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Age and Work-related Health: Insights from the UK Labour Force Survey

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Abstract

Data from the UK Labour Force Survey (LFS) are used to examine two methodological issues in the analysis of the relationship between age and work-related health. First, the LFS is unusual in that it asks work-related health questions to those who are not currently employed. This facilitates a more representative analysis than that which is constrained to focus only on those currently in work. Second, information in the LFS facilitates a comparison of work-related health problems which stem from current employment to a more encompassing measure which includes those related to a former job. We find that accounting for each of these sources of bias increases the age work-related health risk gradient and suggest that ignoring such effects will underestimate the work-related health implications of current policies to extend working lives.

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1. Introduction

Over the last 2 decades, there has been a sustained increase in the employment rate among those approaching retirement age within the UK, marking a reversal of the trend towards early retirement witnessed during the 1970s and 1980s. This increase has been particularly apparent among women (see Chapter 4 in ONS, 2013). Despite such trends, low rates of fertility (ONS, 2013a) and increasing levels of life expectancy (ONS, 2013b) have contributed to concerns among policy makers regarding the affordability of caring for the elderly population. Governments have therefore continued to seek ways of encouraging older workers to stay in employment for a longer (Schils, 2008). Three significant policy changes have been implemented in the UK in recent years to support the extension of working life: the incorporation of age as a protected characteristic within anti-discrimination legislation under the 2010 Equality Act; the abolition of the Default Retirement Age in 2011 which means that businesses can no longer set a compulsory retirement age; and an increase and equalization of the State Pension Age (66 years for both men and women by 2020) implemented under the 2011 Pensions Act. These legislative changes have been accompanied by other government initiatives aimed at encouraging businesses to employ older workers and enhanced provisions for unemployed job seekers over the age of 50 through the Job Seekers Allowance programme (Walsh, 2012).

There is strong evidence to suggest that being in work is good for both physical and mental well-being (Waddell and Burton, 2006). Nonetheless, it is important to understand the health implications of policies which encourage people to work longer. Statistics published by the Health and Safety Executive indicated that in 2011, 1.1 million people in the UK who worked during the last year were suffering from an illness that they believed was caused or made worse by their current or past work. Over 1 in 5 of these people was aged 55 or over. A further 0.7 million former workers (who last worked over 12 months ago) reported suffering from an illness which was caused or made worse by their past work (see HSE, 2011). A number of studies confirm that older workers are more likely to report a variety of work-related ill-health conditions (Griffiths, 1997, Griffiths, 2000, Rogers and Wiatrowksi, 2005, Bohle *et al.*, 2010 and Jones *et al.*, 2013). Whilst physical and cognitive changes associated with age have not been found to adversely affect productivity, particularly when set against the increased skills and experience possessed by older workers (Yeomans, 2011), there are concerns regarding the nature of employment opportunities available for older workers in a segmented labour market (Goos and Manning, 2007). Seeking reduced levels of exposure to risk (referred to as

`downshifting') or responding to job loss increasingly involves older workers gaining employment characterised by non-standard employment relationships, particularly amongst women and those in low paid occupations (Bailey *et al.*, 2008, Smeaton *et al.*, 2009, Blyton and Jenkins, 2012). Such forms of 'precarious employment' are themselves associated with increased risks of ill-health (Benach and Muntaner, 2007).

This paper provides new evidence on the relationship between age and work-related health problems based upon data from the UK Labour Force Survey (LFS). A limitation of previous research is that it is often derived from cross sectional studies which ask those in work about their health in relation to their current job. Such studies are therefore often unable to account for the 'selection biases' that arise out of employment and occupational choices made by individuals some of which aim to ameliorate the symptoms of their ill-health conditions. Such biases are likely to lead to an underestimate of the true prevalence of work-related health problems and may bias the estimated correlation between personal and employment characteristics and work-related ill-health. The selection bias arising from the decision to work has been referred to as the 'healthy worker effect' in occupational epidemiology, although this has been criticised for being a vague concept (Li and Sung, 1999) and so is not used here. Issues of both selection into employment and occupation are likely to be particularly acute in the measurement of work-related health among older groups due to early retirement on the grounds of ill-health (see, for example, Disney *et al*., 2003) and the increased importance of the cumulative (and possibly delayed) effects of work histories on work-related health (Gueorguieva *et al*., 2009). The focus of the analysis is therefore on measuring the direction and extent of these biases on estimates of the association between age and work-related health.

2. Previous Research

A well-developed literature which attempts to measure and examine the determinants of work-related health has emerged across academic disciplines (see Poulakis and Theodossiou, 2013 for a review). A central theme within this literature has been the association between current working conditions, including physical and psychosocial risks, and health. Studies have used a wide range of (predominately self-reported) measures of general physical and psychological health (Martens *et al*., 1999, Pikhart *et al*. 2004) and measures that can be more directly attributed to work (Benavides *et al*., 2000, Benach *et al*., 2004) including accidents/injuries (Ghosh *et al*., 2004) and more recently, broader measures such as mental health (Cottini and Lucifora, 2010). These latter studies, which focus on work-related health, have relied almost

exclusively on surveys, such as the European Working Conditions Survey (EWCS), in which employees are asked about the contemporaneous link between work and their health at a given point in time.

This paper provides new evidence on two empirical issues associated with this type of analysis. First, in focusing on individuals who are currently employed, studies ignore the influence of some of the most serious work-related health problems that force individuals to leave the labour market. Second, even among those in work, focusing on health problems which stem from current employment ignores (1) the persistence of health problems which may stem from a previous occupation and (2) the time it may take for some work-related health problems to manifest themselves. Moreover, individuals may change occupation as a *consequence* of work-related health problems, resulting in their current position being unrepresentative of the causal occupation. Whilst previous studies acknowledge the potential biases associated with focusing only on those currently in employment (see, for example, Griffiths, 1997), fewer have attempted to examine the direction or extent of this issue. Jones *et al.* (2013) are an exception and, by reweighting the employed population in the EWCS on the basis of participation weights generated from an external dataset, the European Social Survey, they demonstrate that the association between age and a range of measures of work-related ill-health is sensitive to the treatment of selection effects.

Longitudinal data would appear to offer the potential to address the issues of selection and work history noted above. Studies using longitudinal data are, however, generally constrained to explore the relationship between working conditions and *general* health as measured by global self-reported measures (Gueorguieva *et al.*, 2009) or general psychological health (Robone *et al.*, 2008). Using these measures they are, however, able to resolve the issue of selection by including those not currently in the labour market and using lagged information on working conditions (Gueorguieva *et al.*, 2009). Further, by utilising information on career history, longitudinal studies are able to account for the effect of previous occupation, or cumulative exposure to working conditions, on health and thereby address issues of simultaneity between health and current occupation (see Amick *et al.*, 2002, Gueorguieva *et al.* 2009 and Fletcher and Sindelar, 2009). These studies find that previous occupations held matter for later general health.

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Within the UK, the main source of longitudinal data used in the analysis of a variety of labour market phenomena over the last 25 years has been the British Household Panel Survey (BHPS). However, this study only routinely included general measures of physical and psychological health. The BHPS has now been replaced by Understanding Society, the first Wave of which was conducted during 2009/10. Based upon instruments previously included within the cross sectional Skills and Employment Survey (see Felstead *et al.*, 2007), measures of psychological health that can be directly attributed to work are only available among those in employment (see Bryan, 2012). Myung *et al.*, (2009) use the BHPS to explore the effects of prior health (as measured by general health status) on socio-economic position which also included a category for the non-employed, thereby enabling the effect of health upon employment status and social class to be examined simultaneously. Consistent with earlier studies, their analysis found that the effect of health on employment status was greater than its effect on transitions between social classes among those who remained in employment, although stronger effects may be expected to emerge in terms of occupational mobility as workers seek to change the nature of their work tasks as opposed to social class which aims to differential positions in the labour market as expressed by employment relations (Rose *et al*., 2005).

Our approach is somewhat different. Like Jones *et al*. (2013) we use cross sectional data, but shed light on the bias arising from selection into employment and focusing on current employment using novel aspects of questions available in the UK LFS. Consistent with the literature this study relies on a subjective measure of work-related ill-health, the limitations of which are well established. The main problem of self-reported data comes from a concern that it is the individuals' perception of the attribution of an illness being caused or made worse by their occupation, rather than verification of work attribution made by a medical practitioner. In our analysis, a key problem relates to self-reported ill-health being an endogenously determined explanatory variable, with individuals justifying their non-participation in employment as being the result of an ill-health condition (Bound, 1991). Empirical evidence on this issue is, however, mixed with some studies that compare subjective and objective information on health finding that self-reported information on long-term health or disability is an unbiased estimate of 'true' health (Dwyer and Mitchell, 1999, and Benitez-Silva *et al*., 2004) while others finding systematic errors in self-reported information (Kerkhofs and Lindeboom, 1995 and Kreider, 1999). Further, measurement error may also contribute to differences with which different groups of individuals attribute ill-health conditions to work. There is, for example, some evidence that older workers under-report their health problems (see Palmer *et al.*, 2008, Jones

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et al., 2013) and, as such, estimates of the age work-related health gradient based on subjective information may be underestimated.

Whilst the problems associated with self-reported data are acknowledged, more objective sources of work-related health data have their own limitations. For example, within the UK, reporting rates among employers for workplace accidents occurring on their premises have been estimated to be approximately 40% (Stevens, 1992). Under-reporting is also prevalent among workers in countries which operate insurance based compensation schemes, particularly among those in `precarious' forms of employment (Quinlan and Mayhew, 1999). Hussey *et al.* (2013) compare the incidence work-related ill-health in Great Britain as derived from multiple sources, including the LFS. Their analysis reveals that the incidence of work-related ill-health are generally highest based on self-reported data due to its greater inclusivity. Finally, the inclusion of objective measures of health to overcome problems associated with endogeneity of self-reported ill-health have not affected the estimated marginal effects of age on ill-health in other recent studies (Kakwij and Vermeulen, 2008, Mortelmans and Vammieuwenhuyze 2013). Given the utilisation of self-reported health measures across a number of surveys related to work and working conditions and the problems that also exist with different forms of administrative data, understanding the statistical properties of self-reported measures of work-related ill-health remains important. Indeed, in this study it is the distinctive nature of the subjective work-related health questions that facilitate examination of the central issues in this paper.

3.   Data and Methodological Approach

The LFS is the largest regular household survey in the United Kingdom. Conducted quarterly, it provides detailed information on individuals' current jobs as well as their personal characteristics.[i] There is a short panel element since interviews are attempted with households over 5 successive quarters (referred to as 'waves'). Since the Winter Quarter of 2003/04 (December-February), the HSE has routinely commissioned a module of questions on work-related illness that appear annually in the LFS. These data contribute to the range of official statistics of work-related illness published by the HSE (see, for example, HSE, 2011). The LFS moved to calendar quarters in 2006, with the HSE module appearing in the first quarter of each year (January-March). To maximise the available sample for our analysis, data has been

combined from Winter 03/04, Winter 04/05 and the first calendar quarters of 2006 and 2007. A routing error occurred in the LFS in 2008 and 2009 resulting in the HSE module only being asked of people who had worked in the last 12 months rather than those who had ever been employed, rendering this data unsuitable for our purposes. The sample is restricted to individuals of working-age who are resident in Britain and report information on the variables in our analysis. This provides a maximum sample of 251,322 individuals, of whom, 200,135 are employed.

Within the HSE module, respondents are asked: *Within the last twelve months have you suffered from any illness, disability or other physical or mental problem that was caused or made worse by your job or by work you have done in the past?* From this a binary variable H_{it} is created which equals 1 if an individual responds positively and 0 otherwise. Abstracting from the subjective nature of this question discussed above, given the focus of this analysis it is appropriate to highlight the key features of this question. First, it is an encompassing measure of work-related health designed to capture ill-health in addition to injuries or accidents at work. Second, it is asked to everyone who is currently in employment or has *ever* been employed. It is, thus, able to capture individuals who have left work possibly as a consequence of their health problem. Third, it captures health problems relating to a current or former job and thus includes individuals who are no longer in the job that caused their work-related health problem. It is, however, time bound, in that the health problem must be evident within the last 12 months. It thus excludes individuals who may have previously suffered from a work-related health problem but, possibly due to changes in circumstances, their health problem is no longer evident.

Further questions in the LFS facilitate an examination of how the exclusion of health problems stemming from a previous job affects the analysis. Those who report a work-related health problem ($H_{it} = 1$) are subsequently asked *May I just check, was the job that caused or made your illness worse the one you previously mentioned as your* (1) main job; (2) second job, or (3) some other job? For those currently in employment a more restrictive measure of self-reported health related to their current main job HMJ_{it} is generated and equals 1 if individual reports work-related health problem relating to their main job and 0 otherwise. Approximately 80% of those currently in work who report a work-related health problem report that it stems from their main job whereas less than 1% report the health problem stems from a second job.

It is noted that the incidence of second job holding among LFS respondents is low relatively low (3% among men and 5% among women) and does not vary greatly with age, with young and older workers exhibit slightly higher rates of multiple job holding. The remaining 20% of those in work with a work-related health problem report that their condition stems from 'some other job', most likely a former job held. Of course, this information relies on individuals being able to correctly identify the causal job of their current work-related health problem. Some ambiguity may arise in cases where a condition was caused by a previous job but was still made worse by a job that they held at the time of the survey. Nonetheless, this information will shed light on the limitations associated with surveys which only consider the contemporaneous relationship between current work and health.

Those who report work-related health problems are also asked to select which, from a list of 11 types of illness, best describes their health problem.[ii] Those with multiple health problems are asked to identify most serious. Consistent with the publication of official statistics, separate analysis of the influence of sample selection and previous employment are conducted in relation to two distinct groups of conditions: musculoskeletal disorders (MSDs) and stress, depression and anxiety (SDA). MSDs include health problems relating to (1) bone, joint or muscle problems which mainly affect (or is mainly connected with) arms, hands, neck or shoulder, (2) hips, legs or feet and (3) back, whereas SDA is listed as one of the 11 possible health problems. MSDs and SDA are the two most prevalent forms of work-related health problems, accounting respectively for about 50% and 20% of all reported work-related health problems. This distinction is important as previous research which suggests that difficulties in physical mobility are more likely to result in withdrawal from employment than symptomatic depression (Rice *et al.*, 2010) and that work based sources of stress are ameliorated after retirement (Coursolle *et al.*, 2010). Previous evidence also suggests that ill-health tends to have a larger effect on the labour market participation of men than women (see Kalwij and Vermeulen, 2008; Pit *et al.*, 2010 and Paradise *et al.*, 2012). We therefore explore whether the bias arising from the employment selection process, and focusing on current employment, varies by both condition *and* gender.

The probability of reporting a work-related health condition (H_{it}) (or HMJ_{it}) is estimated for individual *i* in period *t* using a logistic model as follows:

$$H_{it}^{*} = \alpha + PC_{it}\beta + E_{it}\gamma + S_{it}\delta + \varepsilon_{it} \qquad (1)$$

$$H_{it} = \begin{cases} 1 & if \ H_{it}^{*} > 0 \\ 0 & otherwise \end{cases}$$

where PC_{it} denote controls for personal characteristics, E_{it} refer to employment related characteristics and S_{it} survey related characteristics.[iii] Full details of these explanatory variables are included in Appendix 1. The analysis is conducted in 2 stages. To examine the influence of labour market selection we estimate equation (1) using two samples; i) those who have ever worked and ii) those who were employed at the time of the survey. In this analysis variables relating to job characteristics (E_{it}) are excluded to ensure a common specification between samples. It is by contrasting the responses of those currently employed to those who have ever worked that we aim to identify the effects of bias resulting from focusing only on those in work. To examine the issue of current versus former employment we then estimate two variations of equation (1) for those currently in employment. In the first regression, the dependent variable relates to work-related health problems stemming from all employment (H_{it}), including those from previous jobs held. In the second regression, the dependent variable identifies work-related health conditions relating to the current main job (HMJ_{it}). The results of these regressions are compared to examine the bias associated with focusing only on the contemporaneous link between working conditions and health.

The analysis does not control for a number of job and workplace characteristics that could be regarded as potentially important determinants of work-related ill-health. Shift working (Minors *et al.*, 1986), union membership (Reilly *et al.*, 1995, Nichols *et al.*, 1995, Nichols *et al.*, 2007) and commuting patterns (Hansson *et al.,* 2011) are covered by the LFS and have all been demonstrated to have an influence on work-related ill-health or the reporting thereof. The LFS also collects limited information on career histories, with respondents being asked about their employment circumstances some 12 months earlier. However, in each case these variables are included in different quarters of the LFS to that of work-related health and so are not included as control variables. Perhaps of greater significance is the absence of variables related to job autonomy and intensity that are commonly used in analyses of work-related ill-health (Karasek, 1979). The present analysis uses detailed controls for occupation (25

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occupational dummy variables representing the sub-major groups of the 2000 Standard Occupational Classification (SOC)) and industry (15 dummy variables relating to the Divisions of the 1992 Standard Industrial Classification or aggregations thereof) as a proxy for the direct impacts of working conditions upon work-related ill-health. Given the large sample sizes available from the LFS, this level of detail is far greater than that which could be implemented using other sources. Nonetheless, whilst occupational groups bring together jobs characterised by similar work tasks, within group heterogeneity in exposure to risk will remain. The effect of the omission of variables that control for working conditions on the estimated relationship between age and work-related ill-health is examined in an analysis of the EWCS (see Appendix 2).

4.   Results

Descriptive statistics

In terms of identifying the prevalence of work-related health problems the nature of the survey question is critically important. Table 1 presents the number and rates of work-related health problems reported for (1) those who have ever worked (column 1) and (2) those currently in work (column 2). For the latter it also presents data on work-related health which stem from the current job only (column 3). The higher rate of work-related health problems among the working-age sample implies that work-related health problems are more prevalent among those currently out of work than those in employment (statistically significant at the 5% level in each case). This is consistent with some work-related health problems contributing to withdrawal from employment but persisting (or emerging) after an individual has finished work. The proportion of workers reporting health problems declines when the focus is on those related to current employment since this measure excludes current problems which stem from a previous job. Analysis by type of condition suggests that MSDs are more sensitive than SDA to both employment selection and focussing on conditions stemming from current employment.

In light of concerns regarding the subjective nature of the work-related ill-health measure, Table 1 also presents information on the proportion of LFS respondents reporting that they had days off during the survey reference week, that is, the incidence rather than duration of sickness absence. It is acknowledged that sickness absence is also not an objective measure of work-related ill-health. The impact of economic incentives on injury reporting and absenteeism have been investigated in empirical studies, both in terms of the generosity of compensation

payments (see Currington 1986, Wooden 1989 and Lanoie 1992) and in terms of broader economic environment (see Barmby *et al*., 1991, Boone and van Ours 2007, Davies *et al*., 2009). Nonetheless, it can be seen that levels of sickness absence are higher among those suffering a work-related ill-health condition (7.0%) compared to those with no such conditions (2.7%). Levels of sickness absence are also lower among those who suffer from a work-related ill-health condition but who are no longer employed in the job which caused that condition. Whilst this is suggestive of the potential importance of occupational selection in mitigating the effects of work-related ill-health, these differentials were not estimated to be statistically significant.

Table 1. Prevalence of Work-related Health Problems

	1. Working-age	2. In-work		3. In-work relating to current job	
	Work-related health problem (H_{it})	Work-related health problem (H_{it})	Sickness absence	Work-related health (HMJ_{it})	Sickness absence
Work-related health problem					
No	95.06	95.72	2.69	96.56	2.71
Yes	4.94	4.28	7.00	3.44	7.60
Specific health conditions					
MSD	2.42	2.01	5.79	1.57	6.41
SDA	1.47	1.39	8.35	1.15	9.03
All	100	100	2.87	100	2.87
N	251,322	200,135		200,098	

Notes: The data are unweighted as the application of sample weights did not significantly affect the estimates. Rates of sickness absence are specific to relevant population.

The issue of work-related ill-health and withdrawal from employment is examined further in Table 2. Rates of work-related ill-health are generally higher among the working-age population compared to those who in work and that the scale of this differential increases with age. The relative withdrawal from employment of those suffering an ill-health condition increases with age, although it is particularly apparent among those aged 45 and over. As a result, the age related gradient in work-related ill-health is shallower among the in-work population compared to the overall population of working-age. In terms of job selection, overall

81% of those in employment and who are suffering from a work-related ill-health condition are at the time of the survey still employed in the same job that caused their ill-health condition. It is only among the oldest age group where the proportion who are no longer employed in the same job that caused their ill-health condition increases to approximately 1 in 4 workers. In themselves, these results do not suggest that job selection increases with age.

Table 2: Work-Related Health Problems, Age and Employment

	Working-age			In-work	
		Employment rate			Percentage employed in same job that caused problem
	Work-related health problem (H_{it})	$H_{it} = 0$	$H_{it} = 1$	Work-related health problem (H_{it})	
Age 16-24	1.94	81.80	78.81	1.87	77.02
Age 25-29	3.33	83.39	83.65	3.34	80.42
Age 30-34	3.82	82.67	80.90	3.74	80.44
Age 35-39	4.24	83.06	79.52	4.07	83.23
Age 40-44	5.23	84.62	80.56	4.99	80.62
Age 45-49	5.67	84.44	74.60	5.05	81.38
Age 50-54	6.54	81.08	67.73	5.52	83.78
Age 55-59	7.07	69.60	52.75	5.45	80.93
Age 60+	8.33	56.29	32.17	4.94	73.48
Total	4.94	80.19	68.98	4.28	81.08
N	251,322	238,907	12,415	200,135	8,489

Table 3 considers work-related health problems and withdrawal from employment by both gender and type of ill-health condition. Across the population of working-age, overall rates of work-related ill-health are observed to be higher among men than women. However, women are more likely to suffer from SDA related conditions and constitute a majority of the working-age population who suffer from such conditions. Participation in employment is higher among men than women, although, in line with previous studies, suffering from an ill-health condition is associated with a larger reduction in the rate of employment among men. This is particularly evident among men suffering from MSDs. This relatively high rate of withdrawal from employment among men contributes to a narrowing of the gender differential in the incidence of ill-health arising from MSDs among those in employment. In terms of job selection, men who are in employment and who are suffering from MSDs are less likely than women to still be employed in the same job that caused their ill-health condition.

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Table 3: Work-Related Health Problems, Gender and Employment

	Working-age			In-work	
	Work-related health problem (H_{it})	Employment Rate		Work-related health problem (H_{it})	Percentage employed in same job that caused problem
		$H_{it} = 0$	$H_{it} = 1$		
All					
Male (55.6%)	5.44	84.5	65.7	4.28	79.1
Female (44.4%)	4.43	75.9	73.1	4.28	83.3
Total (100%)	4.94	80.2	69.0	4.28	81.1
MSD					
Male (28.7%)	2.81	84.0	64.5	2.17	76.4
Female (20.4%)	2.03	75.9	68.1	1.83	82.1
All (49.1%)	2.42	80.0	66.0	2.01	78.8
SDA					
Male (13.6%)	1.33	83.6	71.0	1.13	83.5
Female (16.3%)	1.62	75.7	78.8	1.69	82.6
All (29.9%)	1.47	79.7	75.3	1.39	83.0
N	251,322	238,907	12,415	200,135	8,489

Despite low rates of work-related ill-health among the employed population and only a minority of sufferers indicating that they were no longer in the same job, the large sample sizes associated with pooled LFS data provide the opportunity to examine differences in the occupations currently held among those who suffer a health problem acquired in their current job compared to the occupations held by those who acquired their condition in a previous job. Significantly, the size of the LFS sample allows the issue of job selection to be examined separately for those suffering from different types of ill-health condition. Table 4 demonstrates that among those in employment suffering from MSDs, the proportion that are employed in Skilled Trades (manual occupations) declines from 21% among those who remain employed in the same job that caused their ill-health condition to 12% among those whose condition was caused by a previous job. Among those suffering from SDA conditions, there is a shift in employment away from occupations associated with higher levels of skills and responsibility. The proportion employed within Major Groups 1 to 3 of SOC falls from 61% among those who remain employed in the same job that caused their ill-health condition to 43% among those

whose condition was caused by a previous job. A majority of this decline can be accounted for by an increase in employment within less well paid administrative and sales occupations.

Table 4: Work-Related Health Problems and Occupational Selection among the Employed

Current Occupation (SOC 2000 Major Groups)	Any work-related health problem		MSD		SDA	
	Current Job	Previous Job	Current Job	Previous Job	Current Job	Previous Job
1. Managers and Senior Officials	14.24	14.26	10.09	13.52	20.26	14.83
2. Professional Occupations	14.95	8.28	9.96	6.88	21.39	11.86
3. Associate Professional and Technical Occupations	17.81	13.95	16.27	12.81	19.48	16.53
4. Administrative and Secretarial Occupations	9.47	13.76	7.58	12.93	12.65	18.43
5. Skilled Trades Occupations	14.34	9.96	20.50	11.86	5.22	5.30
6. Personal Service Occupations	8.09	6.91	8.69	6.64	7.04	8.26
7. Sales and Customer Service Occupations	5.01	8.84	5.06	7.35	5.04	10.81
8. Process, Plant and Machine Operatives	7.74	11.21	11.17	14.00	3.78	5.72
9. Elementary Occupations	8.32	12.76	10.67	14.00	5.09	8.05
Total	100	100	100	100	100	100
N	6,883	1,606	3,141	843	2,300	472

Multivariate Analysis – Employment Selection Effect

Table 5 presents the relative odds of reporting work-related health problems for different age groups within the working-age population and the in-work sample. Controls for other personal characteristics are included but not reported. Odds ratios are derived by taking the exponential of the estimated coefficients in the logistic regressions. An odds ratio significantly higher (lower) than one indicates higher (lower) odds of reporting work-related ill-health compared to the base group (16-24 years). The first set of models reported under column 1 provides estimates related to all work-related ill-health conditions. For both men and women among the working-age population we see a gradual increase in the odds of reporting work-related health problems with age, holding all other characteristics constant. This gradient is observed to be steeper for men than women. In contrast, among the in-work population we observe the risk of work-related health declining for both men and women during the five years prior to their respective retirement ages[iv]. This difference reflects the effects of sample selection which appear to be particularly pronounced among older groups. As such, among older groups, and

consistent with health being an important predictor of early retirement, those in work are a relatively healthy subset of the population which exerts a downward bias on the estimated effect of age on work-related ill-health. Analyses based on samples of employees thus provide a potentially misleading conclusion with respect to the relationship between age and work-related health.

In the second and third panels, we compare the influence of selection on age by the type of health condition. Two things are apparent. First, age has a larger influence on MSDs than SDA health problems, as indicated by the greater variation in odds ratios over the age distribution. This is evident among both men and women, although men appear to be relatively more susceptible to suffering a MSD related ill-health condition at a younger age. Second, the influence of selection identified above works predominately through its influence on MSDs rather than SDA since differences in the odds ratios between the working-age and in-work samples are less pronounced with respect to SDA conditions. The difference between MSDs and SDA suggests either that work-related SDA health problems are less likely to cause older groups to exit employment or, that these problems are less likely to persist among those not in employment. For both men and women, the risk of suffering from SDA related health problems follows a parabolic trajectory with respect to age. The declining risk of SDA related conditions among older groups is observed across both the working-age population and those who are in employment. This decline is particularly noticeable among men, among whom those over the age of 60 are the least likely of any age group to suffer from SDA related health problems.

Multivariate Analysis – Health Problems Relating to Current Job
Table 6 reports the odds ratios for the in-work sample, where we contrast results for work-related health problems stemming from any job held compared to health problems stemming from a job that is currently held. Considering results from the first set of models that provide estimates related to all work-related ill-health conditions, it can be seen that the age-health gradient is far shallower where the sample is restricted to health conditions caused by a current job. This is consistent with the cumulative impact of exposure over time contributing to an increased chance of reporting work-related health problems relating to a previous job held by older workers. By restricting the analysis to work-related health problems stemming from current employment, the risk is substantially underestimated for older workers. Interestingly, however, even after accounting for longer average tenure (and thus cumulative exposure), older

workers remain more at risk in their current job than the 16-24 group. This increased risk indicates the susceptibility of older workers to current work-related health risks.

Panels 2 and 3 present odds ratios by age group for MSDs and SDA respectively. For MSDs, the age work-related health gradient shallows considerably for both men and women when focusing only on current employment. This is consistent with older workers suffering disproportionately from physical work-related health problems arising and persisting from previous jobs held. A less consistent picture however emerges in terms of SDA. Among women, there is less difference in the influence of age on all work-related health problems and work-related health problems stemming only from the current jobfor SDA related conditions than MSDs. This could suggest that SDA is primarily related to current employment and, consistent with the analysis of selection into employment: that the effect of SDA does not tend to persist after a change in job. However, among men there is a larger difference in the influence of age on SDA related health problems when comparing those conditions stemming from all jobs and conditions arising from current employment only. This could indicate that ill-health conditions acquired in jobs previously held men are more likely to persist. Further examination of the data reveals that women aged 16-24 who report suffering from a work-related SDA are more likely than men to indicate that their condition was caused by a job previously held (37% compared to 23%). This will inflate the incidence of SDA related ill-health among the reference group in the analysis related to any job, contributing to the estimation of a shallower gradient thereafter. This dampening effect on the age ill-health profile could account for the apparent similarity in the influence of age on SDA related health problems.

Table 5. An Analysis of the Influence of Labour Market Selection on Work-related Health: Logistic Regression based on those of Working-age and those In Work.

Odds Ratio	1. All Conditions				2. MSD				3. SDA			
	Males		Females		Males		Females		Males		Females	
	Working-age	In-work	Working-age	In-work	Working-age	In-work	Working-age	In-work	Working-age	In-work	Working-age	In-work
Age 25-29	1.798***	1.560***	1.297***	1.323***	2.179***	1.799***	1.501***	1.523***	2.215***	2.105***	1.672***	1.94***
	(6.82)	(4.59)	(3.31)	(3.2)	(6.15)	(4.23)	(3.14)	(2.94)	(4.76)	(3.66)	(4.1)	(4.63)
Age 30-34	2.176***	1.820***	1.354***	1.337***	2.531***	1.987***	1.580***	1.424**	2.891***	2.641***	1.62***	1.837***
	(9.6)	(6.53)	(3.98)	(3.38)	(7.72)	(5.18)	(3.67)	(2.49)	(6.68)	(5.01)	(3.89)	(4.25)
Age 35-39	2.393***	1.954***	1.536***	1.484***	2.948***	2.253***	1.956***	1.834***	3.189***	2.846***	1.73***	1.926***
	(11.08)	(7.5)	(5.87)	(4.78)	(9.29)	(6.33)	(5.68)	(4.54)	(7.44)	(5.49)	(4.53)	(4.68)
Age 40-44	2.985***	2.489***	1.889***	1.782***	3.763***	2.976***	2.486***	2.245***	3.602***	3.309***	2.096***	2.288***
	(14.2)	(10.44)	(8.91)	(7.18)	(11.65)	(8.71)	(7.91)	(6.22)	(8.3)	(6.35)	(6.25)	(6.04)
Age 45-49	2.941***	2.336***	2.303***	1.994***	3.69***	2.686***	3.01***	2.377***	3.539***	3.083***	2.618***	2.675***
	(13.86)	(9.55)	(11.76)	(8.55)	(11.38)	(7.75)	(9.64)	(6.62)	(8.1)	(5.89)	(8.18)	(7.19)
Age 50-54	3.303***	2.383***	2.766***	2.375***	4.01***	2.511***	3.953***	3.186***	3.737***	3.347***	2.576***	2.686***
	(15.41)	(9.69)	(14.37)	(10.67)	(12.12)	(7.1)	(12.17)	(8.94)	(8.43)	(6.3)	(7.88)	(7.08)
Age 55-59	3.944***	2.633***	2.753***	2.145***	4.603***	2.914***	4.364***	3.119***	3.384***	2.912***	2.287***	2.264***
	(17.98)	(10.8)	(14.21)	(9.01)	(13.49)	(8.3)	(13.09)	(8.55)	(7.74)	(5.46)	(6.73)	(5.55)
Age 60+	3.928***	2.227***			4.842***	2.571***			2.111***	1.593**		
	(17.65)	(8.18)			(13.83)	(6.81)			(4.4)	(2.02)		
N	126,986	105,949	124,336	94,186	126,974	105,945	124,327	94,181	126,974	105,945	124,327	94,181
Likelihood Ratio (p-value)	1734.34 (0.00)	798.41 (0.00)	1166.18 (0.00)	868.74 (0.00)	1348.44 (0.00)	609.29 (0.00)	728.56 (0.00)	443.4 (0.00)	369.54 (0.00)	300.98 (0.00)	588.93 (0.00)	464.24 (0.00)

Notes to table: The dependent variable is work-related health (H_{it}) (see text for details). Z statistics reported in parenthesis. *,**, *** indicate significance at the 10%, 5% and 1% level respectively. Odds ratios are estimated from a logistic regression on the working-age sample and the in-work sample where the dependent variable relates to All Conditions (column 1), MSDs (column 2) and SDA (column 3). Controls of personal and survey characteristics included (see Appendix 1)

Table 6. An Analysis of Work-related Health relating to Current Employment: Logistic Regression based on those In Work

Odds Ratio	1. All Conditions				2. MSD				3. SDA			
	Males		Females		Males		Females		Males		Females	
	Any Job	Current Job	Any Job	Current Job	Any Job	Current Job	Any Job	Current Job	Any Job	Current Job	Any Job	Current Job
Age 25-29	1.553***	1.250**	1.272***	1.115	1.736***	1.573***	1.498***	1.234	2.188***	1.635**	1.767***	1.767***
	(4.45)	(2.03)	(2.7)	(1.07)	(3.9)	(2.85)	(2.78)	(1.28)	(3.77)	(2.1)	(3.93)	(3.27)
Age 30-34	1.831***	1.359***	1.334***	1.129	1.931***	1.487**	1.433**	1.112	2.796***	2.064***	1.773***	1.604***
	(6.38)	(2.9)	(3.27)	(1.21)	(4.82)	(2.54)	(2.47)	(0.64)	(5.12)	(3.22)	(3.92)	(2.68)
Age 35-39	1.951***	1.446***	1.522***	1.291***	2.194***	1.802***	1.878***	1.513***	2.932***	1.953***	1.936***	1.800***
	(7.16)	(3.55)	(4.89)	(2.62)	(5.89)	(3.9)	(4.56)	(2.66)	(5.4)	(2.98)	(4.58)	(3.38)
Age 40-44	2.501***	1.720***	1.816***	1.49***	2.961***	2.144***	2.291***	1.848***	3.316***	2.266***	2.272***	1.987***
	(9.98)	(5.28)	(7.08)	(4.16)	(8.3)	(5.1)	(6.12)	(4.04)	(6.06)	(3.67)	(5.79)	(3.99)
Age 45-49	2.354***	1.624***	2.014***	1.612***	2.722***	1.951***	2.463***	1.828***	3.019***	2.206***	2.595***	2.294***
	(9.15)	(4.63)	(8.21)	(4.92)	(7.5)	(4.37)	(6.57)	(3.89)	(5.49)	(3.5)	(6.68)	(4.81)
Age 50-54	2.406***	1.666***	2.431***	2.006***	2.571***	1.861***	3.373***	2.721***	3.248***	2.342***	2.608***	2.293***
	(9.26)	(4.81)	(10.28)	(7.12)	(6.95)	(4)	(8.87)	(6.52)	(5.81)	(3.74)	(6.52)	(4.7)
Age 55-59	2.682***	1.759***	2.281***	1.894***	2.972***	2.172***	3.407***	2.690***	2.887***	1.987***	2.312***	2.187***
	(10.42)	(5.3)	(9.08)	(6.24)	(8.06)	(5.02)	(8.66)	(6.23)	(5.14)	(2.95)	(5.38)	(4.26)
Age 60+	2.313***	1.477***			2.607***	1.830***			1.727**	1.266		
	(8.15)	(3.34)			(6.6)	(3.62)			(2.28)	(0.88)		
N	105,917	105,897	94,158	94,141	105,913	105,683	94,087	94,071	105,415	105,395	94,153	94,137
Likelihood Ratio (p-value)	1194.69 (0.00)	1099.97 (0.00)	1397.20 (0.00)	1526.81 (0.00)	996.97 (0.00)	910.77 (0.00)	795.21 (0.00)	844.72 (0.00)	708.95 (0.00)	678.78 (0.00)	854.02 (0.00)	901.60 (0.00)

Notes to table: Z statistics reported in parenthesis. *,**, *** indicate significance at the 10%, 5% and 1% level respectively. Odds ratios are estimated from a logistic regression on the in-work sample, where the dependent variable is work-related health or work-related health stemming from All Conditions (column 1), MSDs (column 2) and SDA (column 3). Controls for personal, survey and employment characteristics are included (see Appendix 1). The sample is restricted to those currently in employment.

5. Discussion and Conclusion

The HSE module in the UK LFS provides an important source of regular and timely information on rates of self-reported work-related health problems. Due to its sample size and the availability of personal and employment related characteristics, the LFS also provides an opportunity to examine the relationships between job and personal characteristics and work-related ill-health. A particularly important characteristic of the LFS data is that distinguishes between health conditions caused by jobs currently and previously held. For those who may have switched occupation as a consequence of their health condition, current job characteristics will be particularly unrepresentative of the risk factors that caused their health problem. These issues are particularly pertinent to understanding the health characteristics of aging workforce. Here, we use these data to highlight the potential bias associated with (1) ignoring selection into employment and (2) focusing on work-related health stemming from an individual's current job. Both issues are relevant to much of the existing literature which largely relies on observations from employed individuals within cross sectional surveys. This analysis is able to retain the benefits of using cross sectional data, namely, that of sample size and the specific focus on work-related health but, by using unique questions within the LFS, we circumvent the need for more advanced statistical methods. As such, the paper provides a simple and direct analysis of the bias associated with these issues.

Since the costs of work-related injury or illness to the economy are substantial (£14 billion in 2009/10 according to the HSE, 2011), accurate evidence for policy makers interested in the health and well-being of older workers is clearly of importance. There are a number of important findings. Among the working-age population, the risk of suffering from work-related ill-health conditions increases monotonically with age. In contrast, for those in work, this risk declines during the 5 years prior to retirement, consistent with the relative withdrawal from employment of older workers who report work-related health problems. Among those in employment, the effect of age on work-related health is more pronounced if health problems stemming from a previous job are included in the analysis. This is consistent with the cumulative effect of exposure over the lifecycle and reinforces need to consider an individual's entire work history in the analysis of work-related health. We find that both these issues are more pronounced for MSDs than SDAs, suggesting that it is MSDs which are more likely to persist after the individual leaves the causal occupation. SDA related conditions are less likely to persist among the non-employed population, although they do appear to persist among those

in employment who are no longer employed in the job that is associated with the cause of that condition. The analysis reveals that evidence based from samples of *workers* which focuses only on the contemporaneous link between work and health could contribute to an underestimate of work-related health risks associated with both the increasing concentration of older workers and the move to extend working lives in Britain.

It is nonetheless important to highlight several limitations of the LFS in this type of analysis. First, the analysis relies on subjective work-related health information provided by the individuals themselves. While this is typical in analysis of this type, such information is subject to measurement error and/or reporting bias. The particular concern for this study is that reporting may differ by employment status and, thus, the analysis of selection bias will incorporate systematic differences in self-reporting between these two groups. Second, since the LFS it not specialist survey of working conditions, it does not collect information on some important determinants of work-related ill-health and these are unlikely to be captured fully by controls for occupation and industry. Third, the analysis is restricted by the cross sectional nature of the data available and thus we are able to identify associations rather than causal relationships. In particular, in cross sectional analysis the influence of age will capture any unobservable difference between cohorts.

There are a number of implications arising out of this research in terms of improving our understanding of work-related ill-health. Firstly, official statistics from the UK Health and Safety Executive which currently present rates of ill-health by age among those who have worked during the last 12 months should be extended to cover those who have not worked in the last 12 months so that a more complete picture of work-related ill-health is presented for older groups of the population. The abolition of the Default Retirement Age and increase in the State Pension Age also places greater emphasis on achieving higher levels of granularity with respect to age towards the older end of the age distribution. Given the increasingly atypical nature of employment, rates of ill-health reported as a percentage of workers may also become increasingly inappropriate and could also be adapted to use 'full-time equivalent' employment bases to more accurately capture levels of exposure to risk among workers who may work part-time or have multiple jobs. However, in the face of competing claims on national surveys and falling response rates generally, it is clearly difficult for the LFS to contain all variables necessary to understand the determinants of work-related ill-health, although there may be reason to locate groups of variables asked once per year within the same quarter. Given the

central importance of work to well-being, measures of job demand and job control should be included in the LFS as a matter of routine. At present, this information is only available intermittently from surveys with relatively small sample sizes such as the EWCS or the Skills and Employment Survey. Further, most information in the LFS is collected contemporaneously, and may not therefore reflect the working conditions in the causal job. In the UK, the introduction of work-related health questions in addition to general health questions in *Understanding Society* would enable researchers to trace the work history of individuals and examine more clearly how the nature of employment contributes to the risk of work-related health over the life course. Since *Understanding Society* collects bio-medical information and asks respondents for their consent to link their survey responses to other sources of data held about them, such an extension may also facilitate analysis of the reliability and comparability of subjective and objective measures of work-related health.

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Appendix 1: Definitions of Explanatory Variables

Personal Characteristics	
Age	16-24yrs (ref), 25-29yrs, 30-34yrs, 35-39yrs, 40-44yrs, 45-49yrs, 50-54yrs, 55-59yrs, 60+yrs
Ethnicity	White (ref), Mixed, Asian, Black, Chinese, Other
Region	Government Office Regions
Highest Qualification Obtained	Degree or equivalent, Other Higher Education, GCE A-level, GCSE Grades A-C, Other qualifications, None (ref), Don't Know
Survey Variables	
Year of survey	2004 (ref) – 2007 inclusive
Wave of survey	Wave 1(ref) – Wave 5 inclusive
Proxy response	Personal response, Spouse/Partner proxy, Other proxy
Employment Variables (all refer to current main job)	
Total usual weekly working hours	0/-15hrs, 16-30hrs, 31-40hrs, 41-50 hrs, 51-60hrs, 61 hrs+
Occupation	25 occupational dummy variables representing the sub-major groups of SOC 2000
Industry	15 dummy variables relating to the Divisions of SIC92 or aggregations thereof
Number of employees at workplace	1-10 (ref), 11-19, 20-24, don't know but under 25, 25-49, 50-249, 250-499, don't know but between 50-499, 500 or more
Tenure	Less then 3 months (ref), 3-6 months, 6-12 months, 1-2 years, 2-5 years, 5-10 years, 10-20 years, 20 years or more
Employment status	Permanent employee (ref), temporary employee, self-employed

Appendix 2: Age, Work-Related Ill-Health and the Effect of Controlling for Working Conditions: Analysis of the European Working Conditions Survey (EWCS)

To investigate the effects of omitted variable bias on estimates of the relationship between age and work-related ill-health, additional analysis has been undertaken on the 2010 EWCS. The survey asked respondents *Does your work effect your health or not?* Unlike the 2005 EWCS, specific work-related ill-health conditions cannot be distinguished. Approximately 28% report that work negatively affects their health. Two separate logistic regression models are estimated. In both cases, the dependent variable is a 0/1 variable indicating whether or not a respondent reports that their work adversely effects their health. The first model utilises a parsimonious specification, where the explanatory variables utilised are broadly comparable to those included in the analysis of the LFS and include controls for gender, age, workplace size, sector, hours, second job holding, qualifications, industry (21 dummy variables relating to the 1 digit level of European Classification of Economic Activities, NACE) and occupation (39 dummy variables relating to the 2 digit level of 2008 International Standard Classification of Occupations, ISCO). The second model introduces additional control variables relating to exposure to a variety of physical, ergonomic and psycho-social risk factors (see Parent-Thirion *et al.*, 2007). Due to its small sample size data is pooled across all 34 countries covered by the survey. Country specific dummy variables are also included in the regression models.

The results of the analysis are presented in Table A.1. The estimated age ill-health profile derived from the parsimonious model is very similar to that derived in relation to current employment from the LFS. It can also be seen that the relationship between age and ill-health derived from the parsimonious model is very similar to that derived from the full model among the 25-54 age range. Larger differences do emerge among those over the age of 55, particularly among those aged 60 and over. The reduction in the risk of work-related ill-health among older workers that is derived from the parsimonious model is less apparent within the model that also includes control variables for working conditions. This could indicate the selection of older workers in to jobs with lower risk factors that are commensurate with their ill-health conditions. Once this reduced exposure to risk is taken into account, older workers are estimated to exhibit a higher risk of work-related ill-health within the jobs that they currently hold. In terms of the implications for the LFS based analysis, the relative risks of work-related ill-health among older workers could be being under-estimated. However, this finding would not be expected to influence the overall finding the age/ill-health profile is shallower if only the effects of current

employment upon health are considered, which is in itself an important limitation of the EWCS data.

Table A.1 Estimates of Age and Work-Related Health Problems Derived from the 2010 EWCS

	Odds Ratio	
	Parsimonious Model	Full Model
Age 25-29	1.261***	1.278***
	(3.67)	(3.63)
Age 30-34	1.242***	1.281***
	(3.46)	(3.70)
Age 35-39	1.392***	1.414***
	(5.39)	(5.27)
Age 40-44	1.503***	1.533***
	(6.69)	(6.55)
Age 45-49	1.618***	1.675***
	(7.92)	(7.90)
Age 50-54	1.619***	1.653***
	(7.77)	(7.55)
Age 55-59	1.572***	1.682***
	(6.98)	(7.47)
Age 60+	1.223**	1.487***
	2.03	(3.73)
N	328,44	328,44
Likelihood Ratio Chi Squared (p-value)	3487.9 (0.00)	7236.7 (0.00)

Notes to table: Z statistics reported in parenthesis. *,**, *** indicate significance at the 10%, 5% and 1% level respectively.

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[i] For full details of the LFS sample and questionnaires see: http://www.esds.ac.uk/government/lfs/.

[ii] The 11 groups are listed as follows (1) Bone, joint or muscle problems connected to arms, hands, neck or shoulder (2) hips, legs or feet or (3) back (4) breathing or lung problems (5) skin problems (6) hearing problems (7) stress, depression or anxiety (8) headache and/or eyestrain (9) heart disease/attack or other problems of the circulatory system (10) infectious diseases and (11) other. All these conditions are included in the overall measure of work-related ill-health.

[iii] Potentially some individuals who join the LFS during the same quarter as the HSE module may be observed twice within our data (one year apart). Wave 1 interviews are also conducted 'face to face', whilst a majority of interviews conducted in later waves are generally conducted by telephone, potentially contributing to response bias between different waves of the survey.

[iv] During the period covered by this analysis, the state retirement age was 65 for men and 60 for women, prior to moves in the UK to equalise the state pension age which commenced in 2010.