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**Mid-Career Work Patterns and Physical and Mental Functioning at Age 60-64:  
Evidence from the 1946 British Birth Cohort**

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## ABSTRACT

**Background:** Previous studies of the associations between unemployment and health have primarily focused on mental health and long-term associations have not often been explored. This study investigated if discontinuous employment in mid-career was related to self-reported physical and mental functioning at age 60-64 years.

**Methods:** Data come from the MRC National Survey of Health and Development, a British cohort that has been followed-up since birth in 1946. 2061 study members had data available on mid-career employment patterns and physical and mental functioning assessed using the Short Form 36 questionnaire at age 60-64. Employment patterns in mid-career were categorized into: 1) continuous employment; and discontinuous employment during: 2) early period (ages 36-43); 3) late period (ages 43-53); and 4) both periods.

**Results:** Continuous employment was reported by 63.3% of men and 38.7% of women, while 8.7% of men and 23.4% of women reported being in discontinuous employment during both early and late mid-career. Compared to those in continuous employment those in discontinuous employment during both early and late mid-career had poorer physical functioning, men adjusted  $\beta$  (difference in mean physical functioning T score) -3.84, 95% CI -6.06 to -1.63,  $p=0.001$  and women -3.62, 95% CI -5.17 to -2.08,  $p<0.001$ . Findings were parallel but weaker for those in discontinuous employment during late mid-career. Discontinuous employment during both periods and particularly during late mid-career was associated with poorer mental functioning in early old age.

**Conclusions:** Discontinuous employment during mid-career was associated with poorer self-reported physical and mental functioning around the age of retirement.

**Keywords:** Unemployment, physical functioning, mental functioning, life course epidemiology, ageing

## INTRODUCTION

Ageing of the workforce and the persistently high rates of unemployment<sup>1</sup> together with the global economic uncertainty have fuelled interest in investigating the consequences of employment status and changes in it on health and wellbeing in later life. Research on the association between employment and health has largely focused on confirming the negative influence of unemployment on mental health,<sup>2,3</sup> while a small number of studies have focused on physical health.<sup>2,4</sup> While evidence from cohort studies show that high job strain in midlife is associated with poorer health and functioning in older age,<sup>5,6</sup> there is a need to establish whether the same is true for employment patterns as well. This knowledge will help to estimate the magnitude of potential effects of employment status in older age. Further, unemployment can be hypothesised to lead to both decreased mental and physical health and functioning but the relationship may operate in both directions as decreased health might also subsequently increase the risk of not entering the workforce.<sup>7,8</sup>

Timing of transitions in employment status has been found to be important when considering long-term associations with health outcomes. In this paper we focus on non-employment in recognition of the fact that people may not be in paid employment for either voluntary or involuntary reasons. This is distinct from a focus on unemployment where reasons for not being in paid employment are assumed to be involuntary.<sup>9,10</sup> The reasons for not being in paid work vary across the work career. In early career not being in paid work is more often due to voluntary causes such as studying or caring for the family, whereas during mid-career it is more likely to be caused by involuntary factors such as redundancy or health problems.<sup>9</sup> In the British Household Study employment transitions from paid work to a variety of forms of non-employment were found to have a negative impact on mental health.<sup>10</sup> A recent prospective study found that

unemployment at ages 18 to 21 was associated with poor mental health at ages 21, 30 and 42.<sup>11</sup> A study using data on men from the 1958 British birth cohort found that prolonged unemployment in early career (between ages 16 and 27) was associated with significantly lower health capital (a combined score consisting of body mass index, physical activity, smoking and adherence to a healthy diet), and socioeconomic capital at age 33.<sup>12</sup> In terms of unemployment in late career, a study using data from the Health and Retirement Survey found that it was associated with poorer physical functioning in a two-year follow-up.<sup>13</sup> The mechanisms underlying the associations between employment patterns in midlife and functioning in old age are likely to include material factors such as loss of income but also psychosocial factors such as loss of status which have been shown to be significantly related to health outcomes<sup>14,15</sup>

To the best of our knowledge, few studies have investigated the association between timing of work transitions during mid-career and mental or physical functioning. Further, it is not known whether there are certain time windows i.e. sensitive periods during which time not being in paid employment has a stronger relationship with functioning in later life or whether the accumulation of exposure to not being employed is more strongly related to subsequent functioning.<sup>16</sup> Using prospective data from the nationally representative Medical Research Council (MRC) National Survey of Health and Development (NSHD), the aim of this paper was to investigate if mid-career work patterns (i.e. having gaps in paid employment) were related to self-reported physical and mental functioning in early old age and whether socioeconomic, health or lifestyle factors in adulthood explained these associations.

## **METHODS**

### **Participants**

Data come from the MRC National Survey of Health and Development (NSHD), a socially stratified cohort of 5362 singleton births to married women in March 1946 in England, Scotland and Wales that has been followed from birth every two years in childhood and adolescence and in adulthood at the ages of 26, 31, 36, 43, 53 and 60-64 years.<sup>17,18</sup> At the follow-up at 60-64 years, the study team was still in contact with 3163 members of the original cohort. Of those not contacted, 718 had died, 594 had previously withdrawn from the study, 567 lived abroad and 320 had been untraceable for more than ten years. Of these 3163, 2661 (84.1%) were successfully contacted<sup>18</sup> and 2293 completed all relevant questions on physical and mental functioning, 2061 of whom also had data available on mid-career work patterns between ages 36-53 years. There were no differences in self-reported physical functioning at age 60-64 between those cohort members who had data on mid-career work patterns (n=2061) compared to those who did not have it (n=232) (ANOVA p=0.87), however, mental functioning scores were slightly higher for those who had data on work patterns (ANOVA p=0.039). The study received Multi-Centre Research Ethics Committee approval and informed consent was provided by the participants.

### **Physical and mental functioning**

Self-reported physical and mental functioning were ascertained using the Short Form 36 (SF-36) health survey questionnaire at age 60-64.<sup>19</sup> Eight subscales were generated including physical functioning, role limitations due to poor physical health, bodily pain, general health perception, vitality, social functioning, role limitations due to poor emotional health and mental health on the basis of the questionnaire which consisted of 36 items. All eight subscales with different sex-specific weights obtained from a UK population sample were used to calculate physical and mental component summaries. The scores were transformed into T-scores so that the overall mean for the participants was 50 (SD 10), with a higher score indicating better functioning.<sup>20</sup> The proportion

of missing data for each item ranged from 0.5% to 4.5%. If less than half of the items included in each of the eight subscales were missing, values were imputed for those items missing based on the mean scores of the completed items in that subscale following standard procedures.<sup>21-23</sup>

### **Mid-career work patterns**

In 1989 (age 43) all study members were asked if they had had any spells of 1 month or more when they were not in paid work (referred to here as gaps in employment) between ages 36 and 43 (yes/no). The same question was asked in 1999 for gaps in employment between ages 43 and 53. Together these variables were used to describe mid-career work patterns and were categorised into four mutually exclusive groups 1) continuous employment (no gaps in employment) and three categories of discontinuous employment: 2) early period (gaps in employment between ages 36 and 43 but not ages 43 and 53); 3) late period (no gaps in employment between ages 36 and 43 but gaps between ages 43 and 53); 4) both early and late periods (gaps in employment between ages 36 and 43 and ages 43 and 53). At age 43 and 53 study members were asked whether they had looked for a job or not during gaps in employment. They were also asked about the length of the gaps in employment which was coded as less than one year and one year or more.

### **Covariates**

Based on previous studies,<sup>12</sup> socioeconomic position, health status and lifestyle factors were selected as covariates. Adult occupation was ascertained at age 43 and the British Registrar General's classification was used to assign study members into high (II or III), middle (IIINM or IIIM) or low (IV or V) occupational class. Highest educational level attained by age 26 was coded as degree or higher; A levels, usually achieved at age 18, or their equivalent; O levels, usually

achieved at age 16, or their equivalents; Certificate of Secondary Education, clerical course, or equivalent; and no qualifications. Health status was assessed at age 36 using a derived measure including measured blood pressure, lung function, body weight, self-reported health problems and disability and recent hospital admissions and was coded as best, intermediate or worst health.<sup>24</sup> To account for lifestyle and conditions in later life we used factors ascertained at age 53. Smoking history was coded as current, former or never smoker. Study members were asked about participating in exercise, vigorous activity or sports, which was coded as no participation, participation in relevant activities 1-4 times per month or participation at least 5 times per month. Body mass index, BMI [ $\text{kg}/(\text{m}^2)$ ] was calculated using measured weight and height. For sensitivity analyses we adjusted for working status at age 60-64 years which was coded into working; retired but working full- or part-time; retired; and housewife/unemployed).

### **Statistical analyses**

Characteristics of the cohort members were compared across mid-career work pattern categories using analyses of variance for continuous variables and  $\chi^2$ -square test for discrete variables. Using generalized linear regression models we investigated the associations between mid-career work patterns and physical and mental functioning in early old age. Men and women were analysed separately because of the different patterns of work career and reasons for not being in paid employment.<sup>10</sup> First the analyses were adjusted for educational attainment and occupational class and then for adult health status and lifestyle factors. In order to obtain a dataset with complete data on all main variables and covariates, we imputed values for covariates using multiple imputations (occupational class n=27, education n=102, BMI n=12, physical activity n=1 and adult health status n=153; maximum proportion of data missing was 7.4%). A total of 20 imputed

datasets were created using all variables in the analyses together with data on the same covariates collected at different ages. Regression models were first performed using complete data available for all main variables and covariates and then using multiply imputed datasets combining the effect estimates using Rubin's rules. While these results were very similar, we present findings on imputed data; the models using complete data are presented as Table S1. All tests were performed two-tailed, the level of significance was set at  $p < 0.05$  and analyses were carried out with SPSS IBM version 20.0 (SPSS, Armonk, NY, IBM Corp).

## RESULTS

Of the 2061 cohort members included in the analytical sample approximately 16% of men reported gaps in employment during early and 30% during late mid-career (Table 1). Of men who reported gaps in employment, approximately 67% were looking for employment in early and 34% in late mid-career. At both time points during mid-career,  $\geq 50\%$  of the reported gaps in employment had lasted  $\leq$  one year. Among women approximately 49% reported gaps in employment during early and 37% during late mid-career. Of those women who reported gaps in employment, 20% were looking for employment in early and 64% in late mid-career. At both time points during mid-career  $\geq 50\%$  of the reported gaps in employment had lasted  $\geq$  one year. Using these data we constructed the mid-career work pattern categories (Table 1, lower panel). 63.3% of men and 38.7% of women reported continuous employment during mid-career, while 8.7% of men and 23.9% of women reported discontinuous employment during both early and late mid-career. The remaining participants had discontinuous employment patterns either during early (men 7.2% and women 24.8%) or late (men 20.8% and women 12.6%) mid-career. Among men there were several differences in socioeconomic and lifestyle factors across mid-career work pattern categories (Table 2). Men in discontinuous employment during both early and late mid-

career had lower educational attainment, belonged more often to the low or middle occupational class and were more often smokers compared with men in continuous employment ( $p < 0.012$ ). There were fewer differences between the women in the different work pattern categories with the exception of greater prevalence of inactivity among those in discontinuous employment during both early and late mid-career when compared with those in the other work pattern categories ( $p = 0.024$ ).

Men and women in discontinuous employment during both early and late mid-career or during late mid-career only had lower mean physical and mental functioning scores in early old age compared to those in continuous employment. There were no such differences for those in discontinuous employment during early mid-career only (Table 3). Unstandardized regression coefficients confirmed that compared to those in continuous employment (reference) the study members in discontinuous employment during both early and late mid-career had poorer physical functioning, men  $\beta$  (difference in mean physical functioning T score)  $-4.84$ , 95% CI  $-7.09$  to  $-2.60$ ,  $p < 0.001$  and women  $\beta$   $-4.02$ , 95% CI  $-5.64$  to  $-2.40$ ,  $p < 0.001$ . The findings were similar but weaker for those in discontinuous employment during late mid-career only. Adjustment for covariates did not markedly alter the size of these associations. Discontinuous employment during both early and late mid-career and during late mid-career only were associated with poorer mental functioning compared to the reference in both men and women (Table 3). Adjustment for covariates did not attenuate the associations notably.

Insensitivity analyses, to check that associations were not driven by poor health status we excluded those with poor health at age 36 years from analyses but this did not change our main findings. In order to control for employment status in late career we further adjusted for working

status at age 60-64 years (i.e. working or retired but working full- or part-time, retired or housewife/unemployed) but this did not attenuate the associations.

## **DISCUSSION**

In the NSHD, we found that discontinuous employment during late or during both early and late mid-career was associated with poorer physical and mental functioning in early old age among men and women. These associations remained significant after adjustment for adult socioeconomic position, lifestyle factors and health status. Cumulative exposure to unemployment across the mid-career period was associated with poorer physical functioning, whereas, for mental functioning, proximity of exposure to unemployment was more relevant than accumulation of exposure. The present findings also indicate that re-employment, which may have been the case for those who had gaps in employment during early period in midlife only, was not associated with physical or mental functioning which thus support findings from previous studies where re-employment was found to have beneficial effects on health outcomes.<sup>25</sup>

Our findings on the associations between mid-career work patterns and self-reported physical and mental functioning in early old age are in accordance with the few published studies, one of which showed that prolonged unemployment during early career reduced health capital at age 33.<sup>12</sup> A Norwegian study<sup>11</sup> reported that the accumulation of periods of unemployment between ages 18 and 42 was detrimental for mental health. In line with our non-significant finding on the association between discontinuous employment in early mid-career and mental functioning at age 60-64 years, Strandh et al. found that a single unemployment spell at age 21-30 years was not related to poorer mental health at age 42 years.<sup>11</sup> However, contrary to our findings they found that a single unemployment spell at age 30-42 years was not related to poorer mental health at

age 42 years, thus indicating that there was no association between recent exposure to unemployment and mental functioning. This difference in findings might partly be related to differences between studies in the ages at assessment of both unemployment and outcomes.

In the present study, the associations between employment patterns during mid-career were more strongly associated with physical functioning in early old age. As far as we are aware, only a few studies have investigated the relationship between unemployment and physical and mental functioning in older age. Gallo and colleagues<sup>13</sup> found that job loss during late career was associated with poorer physical functioning two years later, which is consistent with our findings on the relationship between discontinuous employment in late mid-career and poor physical functioning. However, given the limited number of studies on the association between employment patterns and physical functioning and the short length of follow-up in these studies our study is the first to test if there is a cumulative association or whether there are certain sensitive periods during which time exposure to unemployment<sup>26</sup> is more important in terms of subsequent physical functioning.

We focused on employment during mid-career, which is typically a time period when education has been completed and children have been born and when unemployment is more likely to be caused by involuntary factors such as redundancy.<sup>9</sup> In our study of the women reporting discontinuous employment in early mid-career (age 36-43), less than 20% were looking for work whilst almost two thirds with discontinuous employment in late mid-career (age 43-53) were looking for work. The economic impact of unemployment in mid- or late career is also likely to be more severe than during early career when there is more time to overcome economic setbacks.<sup>12,13</sup> For example, compared to younger employees, older employees have been found to

experience more difficulties in re-employment.<sup>27</sup> Thus, unemployment might be more psychologically and physiologically taxing during late career in that employment carries more meaning than just the material aspects but it also has deeper psychosocial aspects such as shame and loss of status which are likely to have long-term health effects.<sup>14,15</sup> This was supported by the recent finding of Hughes et al.<sup>28</sup> who reported that unemployment was associated with elevated inflammatory markers particularly among older people. Unemployment has been identified as a determinant of higher job strain which has been subsequently shown to be related to poor physical and mental functioning and premature mortality in older age.<sup>6,22</sup> The excessive stress caused by unemployment may increase unhealthy behaviours such as smoking and physical inactivity<sup>29</sup> which are established risk factors for lower levels of physical and mental functioning.<sup>30,31</sup> Although adjustment for lifestyle factors only modestly attenuated the associations between work career patterns and functioning in our study, it is plausible that lifestyle effects are complex and that there is residual confounding in the fully-adjusted analyses.

There has been a debate regarding reverse causality in the association between work status and health outcomes, i.e. it is possible that levels of mental and physical functioning influence employment status as well as the reverse.<sup>7</sup> For example, in the US Panel Study of Income Dynamics job loss due to shutting down an establishment was found to predict poorer subsequent self-reported health among those with no prior health conditions.<sup>32</sup> Opposite findings were however reported in a Finnish study where experiencing unemployment was not associated with subsequent self-rated health but self-rated health was lower among those who were unemployed compared with those who were in continuous employment.<sup>8</sup> To take account of the possibility of reverse causality, we investigated employment patterns in mid-career (rather than late-career) which is a time period when the prevalence of poor physical functioning is relatively low in the

workforce. In addition, we allowed for several confounders including a combined measure of health status at age 36.

The study had several strengths. First, data came from a well-characterized and nationally representative British birth cohort and included persons with a wide range of professions. Second, we were able to use prospective data collected across life. Third, we used the validated and widely used SF-36 physical and mental functioning component scores to ascertain physical and mental functioning. Despite these strengths some limitations need to be acknowledged. Firstly, our measure of midlife employment patterns were constructed based on the reports of the individuals, we did not have objective register-based data available. Furthermore, information was not available on why the cohort members were not looking for work between the ages of 43 to 53 years and we were thus not able to explore the reasons for gaps in employment in more detail. Second, attrition, which is inevitable in such a long prospective study, might cause bias, although the occupational class of the MRC NSHD at ages 60-64 to be similar to the 2001 England Census reference population.<sup>18</sup> Third, we did not have SF-36 measures of mental and physical functioning available in midlife. However, in order to account for functioning in midlife and the possibility of health selection, we adjusted for a composite measure of adult health status and this did not attenuate the associations. Finally the results may be partially explained by residual confounding due to other factors that were not included in our models.

In conclusion, evidence suggests that discontinuous work during mid-career may be associated with poorer physical and mental functioning around the age of retirement. Evidence suggested that accumulation of exposure to unemployment was associated with poorer physical functioning in early old age, whereas proximity of exposure to unemployment was more strongly associated

with poorer mental functioning. These findings highlight the long-lasting effects of unemployment on functioning in old age which until now have not been examined in detail.

**Conflicts of interest**

None declared.

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**Key points:**

- Discontinuous employment during late or during both early and late mid-career was associated with poorer physical and mental functioning in early old age.
- Cumulative exposure to unemployment across the mid-career period was associated with poorer physical functioning, but for mental functioning, proximity of exposure to unemployment was more relevant than accumulation of exposure.
- The findings highlight the long-lasting effects of unemployment on functioning in old age.

## REFERENCES

1. OECD. *OECD employment outlook 2014*. OECD Publishing; 2014.  
[http://dx.doi.org/10.1787/empl\\_outlook-2014-en](http://dx.doi.org/10.1787/empl_outlook-2014-en).
2. McKee-Ryan F, Song Z, Wanberg CR, et al. Psychological and physical well-being during unemployment: A meta-analytic study. *J Appl Psychol* 2005;90:53-76.
3. Paul KI, Moser K. Unemployment impairs mental health: Meta-analyses. *J Voc Behav* 2009;74:264-82.
4. van der Noordt M, Ijzelenberg H, Droomers M, Proper KI. Health effects of employment: A systematic review of prospective studies. *Occup Environ Med* 2014;71:730-6.
5. Wahrendorf M, Sembajwe G, Zins M, et al. Long-term effects of psychosocial work stress in midlife on health functioning after labor market exit-results from the GAZEL study. *J Gerontol B Psychol Sci Soc Sci* 2012;67:471-80.
6. von Bonsdorff MB, Seitsamo J, von Bonsdorff ME, et al. Job strain among blue-collar and white-collar employees as a determinant of total mortality: A 28-year population-based follow-up. *BMJ Open* 2012;2:e000860.
7. Wanberg CR. The individual experience of unemployment. *Annu Rev Psychol* 2012;63:369-96.
8. Bockerman P, Ilmakunnas P. Unemployment and self-assessed health: Evidence from panel data. *Health Econ* 2009;18:161-79.
9. Booker CL, Sacker A. Psychological well-being and reactions to multiple unemployment events: Adaptation or sensitisation? *J Epidemiol Community Health* 2012;66:832-8.
10. Thomas C, Benzeval M, Stansfeld SA. Employment transitions and mental health: An analysis from the british household panel survey. *J Epidemiol Community Health* 2005;59:243-9.
11. Strandh M, Winefield A, Nilsson K, Hammarstrom A. Unemployment and mental health scarring during the life course. *Eur J Public Health* 2014;24:440-5.

12. Wadsworth ME, Montgomery SM, Bartley MJ. The persisting effect of unemployment on health and social well-being in men early in working life. *Soc Sci Med* 1999;48:1491-9.
13. Gallo WT, Bradley EH, Siegel M, Kasl SV. Health effects of involuntary job loss among older workers: Findings from the health and retirement survey. *J Gerontol B Psychol Sci Soc Sci* 2000;55:S131-40.
14. Marmot M, Wilkinson RG. Psychosocial and material pathways in the relation between income and health: A response to Lynch et al. *BMJ* 2001;322:1233-6.
15. Groffen DA, Bosma H, van den Akker M, et al. Lack of basic and luxury goods and health-related dysfunction in older persons; findings from the longitudinal SMILE study. *BMC Public Health* 2008;8:242.
16. Kuh D, Ben-Shlomo Y, Lynch J, Hallqvist J, Power C. Life course epidemiology. *J Epidemiol Community Health* 2003;57:778-83.
17. Kuh D, Pierce M, Adams J, et al. Cohort profile: Updating the cohort profile for the MRC national survey of health and development: A new clinic-based data collection for ageing research. *Int J Epidemiol* 2011;40:e1-9.
18. Stafford M, Black S, Shah I, et al. Using a birth cohort to study ageing: Representativeness and response rates in the national survey of health and development. *Eur J Ageing* 2013;10:145-57.
19. Ware JE, Jr, Sherbourne CD. The MOS 36-item short-form health survey (SF-36). I. conceptual framework and item selection. *Med Care* 1992;30:473-83.
20. Jenkinson C. Comparison of UK and US methods for weighting and scoring the SF-36 summary measures. *J Public Health Med* 1999;21:372-6.
21. Mishra GD, Black S, Stafford M, Cooper R, Kuh D, National Survey of Health and Development scientific and data collection team. Childhood and maternal effects on physical health related quality of life five decades later: The British 1946 birth cohort. *PLoS One* 2014;9:e88524.

22. von Bonsdorff MB, Cooper R, Kuh D. Job demand and control in mid-life and physical and mental functioning in early old age: Do childhood factors explain these associations in a British birth cohort? *BMJ Open* 2014;4:e005578.
23. Ware J, Snow K, Kosinski M, Gandek B. *SF-36 health survey manual and interpretation guide*. Boston new england medical centre: The health institute, new england medical center. Boston, US: Boston New England Medical Centre: The Health Institute, New England Medical Center; 1993.
24. Kuh DJ, Wadsworth ME. Physical health status at 36 years in a British national birth cohort. *Soc Sci Med* 1993;37:905-16.
25. Schuring M, Mackenbach J, Voorham T, Burdorf A. The effect of re-employment on perceived health. *J Epidemiol Community Health* 2011;65:639-44.
26. Hallqvist J, Lynch J, Bartley M, Lang T, Blane D. Can we disentangle life course processes of accumulation, critical period and social mobility? an analysis of disadvantaged socio-economic positions and myocardial infarction in the Stockholm Heart Epidemiology Program. *Soc Sci Med* 2004;58:1555-62.
27. Brouwer S, Bakker RH, Schellekens JMH. Predictors for re-employment success in newly unemployed: A prospective cohort study. *J Voc Behav* 2015;89:32-8.
28. Hughes A, McMunn A, Bartley M, Kumari M. Elevated inflammatory biomarkers during unemployment: Modification by age and country in the UK. *J Epidemiol Community Health* 2015 doi: 10.1136/jech-2014-204404.
29. Henkel D. Unemployment and substance use: A review of the literature (1990-2010). *Curr Drug Abuse Rev* 2011;4:4-27.
30. Sabia S, Singh-Manoux A, Hagger-Johnson G, Cambois E, Brunner EJ, Kivimäki M. Influence of individual and combined healthy behaviours on successful aging. *CMAJ* 2012;184:1985-92.

31. Cooper R, Mishra GD, Kuh D. Physical activity across adulthood and physical performance in midlife: Findings from a british birth cohort. *Am J Prev Med* 2011;41:376-84.
32. Strully KW. Job loss and health in the U.S. labor market. *Demography* 2009;46:221-46.

Table 1 Employment status between ages 36 and 53 among men and women in the MRC National Survey of Health and Development

	Total	Men		Women	
	n	n	%	n	%
<b>Employment status between ages 36 and 43 (early period)</b>					
Spells of not working					
Yes	684	155	15.9	529	48.7
No	1377	820	84.1	557	51.3
During spells of not working <sup>†</sup>					
Looking for work		104	67.1	104	19.7
Not looking for work		34	21.9	396	74.9
Not applicable/ has not answered		17	11.0	29	5.4
Duration of spells <sup>†</sup>					
Less than 1 year		83	53.5	118	22.3
1 year or more		40	25.8	274	51.8
Not applicable/ has not answered		32	20.7	137	25.9
<b>Employment status between ages 43 and 53 (late period)</b>					
Spells of not working					
Yes	685	288	29.5	397	36.6
No	1376	687	70.5	689	63.4
During spells of not working <sup>†</sup>					
Looking for work		97	33.7	252	63.5
Not looking for work		190	66.0	141	35.5
Not applicable/ has not answered		1	0.3	4	1.0
Duration of spells <sup>†</sup>					

Less than 1 year	159	55.3	130	32.8	
1 year or more	128	44.4	263	66.2	
Not applicable/ has not answered	1	0.3	4	1.0	
<b>Mid-career work patterns*</b>					
Continuous employment	1037	617	63.3	420	38.7
Discontinuous employment					
Early period	339	70	7.2	269	24.8
Late period	340	203	20.8	137	12.6
Early and late periods	345	85	8.7	260	23.9

\*Continuous employment during mid-career=no spells of not being in paid work for 1 month or more between ages 36 and 53. Discontinuous employment during mid-career=not being in paid work for 1 month or more between ages 36 and 43 (early period), 43 to 53 (late period) or during both periods.

† Percentages calculated using total number who reported spells of not working during the specified period as the denominator.

Table 2 Characteristics of men and women in the MRC NSHD stratified by mid-career work patterns

	Men n=975					Women n=1086					p
	n	Discontinuous employment in mid-career*:			Continuous employment	p	Discontinuous employment in mid-career*:			Continuous employment	
		Early and late periods	Early period	Late period	Early and late periods		Early period	Late period			
		n=85	n=70	n=203	n=617		n=260	n=269	n=137	n=420	
Highest educational attainment at 26, %	1959					0.012					0.274
Degree or higher		4.9	10.6	15.9	21.1		4.8	7.1	6.2	7.3	
A-levels or equivalent		27.2	24.3	33.3	29.4		23.3	27.2	23.0	28.8	
O-levels or equivalent		16.1	22.7	16.4	13.6		30.9	23.7	28.5	30.3	
CSE, clerical course or equivalent		7.4	4.5	6.3	5.3		6.8	10.9	10.8	7.8	
No qualifications attempted		44.4	37.9	28.1	30.6		34.2	31.1	31.5	25.8	
Health status at 36, %	1908					0.36					0.139
Best		9.5	9.4	9.3	13.3		6.3	11.9	15.6	10.2	
Intermediate		66.2	60.9	71.5	64.5		72.0	66.4	67.2	68.0	

Worst		24.3	29.7	19.2	22.2		21.7	21.7	17.2	21.8	
Occupational class at age 43, %	2034					<0.001					0.195
High (I and II)		39.0	43.5	60.7	62.2		57.8	57.9	50.0	55.5	
Medium (III)		48.0	42.0	34.3	31.9		30.7	32.0	41.9	36.9	
Low (IV and V)		13.0	14.5	5.0	5.9		11.5	10.1	8.1	7.6	
Body mass index at 53, mean SD	2049	27.04, 3.8	27.96, 4.2	27.56, 4.1	27.12, 3.7	0.191	27.61, 5.4	26.97, 4.8	27.60, 5.6	27.26, 5.3	0.49
Smoking history at 53, %	2061					<0.001					0.23
Current		29.4	24.3	22.7	14.4		20.0	15.6	13.9	20.7	
Ex-smoker		55.3	51.4	44.3	57.1		45.4	47.6	42.3	46.0	
Never smoked		15.3	24.3	33.0	28.5		34.6	36.8	43.8	33.3	
Physical activity level at 53, %	2060					0.063					0.024
Inactive		56.5	48.6	42.9	40.3		55.4	46.5	41.6	42.2	
1-4 times per month		14.1	25.7	19.7	22.2		15.8	17.1	22.6	18.3	
5 times or more per month		29.4	25.7	37.4	37.5		28.8	36.4	35.8	39.5	
SF-36 Component summaries at 60 to 64, mean SD	2061										
Physical functioning		47.4, 12.8	51.1, 8.9	49.1, 11.4	52.3, 9.0	<0.001	47.7, 12.1	51.4, 9.7	49.7, 10.8	51.7, 9.6	<0.001

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Mental functioning	49.8, 11.0	52.8, 5.4	50.1, 9.6	52.4, 7.1	<0.001	51.3, 8.4	52.3, 8.0	50.7, 9.2	52.8, 7.7	0.020
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\*Continuous employment during mid-career=no spells of not being in paid work for 1 month or more between ages 36 and 53. Discontinuous employment during mid-career=not being in paid work for 1 month or more between ages 36 and 43 (early period), 43 to 53 (late period) or during both periods.

CSE= Certificate for Secondary Education

Table 3 Unstandardized regression coefficients ( $\beta$ ) and 95% confidence intervals (CI) for physical and mental functioning in early old age according to mid-career work patterns for men and women in the MRC NSHD

	<b>Model 1</b>		<b>Model 2</b>		<b>Model 3</b>	
	$\beta$ (95% CI)*	p	$\beta$ (95% CI)*	p	$\beta$ (95% CI)*	p
<b>MEN</b>						
<b>Physical functioning</b>						
Discontinuous employment during <sup>†</sup>		<0.001		0.003		0.014
Early period	-1.20 (-3.64, 1.25)	0.34	-0.68 (-3.13, 1.77)	0.59	-0.07 (-2.48, 2.33)	0.95
Late period	-3.19 (-4.76, -1.62)	<0.001	-3.07 (-4.63, -1.51)	<0.001	-2.86 (-4.40, -1.32)	<0.001
Early and late periods	-4.84 (-7.09, -2.60)	<0.001	-4.09 (-6.35, -1.83)	<0.001	-3.84 (-6.06, -1.63)	0.001
<b>Mental functioning</b>						
Discontinuous employment during <sup>†</sup>		0.006		0.169		0.077
Early period	0.45 (-1.53, 2.43)	0.65	0.61 (-1.39, 2.59)	0.55	0.64 (-1.35, 2.62)	0.53
Late period	-2.24 (-3.51, -0.97)	0.001	-2.30 (-3.57, -1.03)	<0.001	-2.45 (-3.72, -1.18)	<0.001
Early and late periods	-2.56 (-4.37, -0.74)	0.006	-2.27 (-4.10, -0.44)	0.015	-2.15 (-3.97, -0.32)	0.022
<b>WOMEN</b>						
<b>Physical functioning</b>						

Discontinuous employment during <sup>†</sup>		<0.001		<0.001		0.001
Early period	-0.33 (-1.93, 1.27)	0.69	-0.12 (-1.70, 1.46)	0.88	-0.45 (-1.97, 1.08)	0.57
Late period	-1.98 (-3.99, 0.042)	0.055	-1.66 (-3.65, 0.32)	0.101	-2.10 (-4.02, -0.18)	0.032
Early and late periods	-4.02 (-5.64, -2.40)	<0.001	-3.90 (-5.50, -2.30)	<0.001	-3.62 (-5.17, -2.08)	<0.001
<b>Mental functioning</b>						
Discontinuous employment during <sup>†</sup>		0.047		0.047		0.104
Early period	-0.49 (-1.73, 0.76)	0.44	-0.45 (-1.70, 0.80)	0.48	-0.61 (-1.85, 0.63)	0.34
Late period	-2.07 (-3.64, -0.50)	0.010	-2.00 (-3.58, -0.43)	0.013	-2.43 (-4.00, -0.86)	0.002
Early and late periods	-1.53 (-2.79, -0.27)	0.018	-1.46 (-2.73, -0.19)	0.024	-1.38 (-2.64, -0.11)	0.033

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Model 1 unadjusted; Model 2 adjusted for occupational class at age 43 and educational attainment at 26; Model 3 Model 2 plus health status at 36, smoking, physical activity and BMI at age 53.

\*Regression coefficients are the differences in mean functioning scores when comparing each category shown with those in continuous employment.

<sup>†</sup>Discontinuous employment during mid-career=not being in paid work for 1 month or more between the ages of 36 and 43 (early period), 43 and 53 (late period) or during both periods, continuous employment during mid-career served as the reference category.