Title:

Has your work worked you too hard? Physically demanding work and disability in a sample of the older Irish population.

Abstract

Background There is a heightened need for the practitioner to be alert to the determinants of functional limitations and disabilities owing to the ageing workforce in Europe and worldwide.

Aim This study investigated the association between work type and disability in older age in both the paid and the previously unexplored, unpaid worker (household labour).

Methods Data on demographic factors, physical measurements, work history and functional status was collected on 357 57-80 year olds. Past or present work was identified as either physically demanding or not. Functional limitations and activities of daily living (ADL) disabilities were assessed using validated scales. Logistic regression was used to examine the relationship between the dependent variables and work type (physically demanding work or not physically demanding work).

Results Over half of the sample reported doing physically demanding work. Twenty per cent had complete function (*n*=67), 65% (*n*=223) functional limitations and 15% (*n*=53) ADL disability. Physically demanding work was associated with functional limitations [OR 2.52 (1.41, 4.51) *p*=0.01] and ADL disability [OR 2.10 (1.06, 4.17) *p*=0.03] after adjustment for a measure of obesity and gender. When gender stratified, looking only at females, physically demanding work was associated with ADL disability [OR 2.79 (1.10, 7.07) *p*=0.03] adjusted for a measure of obesity and household labour.

Conclusions Physically demanding work was related to functional limitations and ADL disability, in older age. This is valuable information to inform practitioners in the treatment of older people with functional limitations and disabilities and in guiding interventions in the prevention of work related disability.

Background

Individual and societal consequences of functional limitations and disability can be vast. Approximately 14% of the working-age population has a disability with prevalence rates up to 25% in the 50-64 year age-group, higher in the lower educated and women [1]. There is a heightened need to apprise medical and health care professionals in general about this public health issue owing to the ageing workforce. It is therefore important to understand the determinants of functional limitations and disability for prevention.

Functional limitations were seen by Nagi as a precursor of disability [2]. Disability, for the purpose of this paper, relates to the limitations the individual has in performing activities of daily living. Activities of daily living (ADL) disability as described by Katz [3, 4] include functions such as bathing, dressing and feeding. Empirical data supports Nagi's theoretical pathway, with limitations of the individual leading to disability and influencing health outcomes [5]. Nonetheless, not all impairments lead to functional limitations, similarly, not all functional limitations lead to disability [6]. However, there can be a dose response effect with increased disability in those with the most functional limitations.

The determinants of functional limitations and disability are complex. Occupational risk factors from current and past work, especially physically demanding work (also referred to as manual work/manual workers), may give an explanation, although research is controversial. For example, on the one hand studies find that physical work is linked with injury and reduced mobility [7-9]. In addition, after the age of 45, musculoskeletal capacity depreciates at a quicker pace [10] with a poorer outcome for recovery [11]. Conversely, ergonomically orientated studies report that heavy physical work may maintain the physical capacity of the ageing worker. For example, Gall & Parkhouse [12] found older manual workers have specific physical capabilities relevant to their work.

Chau [8] found a strong exposure-response association between physical job demands and injury in older workers with males and manual workers having the greatest risk of injury. Physically demanding work may, through a higher workload, and less control over the work environment [9], increase the risk of osteoarthritis and resultant limitations.

There is also a strong gradient between socioeconomic status, disability and functional limitation which may constitute a confounder in the association of physically demanding work and health outcomes. A lower socioeconomic position has been related to the onset and progression of disability in people aged 55-69 years [13]. In Europe, health inequalities across socioeconomic groups reduce healthy life expectancy by an average of 5.14 years [14]. Lower

educational levels are often accompanied with less pay and manual labour [15]. In addition, having a risk factor such as obesity was strongly associated with reduced function [16].

Furthermore, gender differences are well established. Kenny's review of literature pertaining to physical work capacity in older workers revealed that women have a notably higher rate of musculoskeletal injuries when compared to men [10]. Recovery is less frequent in women with fewer females moving from a functional limitation stage into full function again [7]. Contrarily, Grundy & Glaser [13] found an increased incidence of disability in men. This finding may, as the authors acknowledge, be as a result of researching a slightly younger age group. It is at an older age disability in women increases.

There are a lack of studies that disentangle potential determinants of disability with regard to physically demanding work, gender and socioeconomic position, including paid and unpaid work (also referred to as household labour). Data for the unpaid worker is not so readily available. This role, not recognised as an employed status [17], is as vital to maintaining society as paid work [18]. Household labour may vary by socioeconomic status, with some working families having hired staff and better appliances [19, 20]. Nevertheless some scholars believe mothers, regardless of paid or unpaid work status, perform the most of the physically demanding household work [21].

Household labour poses ergonomic and safety risks [22, 23], this being compounded in the unpaid worker due to their continued exposure to this role. However, injuries from this work and functional ability thereafter were not previously studied. Furthermore, little attention is placed on the effect of a functional limitation on the individual's quality of life, with studies looking predominantly at economic effects of injury [9, 11]. Health promotion starts with the individual, but the price of injury to the worker was not the focus of prior studies with the exception of Arndt [24].

Therefore, the purpose of this paper is to examine the association between physically demanding work, functional limitations and reduced ability to carry out daily activities of living, in older age while taking gender and a measure for obesity into account. We will look at both paid and unpaid workers. We hypothesise; those workers who had carried out or currently carry out physically demanding work as opposed to those who don't, suffer, in older age, functional limitations and ADL disabilities. In addition, that the unpaid worker, as opposed to the paid worker (current worker or retired), experiences increased functional limitations and ADL disability.

Methods

Participants

The Cork and Kerry study is a prospective follow up study looking at the general health of both a rural and urban population. The sample used for this study was first recruited in 1998. At that time stratified random sampling by age (50-54, 55-59, 60-64, 65-69) and gender was used to study the health of the population from 17 general practitioner surgeries in the Cork and Kerry region of Southern Ireland [25]. In total, 1,018 subjects were included in the study (69.9%). This baseline cohort was followed up ten years later in 2008-2009. Allowing for mortality rate at 11% (*n*=111), 22% (*n*=225) loss to follow up (not currently with GP, moved from area) and a further 6% (*n*=43) classified as too unwell to participate, an available sample of 639 subjects were invited to participate. A response rate of 57% (*n*=362) was attained. From baseline data, the non-responders for the follow-up were slightly older than the responders (60.8 vs. 58.6 years), more likely to be retired (30% vs. 17%) and less likely to be married (71% vs. 80%) (*p*-values $\leq$0.02). All participants gave their written informed consent prior to the study. Ethical approval for the study was granted by the Clinical Research Ethics Committee of the Cork Teaching Hospital, Cork, Ireland. For the purpose of this paper the data from the second measurement point are analysed cross-sectionally. This was a secondary data analyses.

Study variables

Specific data on work history, functional status and activities of living was collected at follow-up time, but not in the initial phase in 1998. Self-administered questionnaires were used to collect the data. Physical measurements, height and waist circumference, were taken by trained nurses.

Work history data focused on the job the participant had done for the longest period of time. Each participant was then asked if they described their job as physically demanding. Work status was assessed by asking each participant if they worked in the household, were retired or in paid employment. Only those who indicated that their occupation was household labour for the longest period of time were classified as so. Retired women were included in the retired category.

Functional limitations were assessed using Nagi's [26] scale. Each participant was asked if they had difficulty that lasted longer than three months, for any of eleven different activities. The difficulties included activities such as, walking 100 yards, sitting 2 hours, stooping, or picking up a small coin from a table. A participant with no reported

difficulty was classed as completely functional; those with one or more difficulties were classified as functionally limited. This was used as the outcome measure.

Activities of daily living were assessed using Katz's [4] scale. Participants were asked to indicate if they had difficulties that they expected to last longer than three months in activities such as; dressing, walking, showering, eating, getting in/out of bed and using the toilet. A participant with no reported difficulty was classed as such, and as activities of daily living disabled if they had any disability. This was used as the outcome measure.

Other variables used for this analysis included age, gender, measure of obesity and educational level. Obesity was measured using the Ashwell Category®, ratio of the waist circumference to height (WHtR) [27, 28]. Each participant's waist measurement (which was an average of two readings) was computed. This was then matched against their height. If the participant had a WHtR greater than or equal to 0.5 then they were at increased risk. For the purpose of this paper they are classified as obese. The Ashwell Category® was used as a measure for obesity owing to BMI being an inadequate measure of body fat in older people [29]. BMI was calculated however, to give descriptive details of normal, overweight and obesity rates in the sample. The standard formula was used and overweight was classed as BMI of 25-29.9, with obesity classified as 30kg m^2 and over. Educational level was based on primary education 4-12 years, secondary education 12-17 and tertiary education 17+ years.

Statistical methods

All analysis was conducted for the total sample using PASW™ 18. The analysis was performed in two parts. We initially described socio-demographic characteristics and functional status for the total sample, looking at the difference between the genders and functional status using the chi-square test and independent samples t-test. In the second part, logistic regression models were built to explore the relationship between the dependent and independent variable and covariates. The complete group was analysed initially and then age and gender-stratified analysis was carried out for the 57-69 and 70-80 year olds. Two separate models were used for the dependent variables. The dependent variables treated as categorical (none/any), were whether or not the participant had functional limitations and whether or not they had ADL disabilities. When treating functional limitations as a continuous variable (range from 0-11) a linear regression model was built looking at the association of work type (physically demanding work or not physically demanding work) and the number of functional limitations reported. The independent variable in each model was physically demanding work, coded as 1. Gender, and WHtR were the covariates for the complete sample and

household labour and WHtR were the covariates for the gender stratified analysis. Adjustment for all covariates was carried out concurrently. Dummy variables were created with males, household labour and obese coded as 1.

Results

Characteristics of study participants

The socio-demographic characteristics of the study participants are shown in table 1.

Table 1 - Socio-demographic and work characteristics of the sample

	Men (*n*=169)	Women (*n*=192)	Total Sample (*n*=361)
Age *M* (SD)	68.8 (5.3)	68.3 (5.3)	68.5 (5.3)
Range	60-79	57-80	57-80
Education %			
Primary	46%(*n*=75)	37%(*n*=67)	41%(*n*=142)
Secondary	34%(*n*=55)	40%(*n*=73)	37%(*n*=128)
Tertiary	20%(*n*=32)	23%(*n*=42)	22%(*n*=74)
Work status %**			
Retired	63% (*n*=101)	25% (*n*=46)	42% (*n*=147)
Paid			
Employment	37% (*n*=59)	32% (*n*=61)	35% (*n*=120)
Household labour	-----	43% (*n*=81)	23% (*n*=81)
Type of work			
Physically demanding	64% (*n*=103)	54% (*n*=92)	59% (*n*=195)
WHtR≥0.5**	96% (*n*=162)	79% (*n*=151)	87% (*n*=313)
BMI (kg m^2)**			
≤24.9	11% (*n*=19)	30% (*n*=57)	21% (*n*=76)
Overweight (25-29.9)	51% (*n*=85)	41% (*n*=79)	46% (*n*=164)
Obese (≥30)	38% (*n*=64)	29% (*n*=55)	33% (*n*=119)
Marital Status**			
Married/cohabiting	81% (*n*=135)	61% (*n*=118)	70% (*n*=253)
Single/separated/divorced	11% (*n*=18)	12% (*n*=23)	12% (*n*=41)
Widowed	8% (*n*=14)	27% (*n*=51)	18% (*n*=65)

M =mean, SD=standard deviation
Some totals vary due to missing responses
**=$p<0.01$

Just over half the sample were female (53%) and 42% (*n*=147) of the sample retired (median = 9 years, range of 5 to 14 years since retirement). Over half of the participants were, or had been engaged in physically demanding work with this percentage higher in males, albeit non-significant ($p=0.09$). There was no significant difference between the occupations and whether they described their work as physically demanding or not ($p=0.83$). There was a significant difference between males and females with regard to WHtR, BMI and occupational status. Paid/retired workers (male and female) were significantly more likely to have a higher educational attainment than those carrying out household labour ($p=0.01$) with 25% of them having tertiary education as compared to 10%. In addition, there was a significant difference ($p<0.01$) between the educational level of those carrying out physically demanding work (12% third level) and those who didn't (38% third level). Those doing household labour were significantly older than paid women (*M* age household labour 69.4 years, SD 5.3, *M* age paid women 66.5 SD 5.2, $p<0.01$).

Functional status of study participants

Table 2 shows a relatively high proportion of functional limitations within the complete sample. A significantly lower proportion of people who engaged in physically demanding work had complete function (no functional limitation or ADL disability) (p<0.01). Although non-significant, a higher proportion of people who carried out physically demanding work, as opposed to those who didn't, had a functional limitation. They were, nonetheless, significantly more likely to have an ADL disability (p=0.03). Retired people had the highest risk for functional limitations, and household labour the highest risk of ADL disability.

Table 2 - Functional status of the total sample, and by work type and work status

	Complete function*	*p*	Functional Limitations	*p*	ADL disability	*p*
Complete Sample (*n*=343)	20% (*n*=67)		65% (*n*=223)		15% (*n*=53)	
Physically demanding (*n*=189)	13% (*n*=25)		68% (*n*=128)		19% (*n*=36)	
Not physically demanding (*n*=130)	29% (*n*=38)	<0.01	61% (*n*=79)	0.25	10% (*n*=13)	0.03
Retired (*n*=142)	17% (*n*=24)		69% (*n*=98)		14% (*n*=20)	
Paid workers (*n*=114)	24% (*n*=27)		62% (*n*=71)		14% (*n*=16)	
Household labour (*n*=77)	20% (*n*=15)	0.40	58% (*n*=45)	0.26	22% (*n*=17)	0.24
Male (*n*=162)	20% (*n*=33)		66% (*n*=107)		14% (*n*=22)	
Female (*n*=181)	19% (*n*=34)	0.71	64% (*n*=116)	0.70	17% (*n*=31)	0.37

*Complete function = free from functional limitations and ADL disability

Functional limitations, ADL disability and work type

Percentage of individual functional limitations and ADL disabilities for the total sample, by work type (physically demanding, not physically demanding) and work status was then assessed (result not shown). Although higher proportions of people who had reported physically demanding work had more difficulty with functional limitations, univariate analysis only revealed a significant difference between the item for pushing and pulling (p=0.01, 23% vs. 11%). Those doing household labour, as opposed to retired or paid workers, were significantly more likely to have difficulty with climbing one flight of stairs (p=0.04), reaching (p=0.04), and pushing and pulling (p=0.01). Lifting and carrying was found difficult by 38% of those doing household labour as opposed to 22% of those retired and 17% of those in paid employment (p<0.01). Females were significantly more likely to report difficulty pushing and pulling (p=0.03) and lifting and carrying (p<0.01). There was no significant association found between physically demanding work and work status with regard to ADL disability. Proportions of activities of living disability ranged from 1% to the highest of 9% for the unpaid worker experiencing difficulty bathing.

Association of work type and functional ability

Using a linear regression model looking at physically demanding work and number of functional limitations (data not shown), those who engaged in physically demanding work had more functional limitations than those who didn't (B=0.59, SE=0.25, p=0.02) unadjusted, (B=0.52, SE=0.26, p=0.04) fully adjusted for gender and WHtR. The results of the multiple logistic regression models on physically versus non-physically demanding work and functional limitations (adjusted for WHtR and gender) are shown in table 3. Education was not included in the model as it was seen as a causal link and not a potential confounder. In the complete sample, those who carried out physically demanding work are twice as likely, as those who didn't, to have functional limitations [OR 2.71 (1.54, 4.77) p<0.01] in the unadjusted model. This association remained significant in the fully adjusted model (p=0.01). WHtR was independently significant in the model [OR 2.88 (1.30, 6.39) p=0.01], but gender was not [OR 0.68 (0.37, 1.24) p=0.21].

When stratified by age, the coefficient for physically demanding work was significant in the elderly participants (57-69 year olds) (p=0.04). Adjustment for WHtR and gender showed those doing physically demanding work as being twice as likely to have functional limitations (p=0.04). The very elderly participants (70-80 year old) who carried out physically demanding work were four times as likely to have functional limitations than those who didn't (p=0.02).

The analysis was further stratified by gender to investigate if household labour was associated with functional limitations (Table 3). Only females were investigated, as no males carried out household labour in our sample. There was no significant association found between physically demanding work and functional limitations for females in either the complete group [OR 1.97 (0.86, 4.52) p=0.11] or age stratified, 57-69 year olds [OR 1.66 (0.62, 4.43) p=0.31], 70-80 year olds [OR 2.91 (0.48, 17.77) p=0.25]. Nor was household labour independently significant in the model for the complete sample of women [OR 0.71 (0.31, 1.64) p=0.43] or age stratified, 57-69 year olds [OR 0.42 (0.15, 1.16) p=0.09], 70-80 year olds [OR 1.45 (0.28, 7.44) p=0.66]. WHtR was however, independently significant in the model for the complete sample [OR 2.91 (1.18, 7.22) p=0.02].

Table 4 shows the relationship between physically demanding work and ADL disability. Those who presently or in the past carried out physically demanding work were twice as likely to have ADL disabilities as those who hadn't [OR 2.10 (1.06, 4.17) p=0.03] (fully adjusted model). Although non-significant, males were less likely, independent of work type, to have ADL disabilities [OR 0.64 (0.34, 1.21) p=0.17]. When age stratified, there was no significant association between physically demanding work and ADL disability in the 57-69 year olds (p=0.66), but in the 70-80 year olds,

those who did physically demanding work were over four times as likely to have ADL disability as those who didn't in the unadjusted and fully adjusted models [OR 4.28 (1.37, 13.42) p=0.01].

When the analysis was further stratified and looking at women only (table 4), a similar association can be seen for the complete sample of women with regard to physically demanding work as was seen with the sample including men. Women who carried out physically demanding work were almost three times more likely to have ADL disability in the fully adjusted model [OR 2.79 (1.10, 7.07) p=0.03]. When age stratified, no association was seen for physically demanding work and ADL disability in either of the two age groups, in the unadjusted or fully adjusted models (although, the unadjusted result is borderline significant for the 70-80 year olds [OR 4.88 (0.96, 24.87) p=0.06]) . Women who performed household labour were not more likely than other women to have reduced ADL disability in either the complete group [OR 1.89 (0.82, 4.38) p=0.14], or in the 57-69 year olds [OR 1.08 (0.36, 3.26) p=0.89]. However, household labour was independently significant in the model for the 70-80 year olds [OR 5.42 (1.01, 28.98) p=0.05]. There was no association between household labour and ADL disability if physically demanding work was left out of the model for the complete group of women [OR 1.73 (0.79, 3.77) p=0.17] and for the 57-69 year olds [OR 0.89 (0.31, 2.59) p=0.83]. The association between household labour and ADL disability for the 70-80 year olds with physically demanding work left out of the model was [OR 5.18 (1.05, 25.62) p=0.04].

Table 3 - Association between functional limitations and physically demanding work. Complete sample, women only, age stratified[†].

			Complete Sample			Women Only		
			All (*n*=319)	57-69 years (*n*=188)	70-80 years (*n*=128)	Women (*n*=162)	57-69 years (*n*=103)	70-80 years (*n*=58)
Dependent Variable	**Independent Variable**	**Covariates**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**
Functional limitations	Physically demanding		2.71(1.54-4.77)**	2.06(1.05-4.04)*	5.02(1.50-16.79)**	2.19(0.98-4.88)[a]	1.58(0.61-4.07)	4.50(0.82-24.57)
(Model 1)								
(Model 2)	Physically demanding		2.52(1.41-4.51)**	2.04(1.02-4.07)*	4.36(1.27-14.99)*	1.97(0.86-4.52)	1.66(0.62-4.43)	2.91(0.48-17.77)
		Male	0.68(0.37-1.24)	0.56(0.28-1.14)	0.88(0.25-3.17)	---	---	---
		WHtR	2.88(1.30-6.39)**	2.49(0.94-6.60)	3.12(0.65-14.97)	2.91(1.18-7.22)*	2.54(0.78-8.21)	3.57(0.67-18.98)
		Household labour	---	---	---	0.71(0.31-1.64)	0.42(0.15-1.16)	1.45(0.28-7.44)

[†]Complete sample are adjusted for gender and WHtR. Women only are adjusted for WHtR and household labour.
** $p \leq 0.01$, * $p < 0.05$, [a] $p = 0.06$

Table 4 - Association between ADL disabilities and physically demanding work. Complete sample, women only, age stratified[†].

			Complete Sample			Women Only		
			All (*n*=328)	57-69 years (*n*=192)	70-80 years (*n*=133)	Women (*n*=168)	57-69 years (*n*=106)	70-80 years (*n*=61)
Dependent Variable	**Independent Variable**	**Covariates**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**
Activities of Daily Living	Physically demanding		2.12(1.08-4.17)*	1.16(0.48-2.81)	4.53(1.46-14.07)**	3.00(1.20-7.51)*	2.24(0.73-6.90)	4.88(0.96-24.87)[a]
(Model 1)								
(Model 2)	Physically demanding		2.10(1.06-4.17)*	1.22(0.49-2.99)	4.28(1.37-13.42)*	2.79(1.10-7.07)*	2.20(0.71-6.79)	4.26(0.78-23.31)
		Male	0.64(0.34-1.21)	0.43(0.17-1.11)	0.87(0.35-2.20)	---	---	---
		WHtR	2.12(0.61-7.44)	1.74(0.37-8.17)	2.57(0.29-22.48)	1.69(0.46-6.19)	1.45(0.30-7.18)	2.04(0.20-20.40)
		Household labour	---	---	---	1.89(0.82-4.38)	1.08(0.36-3.26)	5.42(1.01-28.98)*

[†]Complete sample are adjusted for gender and WHtR. Women only are adjusted for WHtR and household labour.
** $p \leq 0.01$, * $p < 0.05$, [a] $p = 0.06$

Discussion

Consistent with our hypothesis, the findings from this study of older Irish adults indicated that lifetime exposure to physically demanding work was related to functional limitations in older age. This effect occurred across the complete sample, but was less consistent when stratified by age. Physically demanding work was also associated with ADL disability for the complete sample and the very elderly participants. There was no relationship between physically demanding work and functional limitations for women, but an association was found for physically demanding work and ADL disability. Those doing household labour were more likely to have an ADL disability than paid or retired female workers in the very elderly age group independent of work type, but not more likely to have functional limitations or ADL disability in any of the other groups. There was also evidence of a dose-response relationship between physically demanding work and the number of functional limitations reported.

The results for the complete sample parallel previous findings [8, 10, 16, 30]. Although physically demanding work influences the functional ability experienced in older age, there are other factors involved. Some potential explanatory factors such as smoking [8] and alcohol intake [16] were not explored due to data restrictions. Explanatory factors looked at; educational levels and WHtR, were similar to previous findings. Educational achievements differed significantly between the two work types. WHtR was an independent risk factor of functional limitations in the total sample and for women only. The result for WHtR concurs with previous findings on mobility limitations [16] and as obesity levels in Ireland have increased [31] as indeed in Europe as a whole, the burden of disease will also increase.

Rates of disability for the general population in Ireland are lower than the European average, with approximately 10% of the over 65 year age group having a disability, and up to 7% in the 50-60 year age group [32]. ADL disability in the present sample was small. Disability rates for the paid worker, (14%) mirrors the collective European rate [1]. However, rates of disability were far higher for the unpaid worker (22%).

The findings for women, and those engaged in household labour were inconsistent with earlier work. It has been previously established that functional limitations are higher in females [10] with scholars revealing poorer recovery rates for women post injury [7]. Gender differences were not found in this present study. However, although non-significant, males were less likely to have functional limitations and ADL disability, independent of work type, in accordance with Kenny et al's [10] work. Furthermore, when the data were stratified by gender, looking specifically at females, no difference was seen with work status contrary to our hypothesis. The female unpaid worker was not more

likely to have functional limitations or ADL disability. However, the very elderly women performing household labour, independent of work type (physically demanding or not), were more likely to have ADL disability. Manke et al [21] found that regardless of work status (full-time/part-time paid work or household labour), mothers did the majority of physically demanding housework. Interestingly, Mattioli et al [33] found full-time household labour increased the risk to the unpaid worker. This is consistent to some extent with our findings although only for the very elderly woman where other factors could have led to this association. There is no retirement age for household labour making it difficult for this group to change their role as age progresses. Increasing age may have been a factor for ADL disability, nonetheless the unpaid workers in the older group was more likely than the paid or retired female to have an ADL disability.

However, the role of household labour in the aetiology of disease and injury is one sparsely investigated and requires further research. To our knowledge this is the first study to investigate the relationship between work status (paid/household labour) and functional limitations / ADL disability, in an older age group. Household labour often includes physically demanding work [21, 33]. There is a dearth of literature pertaining to the unpaid worker. Working conditions in the home, with regard to physically demanding work, can vary by social class and household material standards. Unpaid workers had higher morbidity rates if they were less privileged [20].

The price of functional limitations and disability to the individual can be vast, resulting in reduced healthy years of living, with the burden of this being shouldered by family members primarily. Being unable to comply with societal norms such as being 'able bodied' may result in both social and economic consequences [34] with implications for job promotion and earning capacity. Inequalities in the work place may often have been overlooked. Over three times more non-manual workers had a third level education in comparison to the manual workers in the present study. The opportunity for workers to pursue further education should be encouraged for all levels of workers. Regular training on physically demanding work practices is necessary. The implementation of such training needs to begin early in the workers career to encourage sustainability and reduce premature disability. Some scholars suggest implementing procedures such as assessment of workers for suitability to physically demanding work and intermittent health assessments [35, 36] to troubleshoot functional limitations and disability. Phased early retirement practices may assist in reducing disability rates from physically demanding work. However, in times of an ageing society, early retirement options are being reduced with proposals for retirement age to increase.

Several limitations of the study need to be considered. The use of a cross-sectional design in this present study does not allow causal relationships to be established between lifetime exposure to physically demanding work and health outcomes. Collection of data on functional limitations and ADL disability at baseline of the study in 1998 would have added substantially to the analyses. We can hypothesise that the functional limitations in the study participants may lead to disability, but without follow up we cannot conclude this accurately. Details on exposure to physically demanding work, age at exposure, injury history and the possibility of having a lifelong limitation/disability were not available. This further limits our knowledge on the aetiology of functional limitations and disability. In addition, when the data were stratified by age, the loss of statistical significance may have been due to the small sample size.

Accuracy of self-reported measures of functional limitations and disabilities are often questioned. Self-reports carry bias. Some functional questionnaires measure probable difficulties [37], rather than actual ability through specific tests. Nevertheless, it has been argued that disability is not underestimated in self-report measures [3, 38]. Accuracy of self-reported data with regard to work history also requires cautious evaluation [39]. Retrospective assessment of exposures to factors such as physical work, without company records are subject to recall bias [40]. The World Health Organisation (WHO) International Classification of Functioning, Disability and Health (ICF) [41] may have offered a more robust measure of health and disability in preference to Nagi and Katz's scales. However, the latter scales were used so as to have comparable data, in the future, with an ongoing study in Ireland. Investigating the dimensions of work, such as workloads, work conditions, and possible changing of employment may have enhanced this piece of work. However, this was not possible. The distinction between physically demanding and non-physically demanding work can be described as arbitrary. By using the subjects own description of whether they carry out physically demanding work or not allows for their perception of their work to be measured. However, as earlier discussed, self-reports can be bias.

Conclusions

In summary, exposure to physically demanding work was related to functional limitations and ADL disability in older age. The unpaid worker, doing physically demanding work, was not found to be more likely than the paid female worker to have functional limitations or reduced ability. This study has added to the existing knowledge on work health and specifically provided new data on those who carry out household labour which could inform and augment the practitioners understanding of the determinants of functional limitations and disability. Future studies should focus on household labour teasing out the issues that cause the unpaid worker to have higher disability rates.

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Declaration of Interest statement
The authors report no declaration of interest.

References

1. Organisation for Economic Co-Operation and Development (2003) Transforming disability into ability policies to promote work and income security for disabled people. OECD, Paris

2. Nagi S (ed) (1991) Appendix A: Disability concepts revisited: implications for prevention. Disability in America: A national agenda for prevention. National Academy Press, Washington DC

3. Katz S (1983) Assessing self-maintenance: activities of daily living, mobility, and instrumental activities of daily living. J Am Geriatric Society 31 (12):721-727

4. Katz S, Ford AB, Moskowitz RW et al (1963) Studies of illness in the aged: the index of ADL: a standardized measure of biological and psychosocial function. JAMA 185 (12):914-919

5. Guralnik JM, Ferrucci L (2003) Assessing the building blocks of function utilizing measures of functional limitation. Am J Prev Med 25 (3Sii):112-121

6. Kempen G, van Heuvelen MJG, van Sonderen E et al (1999) The relationship of functional limitations to disability and the moderating effects of psychological attributes in community-dwelling older persons. Soc Sci Med 48 (9):1161-1172

7. Beland F, Zunzunegui MV (1999) Predictors of functional status in older people living at home. Age Ageing 28 (2):153-159

8. Chau N, Bhattacherjee A, Kunar BM et al (2009) Relationship between job, lifestyle, age and occupational injuries. Occupational Medicine 59:114-119

9. Holte HH, Tambs K, Bjerkedal T (2000) Manual work as predictor for disability pensioning with osteoarthritis among the employed in Norway 1971-1990. Int J Epidemiol 29:487-494

10. Kenny GP, Yardley JE, Martineau L et al (2008) Physical work capacity in older adults: Implications for the aging worker. Am J Ind Med 51:610-625

11. Turner JA, Franklin G, Turk DC (2000) Predictors of chronic disability in injured workers: a systematic literature synthesis. Am J Ind Med 38 (6):707-722

12. Gall B, Parkhouse W (2004) Changes in physical capacity as a function of age in heavy manual work. Ergonomics 47 (6):671-687

13. Grundy E, Glaser K (2000) Socio-demographic differences in the onset and progression of disability in early old age: a longitudinal study. Age Ageing 29 (2):149-157

14. DETERMINE Working Document 4 (2009) Economic arguments for addressing social determinants of health inequalities DETERMINE – an EU consortium for action on the socio economic determinants of health. www.health-inequalities.eu. Accessed 11th November 2010

15. Davey Smith G, Hart C, Hole D et al (1998) Education and occupational social class: which is the more important indicator of mortality risk? J Epidemiol Community Health 52 (3):153-160

16. Wannamethee SG, Ebrahim S, Papacosta O et al (2005) From a postal questionnaire of older men, healthy lifestyle factors reduced the onset of and may have increased recovery from mobility limitation. J Clin Epidemiol 58 (8):831-840

17. Padavic I, Reskin B (2002) Women and men at work. 2nd Ed edn. Sage Publications Inc, California

18. Coltrane S (2000) Research on household labor: Modeling and measuring the social embeddedness of routine family work. Journal of Marriage and the Family 62:1208-1233

19. Artazcoz L, Borrell C, Benach J (2001) Gender inequalities in health among workers: the relation with family demands. J Epidemiol Community Health 55 (9):639-647. doi:10.1136/jech.55.9.639

20. Artazcoz L, Borrell C, Benach J et al (2004) Women, family demands and health: the importance of employment status and social class. Soc Sci Med 59:263-274

21. Manke B, Seery BL, Crouter AC et al (1994) The three corners of domestic labor: Mothers', fathers', and children's weekday and weekend housework. Journal of Marriage and Family 56 (3):657-668

22. Artazcoz L, Borrell C, Cortas I et al (2007) Occupational epidemiology and work related inequalities in health: a gender perspective for two complementary approaches to work and health research. J Epidemiol Community Health 61 (Supplement 2):ii39-ii45

23. Jurakić D, Pedišić Ž, Greblo Z (2010) Physical activity in different domains and health-related quality of life: a population-based study. Quality of Life Research 19:1303-1309

24. Arndt V, Rothenbacher D, Brenner H et al (1996) Older workers in the construction industry: results of a routine health examination and a five year follow up. Occup Environ Med 53:686-691

25. Creagh D, Nelson S, Collins A et al (2002) Established cardiovascular disease and CVD risk factors in a primary care population of middle-aged Irish men and women. IMJ 95(10):298-301

26. Nagi S (1969) Disability and rehabilitation legal, clinical, and self-concepts and measurement. Ohio State University Press, Columbus

27. Ashwell M, Hsieh SD (2005) Six reasons why the waist-to-height ratio is a rapid and effective global indicator for health risks of obesity and how its use could simplify the international public health message on obesity. Int J Food Sci Nutr 56 (5):303-307

28. Ashwell MA (2005) Waist to height ratio and the Ashwell® shape chart could predict the health risks of obesity in adults and children in all ethnic groups. Nutrition & Food Science 35 (5):359-364

29. Brunner EJ, Chandola T, Marmot MG (2007) Prospective effect of job strain on general and central obesity in the Whitehall II study. Am J Epidemiol 165 (7):828-837. doi:10.1093/aje/kwk058

30. Partridge REH, Duthie JJR (1968) Rheumatism in dockers and civil servants a comparison of heavy manual and sedentary workers. Ann Rheum Dis 27:559-567

31. Morgan K, Mc Gee H, Watson D et al (2008) SLÁN 2007: Survey of lifestyle, attitudes & nutrition in Ireland. Main Report. Department of Health and Children, Dublin

32. Central Statistics Office (2006) Health and social conditions. Central Statistics Office Ireland,

33. Mattioli S, Baldasseroni A, Curti S et al (2009) Incidence rates of surgically treated idiopathic carpal tunnel syndrome in blue- and white-collar workers and housewives in Tuscany, Italy. Occup Environ Med 66:299-304

34. Barnes C (2000) A working social model? Disability, work and disability politics in the 21st century. Critical Social Policy 20:441-457

35. Sluiter JK (2006) High-demand jobs: Age-related diversity in work ability? Appl Ergon 37 (4):429-440

36. Naumanen P (2006) The health promotion of aging workers from the perspective of occupational health professionals. Public Health Nurs 23 (1):37-45

37. Kopec JA (1995) Concepts of disability: The activity space model. Soc Sci Med 40 (5):649-656

38. Kelly-Hayes M, Jette AM, Wolf PA et al (1992) Functional limitations and disability among elders in the Framingham study. Am J Public Health 82 (6):841-845

39. Revicki DA, Irwin D, Reblando J et al (1994) The accuracy of self-reported disability days. Medical Care 32 (4):401-404

40. Bourbonnais R, Meyer F, Theriault G (1988) Validity of self reported work history. Br J Ind Med 45 (1):29-32

41. World Health Organisation ICF, APPLICATION & AREAS. http://www.who.int/classifications/icf/appareas/en/index.html. Accessed 19/07/2010