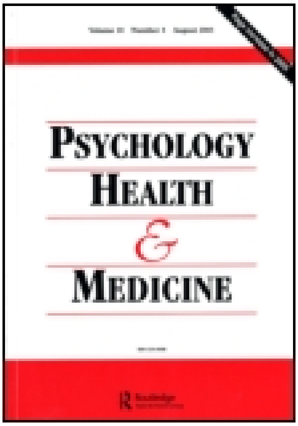

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Job strain and ambulatory blood pressure in British general practitioners: A preliminary study

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Job strain and ambulatory blood pressure in British general practitioners: a preliminary study

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Abstract *Occupational stress, in particular 'high strain' (defined as high psychological job demands and low job control; Karasek, 1979) has been found to be associated with coronary heart disease and hypertensive risk in a number of occupations. However, despite the large number of studies of GP stress, none have extended this model to British GPs. It was hypothesized that 'high strain' GPs would exhibit heightened levels of cardiovascular arousal compared to 'low strain' GPs, with a carry-over effect into the non-work day. Twenty low strain GPs were compared with seven high strain GPs on ambulatory blood pressure during a work day, work day evening, non-work day and non-work day evening. Work day and non-work day monitoring was counterbalanced. Levels of mental health and job satisfaction were also assessed. High strain GPs' systolic blood pressure and diastolic blood pressure was generally elevated, in particular during the non-work day, compared to their low strain counterparts. No gender differences were found for any of the BP variables. Levels of depression, anxiety and job dissatisfaction were found to be significantly greater for high strain GPs. In terms of GP stress research, these findings are novel; however replication is required with a larger sample.*

Introduction

The last decade has witnessed the most radical changes in the recent history of general practice, and has brought a significant increase in job demands and patient expectations (Cooper *et al.*, 1989; Firth-Cozens, 1998; Sutherland & Cooper, 1992; 1993; Swanson *et al.*, 1996, Wall *et al.*, 1997). GPs have reported high levels of occupational stress and have been found to exhibit significantly elevated levels of job dissatisfaction and depressive symptoms (e.g. suicidal ideation, loss of sexual interest, feeling hopeless about the future) than other British white collar workers (O'Connor *et al.*, *in press*) and Canadian family physicians (Rout & Rout, 1997). Occupational stress, in particular job strain (defined as high psychological job demands and low job control; Karasek, 1979), has also been found to be associated with coronary heart disease (CHD) and hypertensive risk in a number of occupations (e.g. Bosma *et al.*, 1997; Goldstein *et al.*, 1999; Karasek *et al.*, 1981; Schnall *et al.*, 1992; Steptoe *et al.*,

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Steptoe *et al.*, 1996; 1999; Van Egeren, 1992), yet to our knowledge this work has not been extended to GPs.

Cardiovascular and neuroendocrine stress responsivity has been suggested as a possible mechanism underlying the associations between CHD and hypertension risk (Schnall *et al.*, 1990; 1992; Steptoe *et al.*, 1996). However, these data presented thus far are equivocal (Steptoe *et al.*, 1999). Cardiovascular responses have been found to increase with decreasing levels of control, therefore it is hypothesized that high strain GPs (those experiencing high psychological demands and low levels of job control) will exhibit heightened levels of arousal compared to low strain GPs. Job strain effects have also been found to carry-over from the workplace into the home (Steptoe *et al.*, 1999; Van Egeren, 1992), implying that job strain has sustained effects on circulation, thus increasing the likelihood of causing long-term damage. For this reason, it is hypothesized that in GPs experiencing high job strain there will be sustained blood pressure during the work day evening and non-work day due to their failure to relax adequately.

Method

Participants

One hundred and twenty-four GPs were randomly selected from Liverpool Health Authority's medical lists and sent a letter outlining the nature of the project. A consent form was also included to be signed and returned to the investigators in a reply-paid envelope if willing to participate. Forty-one consent forms were returned, giving a response rate of 33%. Non-responders were not followed-up. Fourteen of the 41 GPs were excluded from the study. Nine did not pass the screening process (exclusion criteria: reported a history of cardiovascular disease or familial hypertension, reported alcohol abuse, neurological or psychiatric illness, had a history of diabetes mellitus, or were smokers) and five were excluded from analysis either because of incomplete data or technological problems. All GPs worked full time and reported no recent surgical operation prior to testing. The sample size is similar to that reported elsewhere (Van Egeren, 1992; Winefield *et al.*, 1998).

Seventeen (63%) GPs were male and ten (37%) were female. GP ages ranged from 30 to 64 years (mean = 43.45 years, SD = 9.36 years). Male GPs' ages ranged from 30 to 64 years (mean = 44.83, SD = 10.64) and female GPs' ages ranged from 30 to 51 years (mean = 41.38, SD = 6.94). A significant gender difference was found for mean body mass index (males = 24.94 (SD = 3.02), females = 19.94 (SD = 1.25); $t = 4.95$, $p = 0.01$). Twenty GPs were classified as low strain and seven high strain based on their job strain scores (see Questionnaires section).

Ambulatory blood pressure procedure

GPs arrived at the Department of Psychology after morning surgery and were fitted with the Spacelabs 90207 ambulatory blood pressure monitor (ABPM). Reliability and validity data are reported elsewhere (e.g. Cates *et al.*, 1990; O'Brien *et al.*, 1993). Prior to fitting the ABPM a period of familiarization was undertaken for each participant to adjust to the environment and to be given a chance to relax. At this stage GPs were provided with more information about the nature of the project and verbal consent was gained before ABPM was fitted. The ABPM cuff was attached to the non-preferred arm.

Once fitted, a period of customization was undertaken where three readings were obtained at regular five-minute intervals so the GP was able to become comfortable with the operation of the monitor and the measurement process. These customization readings act to calibrate the monitor, with the initial inflation to 165 mmHg. Thereafter, the cuff inflates to approximately 30 mmHg above the previous systolic reading. Each GP was asked to remain as motionless as possible each time the monitor took a reading and then to record his or her activity, the time of the cuff inflation, and how stressed they felt at that moment in time in a diary.

Prior to leaving the university, the investigator demonstrated fully how to operate the ABPM, instructed participants on the use of the diary and dealt with any queries. Each GP wore an ABPM for a minimum of ten hours on a normal work day and again on a normal non-work day. To offset any potential order effects, work day and non-work day monitoring was counterbalanced (i.e. GP 1 first wore the ABPM during a work day, followed by a non-work day; GP 2 wore the ABPM during a non-work day, followed by a work day and so forth). GPs were instructed to wear the ABPM from between 8 am and 10 am on their subsequent work day/non-work day until 11 pm that same evening, and to re-fit the unit on the morning of their subsequent normal non-work day/work day (between 8 am and 10 am). The timer on the monitor was set to take readings at 30-minute intervals during both the work day and the non-work day. GPs were blinded to the values of their blood pressure readings during monitoring. These data were not downloaded until after the ABPMs were returned.

Questionnaires

GPs were given a self-administrating questionnaire and instructed to complete it before returning the ABPM to the university along with the diary. The questionnaire measured psychological job demands (Karasek, 1985), job control (Ganster, 1989), depression, anxiety, somatization (all from the SCL-90; Derogatis *et al.*, 1973) and job satisfaction (Warr *et al.*, 1979). Internal reliability for all scales was within acceptable boundaries ($\alpha = 0.76$–0.89). The independent variable job strain was operationalized as the ratio between psychological job demands and job control described elsewhere (Theorell *et al.*, 1991). Job strain scores were categorized into two groups; upper quartile (high strain) as one group and lower and middle groups as the other group (low strain).

Readings which occurred during the work day until 7 pm were classified as work day (WD) and those recorded after 7 pm until 11 pm as work day evening (WE). This was repeated for readings during the non-work day.

Results

Mean systolic blood pressure (SBP), diastolic blood pressure (DBP) and heat rate (HR) scores during the work day, work day evening, non-work day and non-work day evening are shown in Table 1. No statistically significant gender differences were found for any of the BP variables. Age was not correlated with any of the BP variables. Two-factor analysis of variance (ANOVA) for mixed design revealed a main effect for time period ($F(3, 75) = 5.73$, $p < 0.01$) and job strain ($F(1, 25) = 4.23$, $p < 0.05$). No significant interaction was found for job strain group by time period. Subsequent analyses revealed that high strain GPs' SBP remained significantly elevated during the non-work day ($t = 3.07$, $p < 0.01$), with the trend continuing through to the non-work day evening ($t = 1.90$, $p = 0.07$) compared to their low strain counterparts (see Figure 1). SBP was also higher in high strain GPs during the work day and work day evening, albeit not significantly (see Table 2).

For DBP, a significant main effect was found for time period ($F(3, 75) = 7.83$, $p < 0.01$) and for job strain ($F(1, 25) = 4.69$, $p < 0.05$). No significant interaction was found

Table 1. *Descriptive statistics: means and standard deviation scores for SBP, DBP and HR in male and female GPs¶*

	Male GPs			Female GPs				
	n	Mean reading	SD	*n*	Mean reading	SD	Total	SD
SBPWD*	17	125.19	13.41	10	126.94	13.51	125.83	13.21
SBPWE	17	121.95	13.50	10	124.65	11.99	122.95	12.79
SBPNWD	17	117.32	9.50	10	119.66	11.06	118.18	9.96
SBPNWE	17	116.80	9.87	10	119.98	8.80	117.98	9.44
	Male GPs			Female GPs				
	n	Mean reading	SD	*n*	Mean reading	SD	Total	SD
DBPWD*	17	82.52	10.20	10	82.81	12.58	82.63	10.90
DBPWE	17	83.30	12.66	10	79.84	11.33	82.02	12.08
DBPNWD	17	75.49	7.83	10	76.61	7.21	75.90	7.49
DBPNWE	17	73.90	8.13	10	75.10	6.39	74.34	7.42
	Male GPs			Female GPs				
	n	Mean reading	SD	*n*	Mean reading	SD	Total	SD
HRWD**	17	75.30	7.97	10	73.64	13.24	74.63	10.21
HRWE	17	74.25	6.62	10	73.64	13.24	73.44	8.83
HRNWD	17	75.55	9.70	10	75.02	10.96	75.34	10.04
HRNWE	17	73.99	8.65	10	74.81	10.84	74.32	9.42

Note. *indicates mmHg as unit of measurement; **indicates bpm as unit of measurement; ¶independent samples *t*-tests revealed no statistically significant gender differences on any of the blood pressure variables.

between the factors. Similarly, further analysis found high strain GPs to also have significantly elevated DBP during the non-work day ($t = 3.08$, $p < 0.01$), with the trend spilling over into the non-work day evening ($t = 1.81$, $p = 0.08$; see Figure 2). Although high strain GPs had higher DBP during the work day and work day evening than the low strain GPs, these differences failed to reach significance.

For HR, a significant main effect was found for job strain ($F(1, 25) = 6.82$, $p < 0.05$), but not for time period or the interaction between the factors. HR was found to be significantly elevated in high strain GPs during the work day evening ($t = 2.38$, $p < 0.05$), the non-work day ($t = 2.12$, $p < 0.05$), the non-work day evening ($t = 2.42$, $p < 0.05$), but not during the work day compared to low strain GPs (see Table 2). High strain GPs were also found to report significantly higher levels of depression ($t = 3.22$, $p < 0.01$), anxiety ($t = 2.46$, $p < 0.05$), job dissatisfaction ($t = 3.70$, $p < 0.01$) but not somatization compared to low strain GPs (see Figures 3 and 4).

Discussion

These data offer support to our hypothesis that high strain GPs will exhibit heightened levels of arousal in general compared to low strain GPs, whilst controlling for other known risk factors. In terms of GP stress research, these findings are novel in that, to our knowledge, the

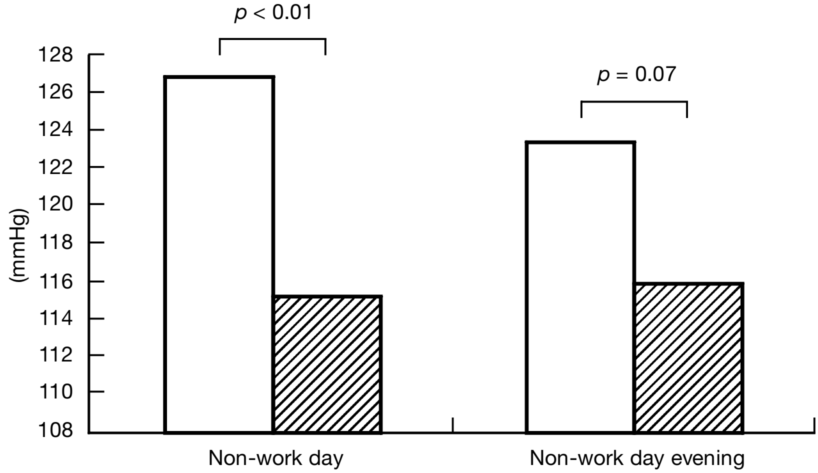

FIG. 1. *Systolic blood pressure and job strain (□ High job strain; ▨ Low job strain).*

job strain model has never been extended to GPs and that all other studies in this area (e.g. Firth-Cozens, 1998; Rout & Rout, 1997; Sutherland & Cooper, 1993; Swanson *et al.*, 1996; White *et al.*, 1997) have failed to employ ambulatory methods which provide an objective outcome measure and ensure more accurate assessment of BP than laboratory or clinical assessments.

Surprisingly, no significant differences in BP and HR were observed in the high and low strain groups over the working day. However, it has been suggested that this pattern is likely to emerge in a single occupational group who share uniform job requirements, whereas most other job strain studies have investigated mixed working populations (Steptoe *et al.*, 1999). Further to this, some researchers argue that personality factors, such as Type A behaviour and cynical hostility, are important moderating factors in the stress–cardiovascular risk relationship as these individuals tend to self-select into very stressful occupations. However, the data presented thus far are equivocal and are likely not to be as relevant in a homogeneous occupational group (e.g. Cohen *et al.*, 1997). Notably, Van Egeren (1992), using a

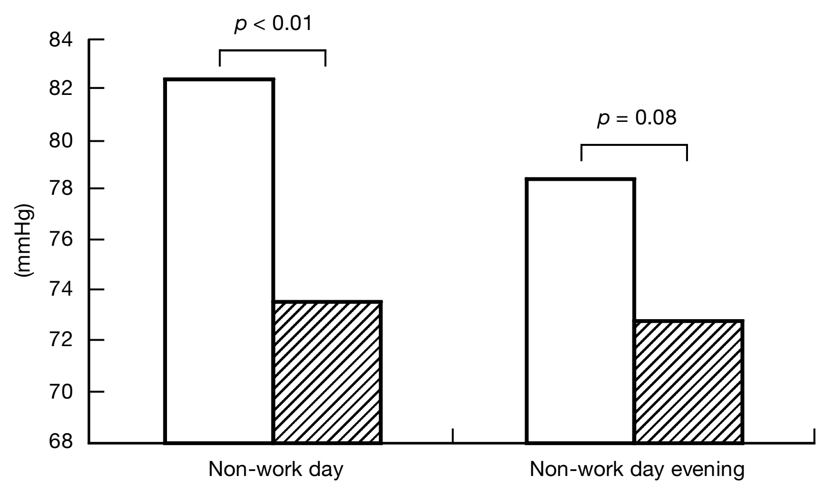

FIG. 2. *Diastolic blood pressure and job strain (□ High job strain; ▨ Low job strain).*

Table 2. *Means and standard deviation scores for SBP, DBP and HR in high and low strain GPs*

	Work day SBP*			Workday evening SBP			Non-work day SBP			Non-work day evening SBP		
Variables	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD
Low strain GPs	20	124.40	13.47	20	120.56	12.61	20	115.16	8.73	20	116.03	9.71
High strain GPs	7	129.95	12.45	7	129.77	11.51	7	126.82	8.44	7	123.55	6.22
	Work day DBP*			Work day evening DBP			Non-work day DBP			Non-work day evening DBP		
	n	Mean	SD	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD
Low strain GPs	20	80.70	11.24	20	80.55	13.11	20	73.63	6.90	20	72.87	7.96
High strain GPs	7	88.14	8.17	7	86.23	7.73	7	82.41	5.06	7	78.54	3.23
	Work day HR**			Work day evening HR			Non-work day HR			Non-work day evening HR		
	n	Mean	SD	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD
Low strain GPs	20	73.03	10.08	20	71.11	8.02	20	72.94	9.72	20	71.81	8.59
High strain GPs	7	79.21	12.24	7	80.07	10.17	7	82.19	10.68	7	81.49	10.66

Note. *indicates mmHg as unit of measurement; **indicates bpm as unit of measurement.

reasonably homogeneous sample, with a similar sample size to this study, found no significant interactions with Type A behaviour and job strain.

The absence of a significant interaction between job strain and time period factors initially fails to provide evidence for the notion of a carry-over effect into the work day

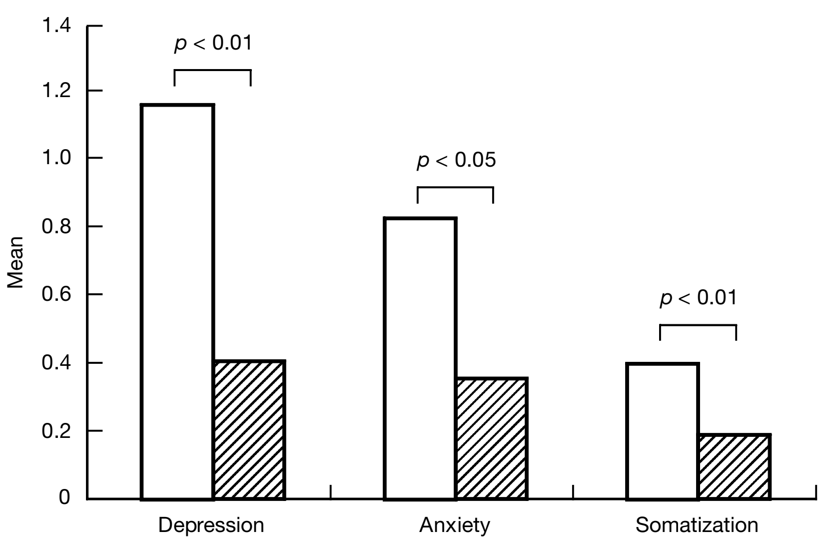

FIG. 3. *Mental health in high and low strain GPs (□ High job strain; ▨ Low job strain).*

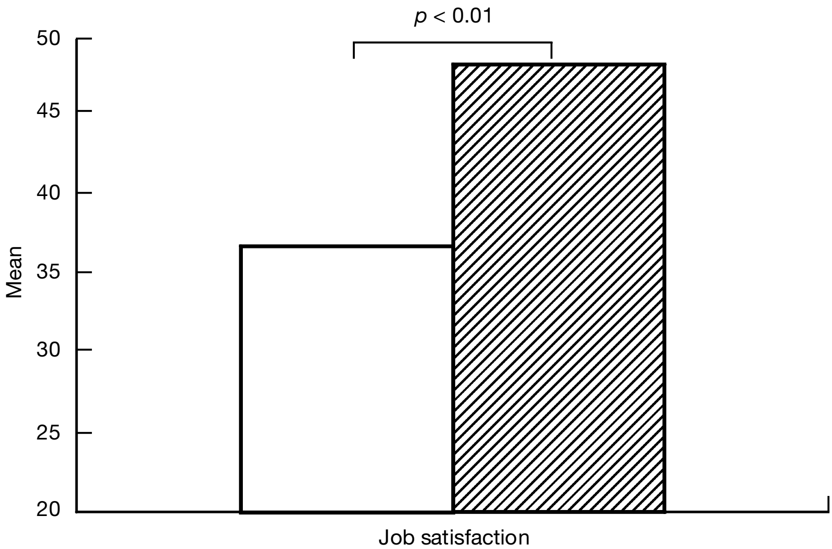

FIG. 4. *Job satisfaction in High and Low strain GPs (□ High job strain; ▨ Low job strain).*

evening reported in other studies (Steptoe *et al.*, 1999; Van Egeren, 1992); although closer inspection of these data reveals a trend in the predicted direction, in particular with high strain GPs' mean SBP remaining elevated in the evening after work, compared to a mean decrease of 4 mmHg in the low strain GPs. Also, the effects of job strain may be masked as it was restricted to a small sample of healthy, non-hypertensive GPs, possibly excluding those who may chronically respond to job strain with large increases in BP.

Further, these results suggest that the effects of high job strain may be more evident during the non-work day, manifest as a failure to relax following the termination of demands (Steptoe *et al.*, 1999). Alarmingly, the difference between high and low strain GPs' SBP, DBP and HR during the non-work day was 11.66 mmHg, 8.78 mmHg and 9.25 bpm, respectively. To place in context, even small increases in BP are important; maintained over time they can have an eventual impact on cardiovascular and hypertensive risk (Goldstein *et al.*, 1999). In fact reductions in DBP by 2 mmHg can have major implications for the population, leading to a 6% and 15% decrease in cardiovascular risk and stroke, respectively (Cook *et al.*, 1995).

Previous research has suggested an association between posture and activity levels and elevated BP and HR (e.g. Turner & Sherwood, 1991). In this study, it was suspected that high strain GPs may have been involved in more vigorous activities during both their work day and non-work day. Therefore, using the ambulatory BP diary, the activity recorded (by each GP) at the time of each cuff inflation was coded as either a high or low level activity (high level activities included: travelling to home visits, driving the car, washing up, activities involving standing, etc.; low level activities included paperwork, repeat prescriptions, reading, activities involving the sitting and supine positions). A chi-square test revealed no significant association between activity level and job strain group ($\chi = 0.25$, $p = 0.61$), thus providing further support for the idea of differences in physiological stress responsivity associated with psychosocial work characteristics.

Alarmingly, high strain GPs reported significantly higher levels of depression, anxiety and job dissatisfaction than low strain GPs. These levels are markedly higher than in a large sample of white collar workers (WCW) and GPs reported elsewhere (O'Connor *et al.*, *in press*); in particular, for depression (high strain GPs = 1.16 versus WCW = 0.71) and job satisfaction levels (high strain GPs = 37.00 versus WCW = 45.58). These findings are consistent with earlier studies and indicate that high levels of job strain are also associated with elevated mental ill health (e.g. Kristensen, 1995; O'Connor *et al.*, *in press*). Further to this, depression has been reported to be associated with making clinical mistakes, and high levels of job dissatisfaction have been found to have direct consequences for the quality of service for patients (Firth-Cozens, 1998; Grol *et al.*, 1985).

A recent study by Winefield *et al.* (1998) provided promising evidence for the beneficial effects of a stress management intervention in female GPs. They found that a programme which encouraged active worker participation and was based around learner-centred group seminars led to a significant reduction in psychological distress and emotional exhaustion. These findings and that of the present study suggest that GPs would benefit if they had greater job control and autonomy. Therefore, future research should implement and evaluate stress management interventions using randomized control paradigms.

As with other preliminary investigations, several shortcomings of this present study require further comment. That is, the number of GPs recruited for the study was small, the window of time studied was limited and the response rate was moderate-to-low. These drawbacks may have implications for the representativeness and generalizability of the results to the profession as a whole and should be borne in mind when extrapolating these data. Unfortunately, as GPs have very challenging schedules they face large demands on their time. As a result, they are often unwilling and unable to participate in research studies of this kind, thus making recruitment very difficult and contributing to a low response rate.

Another limitation is that it is possible that only GPs who felt aggrieved, stressed or who were concerned about their health responded to our letter of invitation. There is always a risk of sample bias with this type of study. However, the effect of this confounding factor is likely to have been reduced because this work was conducted independently, by a university department, with the results not directly informing policy-making within the NHS. Furthermore, one could speculate that only 'stress-free' GPs participated in the study as they had relatively less demanding practices, were better organized or had better resources with more time on their hands.

As a result, we feel that these findings may be representative of the non-hypertensive GP population and may not be generalizable to the entire profession. They may also be an underestimation of the true picture, as in other health studies the non-respondents have been found to be less healthy (Vernon *et al.*, 1984). Future research should endeavour to recruit larger, and possibly more representative, samples in order to overcome these shortcomings.

More detailed research, over a greater period of time, will be required before the effects of job strain can be isolated from the myriad of possible confounding variables. Nonetheless, these preliminary data suggest that GPs who experience low levels of control in relation to the psychological demands of their job are at risk and may benefit from stress management interventions; although at this time it is not known which intervention strategies would be most apposite.

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