ORIGINAL ARTICLE

Gender differences in the association of age with physical workload and functioning

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Aims: To test whether (1) physically demanding work is less frequent for older than younger employees, and whether (2) the association of physically demanding work with decline of physical functioning is stronger for older employees than their younger counterparts. The gender differences in these associations were examined.

Methods: Subjects of the study were 40–60 year old employees of the City of Helsinki. Data (n = 5802) were collected with mail questionnaires in 2000 and 2001. Functioning was measured with the Role Limitations due to Physical Health Problems scale of the SF36 health questionnaire. Logistic regression models were used to analyse the data.

Results: There was a linear trend of less physically demanding work in older than in younger age groups. This trend was more marked for men than women. Age and physically demanding work were associated with poor functioning. In women the association of physically demanding work with poor functioning tended to be stronger for older than for younger age groups, while the opposite was observed in men.

Conclusions: Results suggest that physically demanding work causes more ailments in women of high age than men. It is possible that less men than women are still employed in physically demanding occupations at high age, even though direct evidence of exit from physically demanding work cannot be obtained from cross-sectional data. In these data the physically demanding occupations for men and women were largely different. High physical workload among women working in social and health care is likely to contribute to the gender differences.

Physical workload continues to be common in the working population despite the expectations that technological advances would have reduced physical demands at work.^{1–3} The association of physically strenuous work conditions and musculoskeletal disorders is well known and widely documented.^{4–10} Evidence of a substantial effect of physical working conditions on health inequalities and public health in general also exists.^{11–12} In the context of an ageing workforce,¹³ age differences in possibilities to cope with workload are of increasing policy relevance. There is also evidence from a Nordic cohort study of a decrease in physical workload for men, but not for women,¹⁴ and therefore gender differences are likely to exist. While there is much previous research on work capacity in relation to ageing,^{13–15} epidemiological population based studies on age and gender differences in physical workload are scarce.

Theoretical models of workload emphasise the relation of demands and individual resources.^{16–17} Demands are set by the work tasks, working methods, and working environment. The employees' capability to meet the demands depends on various individual characteristics, such as functional capacities, skills, and motivation. Disproportionate demands and individual resources result in immediate adverse effects, such as physiological responses, subjective exertion, behavioural changes, and symptoms. This condition is sometimes referred to as strain.¹⁶ Prolonged exposure to disproportionate demands and resources is likely to be health damaging. In this study we focused on the relation between physical demands set by the work tasks and failures to manage paid work or housework. Limited functioning indicates conflicting demands and capacities, and is likely to coexist with adverse consequences of workload.

Ageing is related to decreasing physical work capacity as suggested by a multitude of studies on aerobic capacity and muscular capacity.^{13–15–17–18} Furthermore, ageing results in a

higher prevalence of clinical diseases. Diminishing capacity in relation to constant work demands results in increasing strain in ageing employees.¹⁹

It is widely recognised that employees with poor health are more likely to exit from work than their healthy counterparts. "Healthy worker effect" refers to the tendency of the healthy being favoured in employment, on one hand, and the tendency of those with poor health to leave employment, on the other.^{20–21} Consequently, employees "surviving" at work have been selected according to their capacity to work. High physical demands can be expected to cause health related selection, since good physical capacity is required to meet the high demands. Selection may also occur through ageing workers moving to physically less demanding jobs and not only through exit from work life. High physical demands conflict with capacities diminishing by age, and selection can be expected to be strongest for the oldest employees. This will result in employees of high age working in physically less demanding conditions than younger ones.

The association of adverse work conditions with health and functioning observed in cross-sectional studies is weakened as employees with low functioning tend to exit from paid work. However, low physical capacity precedes health related exit from work life. Therefore physically demanding work can be expected to cause more limited functioning in older employees than in their younger counterparts despite the selection that tends to hide this age effect.

The objective of the study was to test the following hypotheses: (1) higher age is associated with a lower prevalence of physically demanding work; and (2) physically demanding work is more strongly associated with limited functioning in older employees than their younger counterparts. Special emphasis was devoted to gender differences in the tested associations.

Occupation is a determinant of employees' social position, and one of the key indicators of socioeconomic status

Main messages

- Among women physical workload is more strongly associated with limitations in daily activities among older than younger employees. However, among men the association is contrasting.
- It is possible that less men than women are still employed in physically demanding occupations at high age. Physical workload and possibilities to adapt to lower work capacity among older employees probably involve gender differences that are so far unknown.

(besides, for example, education and income). Socioeconomic status is known to be related to employee health in various ways other than physical work conditions.^{22–25} Thus any observed association of physical work conditions with health in different occupations might partly indicate other effects of socioeconomic status; for example, the effect of education on health behaviour, rather than the independent effect of physical work conditions. Therefore the possible effect of socioeconomic status on the association of physically demanding work and health needs to be assessed.

METHODS

Subjects

This study is a part of a wider project on employee health and wellbeing called the Helsinki Health Study.^{22–26} The subjects of the study were 40, 45, 50, 55, and 60 year old employees of the City of Helsinki. The data used in this study were collected by means of mail questionnaire in the years 2000 and 2001. A total of 6243 subjects responded to the questionnaires, resulting in a response rate of 68%; 441 subjects were excluded from the analysis because of missing information on items measuring physical workload and functioning. Table 1 shows the number of subjects by age and gender; 80% of the respondents were women. This corresponds to the gender distribution of the staff of the City of Helsinki. The gender distribution of the employees reflects the large proportion of health and social care in the staff of the City. The distribution of socioeconomic status in the study sample was checked against the personnel register of the City, and the data were found to be largely representative of all socioeconomic groups.²⁷

Measurement of physically demanding work

Physical demands were measured with six items: difficult working postures, twisting of back, repetitive movements, strenuous muscular work or lifting and carrying, standing, and walking. The subjects were asked to report whether these demands were present in their work. Table 2 shows the distribution of the number of demands. The presence of several physical demands was common, especially in women. The presence of all six possible demands was considered to indicate physically demanding work. Any other cut point would have resulted in more than half of the women having physically demanding work. If any of the items measuring physical demands was missing, the subject was excluded from the analysis.

Analyses of a possible dose dependence relation between the number of physical demands and limited functioning did not reveal a consistent gradient of uniform effect on functioning for each increase in the number of physical demands. Instead the effect was strongest at the upper end of the scale. Thus the use of a dichotomous physical demands variable was supported. All analyses were furthermore repeated for individual physical demands. The results were mainly similar

Policy implications

- Attention should be directed to problems related to ageing specific to women employees. Questions of increasing conflicts between demands and capacities are emphasised among female dominated lower status jobs within health and social care.

to those obtained with the combined measure. The Cronbach alpha coefficient for the internal consistency of the six demands was 0.73.

Measurement of functioning and health

Limited functioning was measured with the Role Limitations due to Physical Health Problems scale of the SF36 health questionnaire.²⁸ The scale has four items; the subjects are asked to state whether physical health problems had caused them to limit the time used for work, whether they had achieved less than would have been desired, whether they had to limit certain activities, and whether they had difficulties in completing their tasks. The items explicitly referred to housework as well as paid work. Table 2 shows the distribution of the number of limitations. Role limitations due to physical health problems were not very common, and in the analyses all subjects who reported any limitations were considered to have limited functioning. If one item was missing, but the other three showed no limitations, the subject was included with those having no limitations. If more than one item was missing, the subject was excluded from the analysis. Table 3 shows the prevalence of role limitations due

Table 1 Number of subjects by age and gender

Age, years	Men	Women
40	223	991
45	235	1012
50	250	987
55	310	1107
60	168	519
Total	1186	4616

Table 2 Distribution of physical demands and role limitations due to physical health problems

	Men (%)	Women (%)
No. of physical demands		
0	5	3
1	7	5
2	17	10
3	21	12
4	15	14
5	16	19
6	20	37
Total	100	100
No. of limitations due to physical health problems		
0	71	64
1	12	13
2	7	9
3	5	6
4	5	8
Total	100	100

to physical health problems by age group. Analyses were repeated by using the cut point of at least two limitations. Results were similar for both cut points.

The Role Limitations due to Physical Health Problems scale was used instead of the Physical Functioning Component Summary of SF36 questionnaire in order to separate functional limitations from biological and psychological health status. Whereas poor health status may be seen as an outcome of continuous workload, general health status is also an essential part of individual capacity to work. Role performance as such is distinct from individual resources, even though it may be determined by them. Therefore, the use of role limitations due to physical health problems as the outcome for this study was more suitable. However, cross-validation with a generic health outcome was made, and the analyses were repeated by using limiting long standing illness as the dependent variable.

Other variables

Measurement of socioeconomic status was based on occupations, and data were derived from the personnel register of the City of Helsinki. The classification included three hierarchical classes for white collar employees and one for manual workers.

Statistical methods

The association of age with physically demanding work was examined with logistic regression models. Age was applied in the models first as a categorical variable, and optionally as a continuous variable, with each category indicating five years increment in age. The continuous age variable was used to test for linear trends. These two modelling strategies were stratified for gender—that is, the two genders were modelled separately. In a third modelling strategy age and gender were both included as covariates in a single non-stratified model. Further models were fitted for age and physically demanding work as determinants of role limitations due to physical health problems stratified by gender, first unadjusted and subsequently adjusted for socioeconomic status. This was done in order to test for the possible effect of socioeconomic status on interrelations of physical workload, age, and role limitations due to physical health problems.

Interrelations of age, gender, physical workload, and role limitations due to physical health problems were first examined by modelling role limitations due to physical health problems as a function of physically demanding work in models stratified for age and gender. Subjects in physically demanding work were compared to those in the same age and gender strata but not in physically demanding work. An optional modelling strategy was employed to directly examine interaction of age and physically demanding work; age as a continuous variable and physically demanding work were applied as covariates in models stratified for gender

only. Finally, direct comparison of women and men was done by a model applying age, gender, and physically demanding work simultaneously as covariates in a single unstratified model. Only the estimate for the term for interaction of all three covariates is reported. The log likelihood test for the improvement of the fit of the model was used as measure for statistical significance at the 95% level. Results for these tests corresponded to 95% confidence intervals reported in the tables.

All calculations were performed with SAS software.

RESULTS

Physically demanding work was less common in higher than younger age groups in both genders (table 4). There was a linear trend of less physically demanding work in higher ages. This trend was of borderline statistical significance and was more marked for men than for women. The gender difference in the steepness of the age trend, however, did not reach statistical significance at the 95% level.

Physically demanding work and high age were statistically significantly associated with role limitations due to physical health problems in both genders (table 5). The association of physically demanding work with limited functioning was more marked for men, and the association of age with limited functioning was more marked for women. Adjusting for socioeconomic status had no effect on the examined associations.

Age differences in the association of physically demanding work with role limitations due to physical health problems were dissimilar for men and women (table 6). In men the association of physically demanding work with limited functioning tended to be weaker in older than younger age groups. In women the pattern was contrasting, with older age groups showing stronger associations of physically demanding work with limited functioning than their younger counterparts. A linear interaction effect of age and physically demanding work was found, showing increasing role limitations due to physical health problems by increasing age in women in physically demanding work. In men the interaction effect showed decreasing role limitations due to physical health problems by increasing age in physically demanding work, but the linear interaction was, however, not statistically significant at the 95% level in men. The interaction of gender, age and physically demanding work was, however, of borderline statistical significance with combined high age and physically demanding work being associated with excess role limitations due to physical health problems in women when compared to men.

Interactions of age and physically demanding work were repeated by using limiting long standing illness as the dependent variable. This produced almost exactly similar results for women and even a steeper declining age gradient for the association of physically demanding work with limited functioning in men.

DISCUSSION

This study examined the associations of age with physically demanding work, and the associations of age and physically demanding work with limited functioning in middle aged employees of the City of Helsinki. Limited functioning was measured by difficulties to accomplish desired results in paid work as well as housework. The results of the study indicate that there are marked gender differences in the adverse effects of physical workload by age.

A clear linear declining trend for physically demanding work by age was found in both genders. The trend was more marked for men than women, albeit the interaction of age and gender did not reach statistical significance. The association of physically demanding work with limited

Table 3 Prevalence (%) and 95% confidence intervals (CI) of role limitations due to physical health problems by age and gender

Age, years	Role limitations due to physical health problems			
	Men		Women	
	%	95% CI	%	95% CI
40	26	21 to 32	30	27 to 32
45	25	20 to 31	31	28 to 34
50	30	24 to 35	35	32 to 37
55	31	26 to 36	43	40 to 46
60	35	28 to 42	48	44 to 52

Table 4 The association of age with physically demanding work by gender and the association of the interaction of age and gender with physically demanding work as odds ratios (OR) and their 95% confidence intervals (CI) from logistic regression analysis

	Physically demanding work			
	Men		Women	
	OR	95% CI	OR	95% CI
Modelling strategy 1*				
Age, year				
40	1.00		1.00	
45	1.13	0.74 to 1.74	0.88	0.73 to 1.05
50	0.86	0.56 to 1.33	1.01	0.84 to 1.21
55	0.66	0.43 to 1.02	0.82	0.68 to 0.97
60	0.70	0.42 to 1.16	0.80	0.64 to 0.99
Modelling strategy 2†				
Age, 5 years	0.88	0.78 to 0.97	0.95	0.91 to 0.99
Modelling strategy 3‡				
Gender × age, 5 years	1.00		1.09	0.97 to 1.22

*Covariate is age as classified variable, model is stratified for gender.

†Covariate is age as continuous variable, model is stratified for gender. The OR is interpreted as mean effect per 5 years of age in subjects of the same gender.

‡Covariate is interaction of age and gender in a single unstratified model. The main effects of age and gender were adjusted for. The OR is interpreted as mean effect per 5 years of age in women when compared to men.

functioning was stronger in older than younger ages in women. There were signs of a contrasting age trend in men, physically demanding work showing a weaker association with limited functioning in older than younger ages. The gender difference in the combined effect of age and physically demanding work on role limitations due to physical health problems was of borderline statistical significance.

A stronger declining trend of physically demanding work in men suggests that the processes reducing the workload of aged employees are likely to be stronger for men than women. Such processes include exit from work and moving to a job with less physical demands. An additional analysis of the age specific distribution of occupations in the personnel register of the City ($n = 55\,000$) showed that the physically most demanding occupations were markedly less common in men aged 55 years or over than between the ages of 40 and 54 years, whereas in women the corresponding age difference was only modest. These additional data support the conclusion that men may exit from physically demanding work more often than women.

It may be possible to change to lighter work tasks without the need to change job or position. The working environment may also offer possibilities to redistribute individual work

tasks so that the younger employees would take up more of the physically most demanding tasks. If such a distribution of physically demanding tasks according to physical capacity is more common among men than women, this might explain why the results of this study suggest that men suffer less than women from increasing conflict of demanding physical work tasks and work capacity.

Our data are, however, limited to municipal employees. The observation that physically demanding work was more common in women than in men reflects the large proportion of health and social services in the staff of the City of Helsinki. It may be that our data give only a limited insight into the physically demanding work in men in the labour force at large.

Loss to non-response was assessed by comparing the questionnaire data with the personnel register data of the City. A few expected influences were found. Those with higher socioeconomic position and less sickness absence were somewhat more likely to participate in the study in both genders. Older men were also somewhat more likely to participate than their younger counterparts. Thus, the prevalence of limited functioning and physically demanding work might have been somewhat underestimated. The

Table 5 The associations of physically demanding work and age with role limitations due to physical health problems by gender, adjusting for socioeconomic status; odds ratios (OR) and their 95% confidence intervals (CI) from logistic regression analysis

	Role limitations due to physical health problems			
	Men		Women	
	OR	95% CI	OR	95% CI
Model 1: unadjusted*				
Physically demanding work	1.98	1.46 to 2.66	1.67	1.47 to 1.89
Age, 5 years	1.13	1.02 to 1.24	1.24	1.18 to 1.30
Model 2: adjusted for socioeconomic status*				
Physically demanding work	2.08	1.51 to 2.86	1.76	1.54 to 2.02
Age, 5 years	1.13	1.03 to 1.25	1.23	1.18 to 1.29

*Covariates are physically demanding work and age, models are stratified for gender. Model 2 is adjusted for socioeconomic status. Reference group (OR = 1.00) for physically demanding work is those not in physically demanding work. Age is applied as continuous variable and the OR is interpreted as mean effect per 5 years of age.

Table 6 The association of physically demanding work with role limitations due to physical health problems by age and gender, and the interaction of physically demanding work, age, and gender; odds ratios (OR) and their 95% confidence intervals (CI) from logistic regression analysis

	Role limitations due to physical health problems			
	Men		Women	
	OR	95% CI	OR	95% CI
Modelling strategy 1*				
Physically demanding work by age year				
40	2.37	1.21 to 4.63	1.53	1.16 to 2.02
45	2.86	1.51 to 5.43	1.35	1.03 to 1.78
50	1.51	0.79 to 2.89	1.75	1.34 to 2.29
55	2.02	1.08 to 3.77	1.81	1.41 to 2.32
60	1.28	0.56 to 2.93	2.27	1.57 to 3.29
Modelling strategy 2†				
Physically demanding work × age, 5 years	0.86	0.69 to 1.08	1.10	1.00 to 1.21
Modelling strategy 3‡				
Physically demanding work × gender × age, 5 years	1.00		1.27	1.00 to 1.63

*Covariate is physically demanding work, modelling is stratified for age and gender. Reference group (OR = 1.00) is those not in physically demanding work in the same gender and age group.
†Covariate is the interaction of physically demanding work and age, modelling is stratified for gender. Main effects of age and physically demanding work were adjusted for. The OR is interpreted as mean effect of 5 years of age in physically demanding work when compared to those not in physically demanding work in the same gender.
‡Covariate is the interaction of physically demanding work, gender, and age, applied in single unstratified model. Main effects of physically demanding work, age, and gender, and interaction effects of age and gender, age and physically demanding work, and gender and physically demanding work were adjusted for. The OR is interpreted as mean effect of 5 years of age in physically demanding work in women when compared to women not in physically demanding work and all men.

possible bias would reduce the association of physically demanding work with limited functioning in both genders. The possible age bias in men would accentuate the age related decrease in functioning more in men than in women. Therefore the possible non-response bias is unlikely to explain our main findings.

It is important to note that the most common municipal occupations for men and women differ quite markedly from each other. Therefore, men and women with physically demanding jobs often work in different occupations. Physically demanding work in women was most prevalent in practical nurses (73% reporting physically demanding work). Of all women reporting physically demanding work, 32% were working in health care, 38% in social care, while kitchen and cleaning work together accounted for 14%. In men physically demanding work was most prevalent among fire fighters (82% reporting demanding work). Physically demanding work was more widely distributed among different occupations in men than in women, with fire protection accounting for 12%, real estate maintenance for 12%, technical and machine operating work for 15%, and social and health care together for 14% of men reporting physically demanding work.

It is difficult to answer whether differences in possibilities to adjust the work tasks to correspond to physical capacity are mostly occupation specific rather than gender specific, because of a strong tradition of many occupations being dominated by one gender. Furthermore, the occupations in which the gender distribution has become less uneven or reversed include mostly highly educated professionals among whom physical workload is uncommon. Lesser possibilities to adjust the physical workload according to individual capacity in women's work than in men's work might also be related to increasing use of technical equipment and machines. Physically demanding low status jobs in health and social care possibly have benefited less from technological advances than jobs that consist mainly of handling material products and equipment rather than people. There is, however,

evidence from a previous study suggesting that physical workload may be higher for women than men working in the same industrial occupation.²⁹

The results of this study suggest that physically demanding work is associated with difficulties to cope with daily tasks especially among ageing women employees in health and social care. High physical workload in low status jobs in health and social care is also documented in previous Finnish studies.^{30–32} This might explain why results from longitudinal studies indicate that physical workload has not declined for women while some decline for men has taken place.¹⁴ The ageing of the population will further increase the demands for health and social services for the elderly in the future, while at the same time the employees providing these services are ageing as well. Therefore, the welfare of the ageing employees within health and social services is an increasingly burning issue in the future work life.

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Ethical approval statement: Participation to the study is voluntary and all participants have been informed on this. A written permission to link the questionnaire data with the register data has been asked from each participant. The study protocol of the Helsinki Health Study has been approved by the ethical committee of the Department of Public Health, University of Helsinki, and the ethical committee of the City of Helsinki health authorities. Additionally, the personnel board of the City of Helsinki has approved the protocol, and acts as a follow up group.

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