

Longest held occupation in a lifetime and risk of disability in activities of daily living

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Abstract

Objectives—To examine the association between the longest held occupation in a lifetime and risk of disability in activities of daily living (ADL) among elderly people (65 years and older) in northern Taiwan.

Methods—A case-control design was used nested within two cohorts of a total of 2198 elderly people who had been followed up either between 1993 and 1997 or between 1996 and 1997. Cases were 360 elderly people with ADL disability within the study period. For each case, two sex matched controls were randomly sampled from the pool of elderly people free from ADL disability. Occupational data were collected through interviews conducted in 1997. Performed job contents were classified into occupational categories and occupation based social classes. Unconditional logistic regression techniques were used to estimate relative risk and 95% confidence intervals (95% CIs) of ADL disability.

Results—Compared with people who were former legislators, government administrators, or business executives and managers, workers in agriculture, animal husbandry, forestry, or fishing (odds ratio (OR) 1.9, 95% CI 1.1 to 3.5) and workers in craft and related trades (OR 1.9, 95% CI 1.1 to 3.4) had significantly increased risks of subsequent ADL disability. Differential risks of ADL disability were found across social classes, with a significant dose-response trend in which unskilled blue collar workers had an 1.8 times higher risk of ADL disability than higher social classes of white collar workers.

Conclusions—After adjustment for education, there was still an inverse relation between risk of ADL disability and social class. Although total control for all the known risk factors for ADL disability among elderly people was impossible, the results tend to suggest a potential for an effect of longest held occupation in a lifetime on risk of ADL disability.

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To prevent elderly people from becoming limited in activities of daily living (ADL) is an important health objective worldwide, particularly in nations in which, because of advances in medical care, the fastest growing segment of

population is elderly people. In Taiwan for example, the population of elderly people has grown from 1.1 million in 1988 to 1.7 million in 1997, a 55% increase. The total population, on the other hand, increased only by 8.7% during the same period.¹ Aging is usually characterized by progressive decline in physical functioning which can lead to deterioration of quality of life.² Our previous study found an annual incidence of 3.7% of chronic (lasting for at least 3 months) disability in ADL in Taiwan, leading to an estimated incidence of some 60 000 new cases of ADL disability in the elderly people of Taiwan.³ Research has reported various predictors of functional health of elderly people.³⁻¹⁶ These include demographics, psychosocial variables, health status, and patterns of activity. Little attention, however, has been paid to the possible association between employment in early life and the subsequent risk of ADL disability. This study aimed to consider this question.

Methods

DESIGN AND PARTICIPANTS

We used a case-control study design in which participants were sampled from two cohorts of a total of 2198 elderly people. The first cohort consisted of 1583 people who were residents of the four districts of Taipei metropolitan area and completed an annual interview about their ADL between 1993 and 1997. The ADL functional status was assessed as being independently able to perform six items: bathing; dressing; moving between bed and chair; using the toilet; eating; and walking inside the house.³ Elderly people incapable of independently performing one or more of these six items were considered chronically disabled. The method adopted in this longitudinal study has been described elsewhere.³ The second cohort (n=615) was sampled in 1996 from elderly people in the same area to supplement the 1993-7 longitudinal study. The ADL functional status for participants of the second cohort was assessed twice, in 1996 and 1997. Altogether 360 elderly people were identified as having ADL disability. Of them, 121 were prevalence cases and 239 were incidence cases. For each case, we randomly sampled two sex matched controls from the pool of elderly people free from ADL disability.

INFORMATION ON LONGEST HELD OCCUPATION IN A LIFETIME

In 1997 we collected data on lifetime occupations through interviews. The next of kin was allowed to provide proxy information for dead participants (n=152) and for those elderly

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people who were too sick or distracted to respond (n=87). Two investigators independently reviewed the participant's work history and categorised each participant's longest held job into one of 11 occupational categories: legislators, government administrators, business executives, and managers; professionals; technicians and associate professionals; clerks; service workers and shop and market sales workers; agricultural, animal husbandry, forestry, and fishing workers; craft and related trades workers; plant and machine operators and assemblers; elementary occupations; servicemen; and housekeepers. The occupational classification was based on the standard occupational classification system (SOCS) of Taiwan for which interrater reliability has been shown to be good.¹⁷ The SOCS is based on a four digit system. The first digit in the series represents the broadest job category and the subsequent digits are indicative of more specific details. The job title classification was based on the agreement of two raters. We further recategorised each participant's longest held job into a social class scheme based on occupation that consists of four levels of social classes indicated by the occupation's position within a hierarchy of skilfulness (higher level white collar workers, lower level white collar workers, skilled blue collar workers, and unskilled blue collar workers). Because housekeepers and self employed people did not fit into the four social classes applied, we excluded them from the analysis of the association between the social class and ADL disability.

STATISTICAL ANALYSIS

We first compared the distributions of baseline characteristics between cases and controls. With a multivariate unconditional logistic regression technique we then assessed the independent effect on risk of ADL disability of occupational category and social class based on occupation. The analyses comparing the 11 occupations were carried out relative to the arbitrarily selected occupational categories of legislators, government administrators, business executives, and managers. We therefore conducted a test for heterogeneity, with Woolf's method with 10 degrees of freedom,¹⁸ among relative risk estimates for 11 selected occupation categories to provide an overall significance in heterogeneity between relative risk estimates. The dose-response relation between social class and ADL disability was assessed in a multivariate logistic regression model by fitting a term for social class coded 1–4. As we simultaneously included both educational level and longest held occupation or social class based on occupation in the multivariate regression model, a potential numerical problem concerned collinearity between covariates, rendering estimated regression coefficients invalid. To investigate this question, we found that collinearity should not be a concern in our data as the multivariate logistic regression model that included both variables educational level and social class based on occupation (or longest held occupation) had no large estimated slope coefficients and estimated SEMs.¹⁹

Table 1 Comparison of demographic and lifestyle characteristics between cases and controls

Variables	Cases n (%)	Controls n (%)
Age (y):		
65–74	190 (52.8)	608 (84.5)
75–84	130 (36.1)	106 (14.6)
≥85	40 (11.1)	6 (0.8)
Sex:		
Male	176 (48.9)	352 (48.9)
Female	184 (51.1)	368 (51.1)
Education level:		
Illiterate	177 (49.2)	272 (37.8)
Elementary school	162 (45.0)	370 (51.4)
High school and higher	21 (5.8)	78 (10.8)
Marital status:		
Living with spouse	164 (45.6)	436 (60.6)
Otherwise	196 (54.4)	284 (39.4)
Active smoker:		
Yes	88 (24.5)	190 (26.4)
No	272 (75.5)	530 (73.6)
Alcohol consumption:*		
Yes	43 (11.9)	114 (15.7)
No	317 (88.1)	606 (84.3)
Routine exercise:†		
Yes	111 (30.8)	246 (34.2)
No	249 (69.2)	474 (65.8)
Self reported chronic diseases (n):		
0–3	257 (71.4)	600 (83.3)
4–6	86 (23.9)	110 (15.3)
7–9	16 (4.4)	9 (1.3)
10–13	1 (0.3)	1 (0.1)
Duration of employment for the lifetime longest held occupation (y):		
<10	9 (2.5)	35 (4.9)
10–19	27 (7.5)	67 (9.3)
20–29	28 (7.8)	91 (12.6)
30–39	73 (20.3)	150 (20.8)
≥40	223 (61.9)	377 (52.4)
Total	360 (100.0)	720 (100.0)

*At least one drink/day.

†Participation of folk dancing, hiking, jogging, or walking at least twice a week.

All statistical analyses were performed with an SAS statistical package.²⁰

Results

Table 1 shows demographic and lifestyle characteristics of the participants. Compared with controls, cases tended to be older, less well educated, and less likely to live with a spouse. More controls than cases took part in physical exercise on a regular basis and often consumed cigarettes or alcohol. Chronic medical conditions were more prevalent in cases than in controls. Occupational data showed that the period of employment of the longest held occupation was more than 40 years for more than half of the study participants. Only 2.5% of cases and 4.9% of controls held their longest employed occupations for less than 10 years.

Table 2 shows the crude and adjusted odds ratios (ORs) and 95% confidence intervals (95% CIs) for risk of ADL disability by occupational categories. Compared with legislators, government administrators, business executives, and managers (reference category), agricultural, animal husbandry, forestry, and fishing workers (OR 1.9, 95% CI 1.1 to 3.5), and craft and related trades workers (OR 1.9, 95% CI 1.1 to 3.4) had significantly increased risks of ADL disability. Plant and machine operators and assemblers had the highest risk with an OR of 3.0 (95% CI 0.9 to 9.7), but this was based on small numbers. Despite certain occupations that showed relatively higher risks of ADL disability, the test for heterogeneity suggested no overall significance in difference between relative risk estimates.

Table 2 Odds ratios (ORs (95% CIs)) for risk of disability in activities of daily living among elderly people in Taiwan by longest held occupation in a lifetime

Longest held occupation in a lifetime	Controls n	Cases n	Crude estimates		Adjusted estimates	
			OR (95% CI)	p Value	OR* (95% CI)	p Value
Legislators, government administrators, business executives and managers†	75	22	1.0		1.0	
Professionals	19	5	0.9 (0.3 to 2.7)	0.85	0.8 (0.2 to 2.6)	0.65
Technicians and associate professionals	12	5	1.4 (0.5 to 4.5)	0.55	1.3 (0.4 to 4.3)	0.66
Clerks	30	10	1.1 (0.5 to 2.7)	0.77	1.3 (0.5 to 3.3)	0.55
Service workers and shop and market sales workers	19	9	1.6 (0.6 to 4.1)	0.31	1.5 (0.6 to 4.2)	0.42
Agricultural, animal husbandry, forestry and fishing workers	122	87	2.4 (1.4 to 4.2)	<0.01	1.9 (1.1 to 3.5)	0.04
Craft and related trades workers	146	77	1.8 (1.1 to 3.1)	0.04	1.9 (1.1 to 3.4)	0.04
Plant and machine operators and assemblers	10	6	2.0 (0.7 to 6.3)	0.21	3.0 (0.9 to 9.7)	0.06
Elementary occupations‡	85	37	1.5 (0.8 to 2.7)	0.21	1.5 (0.8 to 2.8)	0.26
Servicemen	29	7	0.8 (0.3 to 2.1)	0.69	0.9 (0.3 to 2.6)	0.91
Housekeepers	173	95	1.9 (1.1 to 3.2)	0.02	1.5 (0.8 to 2.8)	0.17
Total	720	360				

*Odds ratios were calculated from unconditional logistic regression models with adjustment for age, sex, education level, marital status, cigarette and alcohol consumption, exercise, comorbidity and duration of employment for longest held occupation in a lifetime.

†Reference category.

‡Based on Taiwan's standard occupational classification system, the category of elementary occupations includes a total of 15 occupations including: sanitation workers, construction workers, assembly workers, meat packers and producers, telephone sales, domestic helpers and cleaning workers, business and public cleaning staff/personnel, doorkeepers, meter readers, street food vendors, street vendors (non-food products), shoes shining/car wash workers, caretakers, dry cleaning and laundress, messengers/package/luggage porters and delivers.

Table 3 shows the crude and adjusted ORs and 95% CIs for risk of ADL disability by social class based on occupation. Compared with controls, cases were more often unskilled blue collar workers (OR 1.8, 95% CI 1.1 to 3.0) or self employed people (not shown in table 3) (OR 1.8, 95% CI 1.1 to 2.9). Trend analysis of the relative risk estimates showed a dose-response relation ($p=0.03$) between social class and risk of ADL disability. Former employees with low skills tended to experience higher risks of ADL disability in later life. Analyses stratified by sex or restricted to incidence cases yielded essentially similar results.

Discussion

Results from the current study showed that former employment as an agricultural, animal husbandry, forestry, and fishing worker, or craft and trades worker had increased risks of ADL disability in old age. Also, being an unskilled blue collar worker or being self employed had significantly higher risks of ADL disability after retirement. We also noted an inverse gradient between social class based on occupation and risk of ADL disability; with worse physical functioning more often found in those formerly employed in occupations of low skill. Previous research indicated sex differences in factors

associated with change in physical functioning in old age.¹³ We performed analyses stratified by sex but found no modification of effect by sex.

Our data showed that more controls than cases smoked cigarettes. This is opposite to most of the scientific literature, which shows that non-smokers generally have better health. Because the relation between cigarette smoking and case-control status was assessed cross sectionally in this study, it is likely that many cases stopped smoking because of certain chronic health conditions that are often followed by the development of ADL disability. This possible reverse causality bias may also be applied to the inverse relation between alcohol consumption and prevalence of ADL disability.

Our study has several methodological strengths. Firstly, we used a nested case-control design, which is more efficient at collecting exposure information and less likely to be subject to selection bias.^{21, 22} Secondly, the longest held occupation in early adulthood would always precede the development of functional decline in old age, allowing a causal interpretation of the results by time sequence. Thirdly, we conducted face to face interviews to collect the information on lifetime employment, and to identify the longest held occupation for each participant. The use of longest held occupation

Table 3 Odds ratios (ORs (95% CIs)) for risk of disability in activities of daily living among elderly people in Taiwan by social class indicated by occupation

Social class indicated by longest held occupation in a lifetime	Controls n	Cases n	Crude estimates		Adjusted estimates	
			OR (95% CI)	p Value	OR* (95% CI)	p Value
Higher level white collar workers†	75	22	1.0		1.0	
Lower level white collar workers	31	10	1.2 (0.5 to 2.6)	0.73	1.0 (0.4 to 2.5)	0.98
Skilled blue collar workers	49	19	1.4 (0.7 to 2.7)	0.33	1.4 (0.7 to 2.9)	0.34
Unskilled blue collar workers	241	120	1.8 (1.1 to 2.8)	0.01	1.8 (1.1 to 3.0)	0.02
Total	396	171				p for trend=0.03

*Odds ratios were calculated from unconditional logistic regression models with adjustment for age, sex, education level, marital status, cigarette and alcohol consumption, exercise, co-morbidity and duration of employment for longest held occupation in a lifetime.

†Reference category.

rather than cross sectional information may best reflect a person's lifetime employment, and would help to show the influence, if any, of work conditions or other factors related to occupation on physical functioning. Although we allowed proxy information of occupation for both dead participants and those who were too sick or too distracted to respond, this approach was unlikely to compromise the validity of exposure information as the participant's occupation can be easily recalled by the next of kin. Finally, we made adjustment for the potential confounding factors age, sex, educational attainment, marital state, smoking, exercise, comorbidity, and duration of employment.

Previous research has reported factors that may predict loss of mobility among elderly people. These are demographic characteristics, lifestyle or behaviour patterns, physiological and biological conditions, socioeconomic status, and psychological factors. Older age,^{3 4 6 8 9 11 16} being a woman,^{6 12} being of non-white race,^{6 10} and obesity^{9 10 12 15} were the demographic predictors often reported to be associated with functional decline. Functional dependence is also more prevalent among those with chronic diseases^{4 7 9 11 16} or those making more demands on the healthcare system.¹¹ Active lifestyle and positive health behaviour were considered strong predictors of better physical function. The elderly people who were non-smokers,^{4 6 10 15} drank moderate amounts of alcohol,^{10 14} did more physical activity—such as regular exercise^{3 5 15} or voluntary activities⁶—tended to experience lower risks of functional decline. Socioeconomic status has been consistently considered to be related to measures of ill health, and is a strong predictor for physical functioning.^{6-10 12-14 16} Psychological factors were found to predict good physical function in several studies. These factors include greater self sufficiency,⁶ fewer psychiatric symptoms,⁶ greater satisfaction,¹¹ and having a healthy living spouse.^{11 13}

The relation between ADL disability and certain occupations and social class can be interpreted in several ways. Firstly, occupation could be a better long term predictor of physical disability than education. In an attempt to measure socioeconomic status, three indicators—education, occupation, and income—have often been used.²⁵ Among these, occupational data are difficult to obtain and code properly. Also, occupational data are often outdated.²⁴ Most studies that found an inverse relation between socioeconomic status and physical functioning used education,^{6 7 9 12-14 16} family, or personal income^{6-8 10 13-16} as indicators of socioeconomic status. Because education has the attraction of a graded scale that lends itself to obvious cut off points, and is stable in adulthood, the educational gradient in physical functioning has often been interpreted as a socioeconomic status gradient. However, the Whitehall studies indicated that grading based on occupation was a better predictor of ill health than education.²⁵ As a single indicator of socioeconomic status, occupational social class in

adulthood has been found to be a better discriminator of socioeconomic differentials in mortality than education.²⁶ Our study showed an influence on functional decline of social class based on occupation to be independent of educational attainment. Our results may mean that occupation is more intimately involved than education in the causal pathways leading to ADL disability.

Secondly, physical hazards related to occupation might have played a part in the cause of ADL disability. Certain physical hazards at work may have no apparent adverse effect on a person's current physical functioning but could ultimately lead to functional decline years later. For example, heavy manual work and repetitive monotonous movements could lead to ultimate disability,²⁴ through, for instance, musculoskeletal disorders.²⁷ A recent study found that heavy manual work and piecework (with repetitive movements and little influence on job conditions) were most often found among blue collar workers and might to some extent explain the excess disability due to diseases of the musculoskeletal systems among these workers.²⁴ These musculoskeletal disorders might not cause immediate physical disability, but could lead to functional decline many years later.

The third possible explanation for the unequal risk of ADL disability across occupational classes is related to psychology. Previous studies have indicated that job control and physical working conditions explained a substantial portion of the association between occupational class and perceived general health.²⁵ Results from the Whitehall study showed no effect of job demands but an obvious effect of job control on incidence of coronary heart disease.^{28 29} A lack of job control might have a negative impact on health, because such conditions result in biological arousal.²⁷ Such arousal has been hypothesised as resulting in an increased release of catecholamines and increased blood pressure, which are risk factors for cardiovascular disease.³⁰ Because we did not collect information on job control in the study, we were unable to assess whether the effect found was attributable to lack of job control. Nor were we able to examine the possible presence of a differential prevalence in lack of job control among occupational categories.

The causes of disability are complex and both individual and environmental factors may affect the risk.²⁴ For example, environmental stress, job satisfaction, and body weight have all been associated with disability caused by low back pain.³¹ Lack of a balance between demands and controls at work may, mediated by physiological linkages, cause physical or mental illness.³² Although we were unable to control for all the known risk factors for ADL disability listed, our results suggest a potential for the effect of longest held occupation in a lifetime on risk of ADL disability. Further studies that collect information on specific physical hazards (such as heavy manual work and repetitive monotonous movements) and psychological hazards—such as job dissatisfaction and lack of job control—at

work would help to further interpret the effect of this phenomenon.

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Open reviewing

Many journals, including the BMJ, have moved to a system of open reviewing, whereby authors know the names of reviewers of their papers. Research has shown that named reviews, although not of better quality than anonymous reviews, are not of worse quality either. Therefore in the interests of transparency, it seems fair to let authors know who has reviewed their paper. At *Occupational and Environmental Medicine* we have considered the issue carefully. There are some concerns that reviewers, especially those who are more junior, might feel intimidated and not wish to make negative comments about papers submitted by senior people in the field. On the other hand, some reviewers might hide behind the cloak of anonymity to make unfair criticisms so as to reduce the chances of publication by rivals. We have decided to introduce initially a system of open reviewing if the reviewers agree explicitly. So when a reviewer is sent a paper, he or she is asked to indicate whether we can disclose their name or not when sending the authors their comments. We will be monitoring this to see how many of our reviewers are happy to be named. If it is most of them, we will move to a system of open reviewing as the norm, with a possible “opt out” clause for reviewers.