, Sektion Experimentelle Orthopädie, Schlierbacher Landstraße 200, D-69118 Heidelberg, Germany (e-mail: sven.schneider@ok.uni-heidelberg.de)

physical activity (PA) at the psychological and social level.

The purpose of the present study is to investigate the extent of leisure-time physical activity among employed persons (using Germany as an example), establish which subgroups engage in leisure-time physical activity more than others, and define the extent to which work-related and other factors are predictive of greater or lesser participation in sports.

Materials and Methods

Sample design

The National Health Survey was the first study to produce up-to-date data on physical activity and its correlates for the 82.5 million inhabitants of the European Union's most highly populated country on the basis of a representative cross-section of the public. The study was carried out at the Robert Koch Institute in Berlin, the central research institution for the Public Health Service of the German Federal Ministry of Health, between October 1997 and March 1999. It comprised a total sample pool of 7,124 people between the ages of 18 and 79 yr with their primary residence in the region under study, with a response rate of 61%. Through the use of a weighting procedure for the individual cases based on age, sex, size of community, and German state of residence, the results were representative of the German-speaking population of the entire country for the year 1998 (for detailed evidence of the representativeness, see[12, 13]). The interviews and medical examinations of the participants were carried out with four mobile inspection teams composed of doctors and medically-trained examiners in 130 locations within 113 cities[14, 15]). The examiners were subjected to regular external quality control procedures. The participants took part in a standard medical interview (Computer Assisted Personal Interview, CAPI) as well as a medical examination, which included blood pressure, pulse, weight, height, and laboratory blood tests. In addition, the participants answered a self-rating questionnaire composed of 107 questions covering medical risk factors, health-related behavior patterns and medical-sociological items[16]). Participants with mobility problems could request the interview and examination in their home. For the purposes of the present study, participants over 69 yr of age (n=721), those who were unemployed at the time of the interview (n=2,183), and those for whom data sets were incomplete (n=897), were excluded. After these modifications, a weighted cross-section of data from a total of 3,323 participants was available.

Questionnaire and examination

Assessment of the dependent variable "Physical activity (PA)": PA was graded into five categories on the basis of responses to the question: "How often do you practice a sport?" A note explained that sport in this context meant regular PA and that the question related to average behavior during the three months prior to the survey. For the bivariate and multiple analyses, respondents claiming no regular sporting activity ("less than 1 h/wk") were contrasted with those who said they practiced a sport on a regular basis ("more than 1 h/wk").

Assessment of correlates of PA: The selection of the correlates factored in corresponds to the procedure employed by Sallis *et al.*[17]) in their similar study of determinants of PA. The underlying review of studies identifying the selected variables as predictors of PA has been published elsewhere[18]). Specifically, the variables thus identified were coded as described below.

Occupational and workplace correlates: Factors in the workplace encompassed five dimensions: (1) strenuous manual labor ("such as maintaining a single posture, carrying heavy objects"), (2) mental stress ("stress in the workplace—such as time/performance pressure, strict concentration, poor working atmosphere—or anxiety in the workplace"), (3) overtime or long working hours, and (4) shift work. People with weekly working hours in excess of 35 hours and occupational trainees were defined as full-time employed. Dimensions of vertical stratification (professional position, level of education, income and social status) were coded as suggested by Winkler, *et al.*[19]) Professional position was investigated in the survey in 19 categories and recoded to give seven ordinal categories maximizing distances between the groups and minimizing variation within the groups[20]).

The "level of education" variable was constructed using seven ordinal categories on the basis of the highest school-leaving qualification achieved, vocational training and university or college education.

The respondents' income was documented in the survey on the basis of 13 amount intervals, and from this the monthly per capita equivalized income was calculated in euros according to the modified OECD equivalence scale, with appropriate adjustments made for other household members[21]): Net income per person is calculated by dividing household income by household size. When calculating the household size, children under 15 are allocated a factor of 0.3, children aged 15 to 18 are included in the calculation with a factor of 0.6, and all persons over 18 living in the household receive a factor of 1.

The construction and validation of these variables, known to sociologists as indicators of "vertical inequality", and the social status derived from them have previously been described in detail[19, 22]). The class index is also described extensively in the same source and is recognized as an internally and externally valid status indicator in terms of education, income and qualification levels of German households at this time. Operational design gives the education, income and occupation data equal weighting. Any missing figures are replaced by

the mean of the other two. For suitable classification of the social status of non-working women, the occupational status of their employed husband was factored in[19].

Social and lifestyle correlates: Residential community size was categorized on the basis of a regional population density indicator established by the German government[23]. To factor in the effect of the respondent's neighborhood on sporting habits, respondents were asked whether their current place of residence was adjacent to a main thoroughfare with heavy traffic or located in a peripheral residential area. Categorization of nutritional habits followed the ordinal score of Reime *et al*.[24] For current tobacco consumption, each respondent was classed (consistent with the international WHO-MONICA study) as a smoker (smokes tobacco daily), an occasional smoker (smokes less than once per day), an ex-smoker or as having never smoked (nicotine-naïve)[25]. Alcohol consumption was queried separately for beer, wine and spirits. The average amount of pure alcohol consumed daily was calculated on the basis of six quantity and seven frequency categories, where "low" was 0–5 g/d, "moderate" was 5–30 g/d, and "high" was >30 g/d. The respondent's height and weight were measured in the course of the medical examination to one decimal place using calibrated instruments, without shoes and outer clothing[12]. These dimensions were used to calculate the body mass index. The dummy variable "flu shot" was included with the intention of introducing a further dimension of preventive behavior, as proposed and implemented by Elward *et al*. in a similar study[26]. A score of "1" was accorded to respondents who reported having received a flu vaccination during the previous winter. Medical advice on PA habits was recorded for respondents who said they received advice on exercise or sport during an otherwise unrelated doctor's visit within the past year. More detailed information on the documentation and coding of the variables is given in Tables 1 and 2.

Statistical analyses

The first step was to determine percentage rates of involvement in sports for individual subgroups of the population (variable categories, Tables 1 and 2). For continuous variables, the arithmetic mean ± standard deviation (AM ± SD) for exercisers and non-exercisers was calculated instead. To establish any significant differences in rates of activity in terms of any of the factors studied, a Chi-square test was used for nominal and ordinal variables and an unpaired t test was used for continuous variables. Then, multiple analysis was done using the statistical method of multiple logistic regression analysis (Table 3). To minimize the number of parameters, all predictors that were non-significant in the bivariate analysis were excluded. Furthermore, to reduce collinearity among the predictors of social inequality (professional position, level of education, Income, social status), professional position was chosen. All tests were two-tailed and the level of significance was set at $p<0.05$. All analyses were performed using SAS for Windows software Version 8.02 (SAS Institute Inc. Cary, NC 27513, USA).

Results

Four in 10 German workers (39.2%) practice no sport of any kind. 19.0% of all employees engage in sports for less than one hour per week. 20.2% said they engaged in regular sporting activity for one to two hours per week. 13.4% said they practiced sports for two to four hours per week. Only one in 12 of the German working population (8.2%) engages in regular sporting activity for more than four hours per week. Table 1 shows participation rates for different sections of the working population. It can be seen that there was no correlation between mental stress at work, employment status, or a sedentary occupation, and participation in sports. No matter how socioeconomic affiliation is categorized, the association is conclusive: The percentage of those engaging in sporting activity is more than twice as high among people with school-leaving qualifications qualifying for university entrance and among university graduates than for those leaving school after nine years (lowest secondary level without vocational training). The same social differences are apparent in terms of income and the socioeconomic status composed of these dimensions (Table 1).

Logistic regression analyses (Table 3) were then used to explore the extent to which individual working situation, social inequalities, and lifestyle-related behaviors are relevant determinants of PA per se or whether individual associations disappear if other variables are factored in and held constant. To this end, all variables emerging as significant correlates from the bivariate analysis were included in the logistic regression models.

It can be seen in Table 3 that manual laborers and employees working long hours are significantly less likely to engage in sporting activity (model 1 and combined model). The percentage of physically active people among highly qualified professionals is twice as high as among skilled workers. In contrast, there was no correlation between shift work, and participation in sports.

Table 3 shows that those engaging in leisure time physical activity tend to be younger and unmarried. Habitual smokers and overweight people are significantly less common among the physically active. With the inclusion of potential confounders, no differences in the extent of physical activity were seen in terms of working nights or shifts, social networks, size and location of dwelling, and eating habits (Table 3, combined model).

Table 1. Representative prevalence rates for physical activity in Germany according to occupational and workplace correlates. The first German National Health Survey[54)]

Variable		Of which:				Test value/ degrees of freedom/ level of significance
		(AM (± SD) or per-centage)	n	(AM (± SD) or per-centage)	n	
		Exercisers[2)] n=1.393		Non-exercisers n=1.930		
Strenous manual labor	Yes	33.62%	425	66.38%	839	χ^2=57.83, df=1, p<0.001
	No	47.03%	968	52.97%	1.091	
Mental Stress	Yes	40.67%	780	59.33%	1.137	χ^2=2.97, df=1, p=0.085
	No	43.65%	614	56.35%	792	
Overtime/long working	Yes	39.67%	576	60.33%	876	χ^2=5.40, df=1, p=0.020
	No	43.68%	817	56.32%	1.054	
Time spent sitting		7.06 ± 2.95		6.90 ± 2.95		t=–1.60, df=3.347, p=0.120
	Metric (h/d)					
Shift work		34.95%	178	65.05%	332	
		43.20%	1.215	56.80%	1.598	χ^2=12.06, df=1, p<0.001
Employment	Full-time	42.27%	1.095	57.73%	1.495	χ^2=1.91, df=1, p=0.384
	Part-time	40.65%	298	59.35%	435	
Professional position						χ^2=110.48, df=6, p<0.001
High grade civil servant, executive employee		53.77%	77	46.23%	66	
Civil servant (senior), professional employee		50.34%	323	49.66%	319	
Self-employed with up to 9 employees		46.31%	97	53.69%	112	
Intermediate-grade civil servant, qualified white-collar worker		46.23%	396	53.77%	460	
Civil servants and clerical workers (lower grade), foremen		35.55%	113	64.45%	205	
Skilled and unskilled blue-collar workers		29.10%	268	70.90%	652	
Trainees, students and unskilled laborers		50.98%	120	49.02%	115	
Level of education[1)]						χ^2=73.99, df=6, p<0.001
University or college degree		51.83%	291	48.17%	271	
Highest secondary level		51.69%	135	48.31%	127	
Intermediate secondary level and apprenticeship		41.49%	594	58.51%	837	
Lowest secondary level and apprenticeship		37.81%	281	62.19%	462	
Intermediate secondary level without vocational training		43.79%	45	56.21%	35	
Lowest secondary level without vocational training		24.05%	50	75.95%	157	
No educational qualification (yet)		18.69%	7	81.31%	31	
Income						
	Metric	1,363 ± 643		1,203 ± 582		z=7.9, p<.0001
Social Status						χ^2=63.25, df=2, p<0.001
Upper socioeconomic status		52.02%	421	47.98%	388	
Intermediate socioeconomic status		41.12%	778	58.88%	1.113	
Low socioeconomic status		31.30%	195	68.70%	428	

Notes: $n_{(weighted)}$=3,323, [1)]The "highest secondary level" is taken by German pupils after about thirteen years at school, the "intermediate secondary level" after about 10 yr and the "lowest secondary level" after about 9 yr, [2)]At least 1 h/wk

Table 2. Representative prevalence rates for physical activity in Germany according to social and lifestyle correlates. The first German National Health Survey[54)]

Variable		Of which:				Test value/ degrees of freedom/ level of significance
		(AM (± SD) or per-centage)	n	(AM (± SD) or per-centage)	n	
		Exercisers[2)] n=1.393		Non-exercisers n=1.930		
Age	Metric	38.86 ± 11.77		40.06 ± 11.15		z=–5.1, p<0.001
	60–69	33.99%	40	66.01%	78	χ^2=20.85, df=4, p<0.001
	50–59	39.24%	256	60.76%	396	
	40–49	40.30%	338	59.70%	501	
	30–39	41.03%	417	58.97%	600	
	18–29	49.07%	342	50.93%	355	
Gender						χ^2=0.86, df=1, p<0.354
	Female	41.03%	596	58.97%	857	
	Male	42.63%	797	57.37%	1.073	
Marital status						χ^2=41.73, df=3, p<0.001
	Married	38.53%	810	61.47%	1.293	
	Separated	38.15%	106	61.85%	172	
	Single	50.97%	455	49.03%	438	
	Widowed	44.48%	22	55.52%	27	
Childlessness	Yes	43.57%	937	56.43%	1.214	χ^2=6.76, df=1, p=0.009
	No	38.92%	456	61.08%	716	
Social Support						χ^2=10.31, df=2, p=0.006
	More than 3 dependable friends	43.57%	959	56.43%	1.242	
	2 to 3 dependable friends	39.86%	374	60.14%	565	
	Less than 2 dependable friends	32.84%	60	67.16%	123	
Level of satisfaction with life						χ^2=25.62, df=2, p<0.001
	High	44.96%	947	55.04%	1.160	
	Moderate	37.32%	434	62.68%	729	
	Low	22.70%	12	77.30%	41	
Community size						χ^2=9.20, df=2, p=0.010
	≥ 100,000 inhabitants	44.37%	794	55.67%	997	
	20,000–100,000 inhabitants	39.54%	173	60.46%	264	
	≤ 20,000 inhabitants	38.97%	427	61.03%	668	
Location of building (adjacent to a main thoroughfare)						χ^2=7.69, df=1, p=0.006
	Yes	37.51%	279	62.49%	465	
	No	43.21%	1.114	56.79%	1.465	
Tobacco consumption						χ^2=73.90, df=3, p<0.001
	Habitual smoker	31.95%	321	68.05%	685	
	Occasional smoker	57.51%	138	42.49%	102	
	Former smoker	46.43%	331	53.57%	382	
	Never smoked	44.21%	603	55.79%	761	
Dietary habits						χ^2=17.99, df=2, p<0.001
	Healthy diet	48.44%	382	51.56%	406	
	Mixed	39.82%	835	60.18%	1.261	
	Unhealthy diet	40.34%	177	59.66%	262	
BMI	metric	25.63 ± 3.88		26.55 ± 4.55		z=–6.26, p<0.001
Alcohol consumption						χ^2=17.99, df=2, p<0.001
	≥ 30 g/d	43.42%	159	56.58%	207	
	5 to < 30 g/ d	46.45%	536	53.55%	618	
	< 5 g/ d	38.74%	698	61.26%	1.105	
Flu shot	Yes	36.39%	101	63.61%	178	χ^2=3.85, df=1, p=0.050
	No	42.44%	1.292	57.56%	1.752	
Medical advice on physical activity	Yes	52.83%	183	47.17%	164	χ^2=18.86, df=1, p<0.001
	No	40.66%	1.210	59.34%	1.766	

Notes: $n_{(weighted)}$=3.323, [1)]At least 1 h/wk

Table 3. Logistic regression analysis of association between physical activity and occupational, workplace, social, and lifestyle factors presented as adjusted odds ratios (and 95% confidence intervals). The first German National Health Survey[54)]

Variable	Model 1: Occupational and workplace factors	Model 2: Social Factors	Model 3: Lifestyle factors	Combined Model
	Odds ratios (95% CI)			
Strenuous manual labor	0.73 [0.62; 0.86]***			0.76 [0.65; 0.90]***
Overtime/ long working hours	0.84 [0.72; 0.97]*			0.82 [0.70; 0.95]**
Shift work	0.88 [0.71; 1.08]			0.87 [0.71; 1.08]
Professional position[1)]				
High-grade civil servant. executive employee	2.39 [1.65; 3.45]***			1.96 [1.34; 2.90]***
Civil servant (senior), professional employee	2.16 [1.73; 2.70]***			1.87 [1.48; 2.37]***
Self-employed with up to 9 employees	2.03 [1.49; 2.78]***			2.05 [1.48; 2.85]***
Intermediate-grade civil servant, qualified white-collar worker	1.86 [1.52; 2.86]***			1.51 [1.22; 1.87]***
Civil servants and clerical workers (lower grade), foremen	1.27 [0.97; 1.67]			1.18 [0.89; 1.57]
Trainees, students and unskilled laborers	2.37 [1.77; 3.19]***			1.69 [1.22; 2.34]**
Age[2)]				
30–39		0.94 [0.75; 1.18]***		0.89 [0.71; 1.08]
40–49		1.00 [0.78; 1.28]***		0.87 [0.66; 1.15]
50–59		0.92 [0.70; 1.22]***		0.73 [0.54; 1.00]*
60–69		0.68 [0.43; 1.06]***		0.52 [0.32; 0.84]**
Marital status[3)]				
Separated		1.05 [0.80; 1.36]		1.13 [0.86; 1.49]
Single		1.61 [1.29; 2.00]***		1.53 [1.22; 1.94]***
Widowed		1.46 [0.81; 2.61]		1.75 [0.95; 3.21]
Childlessness		1.07 [0.90; 1.28]		1.08 [0.90; 1.30]
Social support[4)]				
> 3 dependable friends		1.47 [1.06; 2.04]*		1.31 [0.93; 1.84]
2 to 3 dependable friends		1.34 [0.95; 1.88]		1.24 [0.87; 1.76]
Level of satisfaction with life[5)]				
High		2.77 [1.44; 5.34]**		2.38 [1.20; 4.69]*
Moderate		2.01 [1.04; 3.89]*		1.81 [0.91; 3.60]
Community size[6)]				
≥ 100,000 inhabitants		1.28 [1.09; 1.50]**		1.15 [0.98; 1.36]
20,000–100,000 inhabitants		1.05 [0.83; 1.32]		1.02 [0.80; 1.29]
Location of building (adjacent to a main thoroughfare)		0.79 [0.66; 0.93]**		0.86 [0.72; 1.03]
Tobacco consumption[7)]				
Habitual smoker			0.56 [0.47; 0.67]***	0.62 [0.51; 0.75]***
Occasional smoker			1.59 [1.20; 2.12]**	1.56 [1.17; 2.10]**
Former smoker			1.08 [0.90; 1.30]	1.23 [1.01; 1.49]*
Dietary habits[8)]				
Healthy			1.33 [1.04; 1.70]*	1.27 [0.98; 1.65]
Mixed			0.96 [0.78; 1.20]	0.95 [0.76; 1.19]
BMI			0.94 [0.93; 0.96]***	0.96 [0.95; 0.98]***
Alcohol consumption[9)]				
≥ 30 g/d			1.34 [1.06; 1.70]*	1.26 [0.98; 1.62]
5 to < 30 g/d			1.44 [1.23; 1.68]***	1.40 [1.19; 1.65]***
Flu shot			0.75 [0.58; 0.98]*	0.81 [0.62; 1.06]
Medical advice on physical activity			1.56 [1.24; 1.96]***	1.48 [1.17; 1.87]**
r-square adjusted [10)]	4.08	2.90	5.09	9.61

Notes: $n_{(weighted)}$=3.323; $p<0.001$ (***); $p<0.01$ (**); $p<0.05$ (*); Dependent Variable: Dummy variable "physical activity (at least 1 h/wk)", 1) Reference category: Skilled and unskilled blue-collar workers, 2) Reference category: 18–29, 3) Reference category: married, 4) Reference category: Less than 2 dependable friends, 5) Reference category: low level of satisfaction with life, 6) Reference category: less than 20.000 inhabitants, 7) Reference category: Never smoked, 8) Reference category: Unhealthy diet, 9) Reference category: < 5 g/d, 10) r-square according to Nagelkerke in %

Discussion

Limitations

The data quality and representativeness of the National Health Survey have been reviewed and documented in a rigorous internal and external total quality management program[12, 13, 15, 27]. The pros and cons of cross-sectional studies like this one have been extensively discussed[25]. One point is that all retrospective data are likely to be skewed by recall bias and social desirability bias[26]. Accordingly, we must assume that the true level of engagement in PA in the German working population is probably (even) lower. Another point is that the significant participation factors investigated cannot be interpreted in a causative manner because of the cross-sectional study design[6, 19, 29–31].

The participation rate of 61.4% is above that of other current questionnaire-based physical activity studies with participation rates ranging from 38.9%–59.3% (38.9%[32], 43.4%[33], 59.3%[34], 53.5%[35]) for the total data set, despite a conservative definition of what constitutes "participation". Half of the non-participants were prepared to provide basic health information and socioeconomic data for a non-respondent analysis. According to the data provided, non-participants and participants did not differ with regard to age, gender ratio, smoking or health, but non-participants were more likely to have lower educational qualifications[13].

The investigation of physical activity did not take account of the route to work or commuting behavior, as the investigators were interested in the extent of (in most cases) intrinsically motivated leisure time physical activity. One of the purposes of our study is to investigate the extent and pattern of leisure time physical activity and to identify inactive subgroups for future preventive strategies. Individuals who walk or cycle to work every day will of course nevertheless derive health benefits from this activity. Unlike other countries (Japan, for example, where a heavy workload leaves little time for leisure time physical activity but where many employees walk long distances to work), German employees generally drive to work. Seven out of 10 members of the workforce in Germany (69%) take their own car to work and 13% use public transport (subway, train). Only 18% of German employees walk or cycle to work. This percentage has been declining for many years and is almost exclusively limited to short distances. Distances of 10 km or longer on foot or bike are extremely rare. The percentage of commuters in this category as a proportion of the total workforce is measured in the thousandths[36].

Current mobility data furthermore provide evidence of sufficient time resources to engage in leisure time physical activity, as Germany has a low number of weekly working hours (36 h) compared with other countries and an average commuting distance of just 10 km[36].

Findings

The most striking finding is that people with physically strenuous occupations seem to be less motivated than non-manual workers to engage in physical activity during their leisure time (Table 3: Combined Model). Recent reviews and studies from other countries corroborate this[7, 17, 18, 29–31, 37–44]. The same applies to the uptake of in-house sports facilities provided by employers[45]. This phenomenon is of particular concern given the already mentioned association between physical stress at work and higher morbidity and mortality. As such, leisure-time physical activity could help prevent the above-described overuse phenomena resulting from one-sided tasks, especially in the high-risk group of manual workers. A latent interest in sport is evident from Swiss data showing a higher level of interest in sports in the media (TV, print media) in lower socioeconomic groups than in those with a higher socioeconomic status[46].

A low sport participation has been attributed to "internal barriers" [38], or socialization factors specific to a particular socioeconomic group which give rise to internalized differences in a person's health awareness and identification with the sportsperson's role[47, 48]. Internal barriers include a low motivation to engage in additional physical exertion after a heavy day's work[37, 38]. Japanese data recently published in this journal show that a mental disinclination toward exertion and perspiration and fear of aching muscles and injuries act as additional internal barriers, especially among women[49]. Coincidental external barriers include limitations based on poorer health with advancing age[41]. These are compounded by work-related factors[50]: For example, shift work and the dual strain imposed by child-rearing and paid employment are factors which militate against a healthy, active lifestyle, as two studies from Japan show[49, 51]. In contrast, our data suggest that night work and shift work, and having children living in the household, do not correlate with leisure time physical activity (Table 3).

To complete the database, the lifestyle of physically inactive workers was compared with that of the physically active (Table 3). Our study discloses a phenomenon familiar to us from other countries: While other studies report a linear correlation between levels of engagement in PA and other health-relevant lifestyle aspects/patterns of behavior[17, 42, 44], our data suggests that some physically active workers "treat themselves" to a cigarette once in a while—but not daily—and drink a beer or two after exercising (Table 3). Nor do physically active people in Germany differ significantly from the rest of the German population in terms of their dietary habits.

These correlations between social living conditions and individual lifestyle show that one-off, short-term

preventive measures to promote physical activity cannot be effective. In this journal, Okubo recently presented the integration of activity programs in multidimensional job-related health promotion programs. Instead of trying to solve health problems "like fire fighters"[52], Okubo says the basic concept of occupational health should aim not just to minimize negative health effects, but introduce the idea of seeking positive health. The ideal solution according to Okubo is a whole package of job-related measures under medical supervision to address issues such as "stress management, nutrition, life style, recreation and physical activity"[52].

Perspective

It is a known fact that involvement in and adherence to a leisure time PA heavily depends on the degree of fitness and proficiency expected from the participant when he or she begins the activity (people from whom too little is expected are just as likely to drop out as people from whom too much is expected[53]). We would therefore advocate low-threshold physical activity, adapted to the individual level of fitness, for occupation groups with a high morbidity risk coupled with low participation in sports (heavy manual laborers, workers with long hours and lots of overtime, overweight workers who smoke and have an unhealthy diet). Suitable activities would be low-cost, easy-to-learn, flexible sports such as power walking, swimming, jogging and cycling (as proposed by Droomers *et al.*[29] and Eyler *et al.*[7]). Any such sport should ideally be part of a job-related health promotion program (incorporating stress management, relaxation techniques), as presented by Okubo in this journal[52].

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