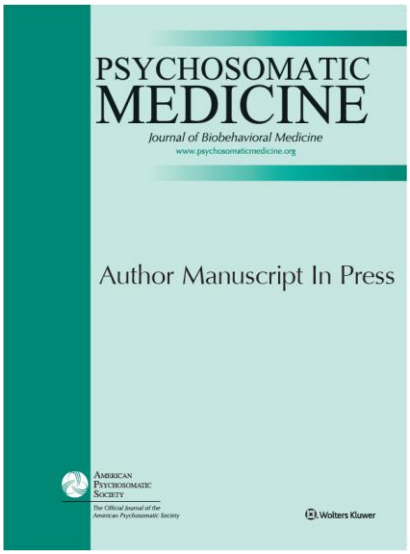

Psychosomatic Medicine
Author's Accepted Manuscript

Article Title: Associations between financial strain and emotional wellbeing and physiological responses to acute mental stress

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DOI: 10.1097/PSY.0000000000000867

Received Date: February 5, 2020
Revised Date: August 24, 2020

Psychosomatic Medicine Publish Ahead of Print
DOI: 10.1097/PSY.0000000000000867

Associations between financial strain and emotional wellbeing and physiological responses to acute mental stress

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Financial support: This research was supported by the British Heart Foundation (RG/10/005/28296).

Conflict of interest: The authors report no conflicts of interest.

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Abstract

Objective: To investigate associations between financial strain and emotional wellbeing, health, and physiological responses to acute mental stress.

Methods: Participants were 542 healthy men and women aged 53-76y from the Whitehall II study divided into those who reported no (n = 316), some (n =135) or moderate/severe (n = 91) financial strain. Emotional wellbeing and self-reported health were assessed at baseline and 3 years later. Laboratory mental stress testing involved assessment of blood pressure (BP), heart rate, and lipid reactivity and recovery, and plasma interleukin 6 (IL-6) responses to challenging behavioral tasks. Analyses adjusted for objective financial status, age, sex, socioeconomic status (SES) and marital status.

Results: Financial strain was positively associated with more depressive symptoms, lower positive affect, greater loneliness, and lower optimism, self-esteem and sense of control, and with poorer self-reported physical health, mental health and sleep (all $p < .001$). Longitudinally, financial strain predicted poorer outcomes 3 years later, but associations were attenuated after baseline levels were taken into account. Financial strain was associated with reduced systolic and diastolic BP reactivity to acute stress (mean systolic BP increase 32.34 ± 15.2, 28.95 ± 13.1 and 27.26 ± 15.2 mmHg in the none, some, and moderate/severe financial strain groups), but not with heart rate, IL-6 or lipid responses.

Conclusions: Financial strain was correlated with a range of emotional and health-related outcomes independently of objective financial status. The diminished BP reactions to acute mental stress suggest that financial strain may contribute to dynamic chronic allostatic load.

Keywords: Economic stress; Cardiovascular reactivity; Depression; Sleep problems; Cholesterol

Abbreviations: BP = blood pressure; CESD = Center for Epidemiologic Studies Depression Scale; CHD = Coronary heart disease; HDL = high density lipoprotein; IL-6 = Interleukin 6; PANAS = Positive and negative affect scale; SES = socioeconomic status;

Introduction

Financial strain is the perception that the person has inadequate funds to pay bills and provide for one's family in terms of food, clothing, health care, and other expenses (1). Financial strain or perceived income adequacy is related to economic hardship and relative poverty, but is distinct in that even moderately affluent people may perceive financial strain if their outgoings outstrip income. As Mr Macawber famously remarked in Charles Dickens's *David Copperfield* 'Annual income twenty pounds, annual expenditure nineteen and six, result happiness. Annual income twenty pounds, annual expenditure twenty pounds ought and six, result misery.' It has been argued that financial strain is one of the worst of everyday chronic stressors, in that it can afflict people on a sustained basis (2).

A number of studies have evaluated associations between financial strain and depressive symptoms. Retrospective and cross-sectional analyses have established that the accumulation of reports of financial strain over the life course are related to greater depressive symptoms independently of objective financial status (2-4). There have been fewer prospective studies, but financial strain was found to predict increases in depressive symptoms over a 3-year period in a sample of older men (5). Wilkinson (6) showed that decreases in financial status were related to increased financial strain during the 2006-2010 recession period; interestingly, financial strain but not objective financial status predicted increased depressive and anxiety symptoms. Less is known about associations between financial strain and other negative psychological factors such as loneliness, pessimism and low self-esteem. The first aim of this study was therefore to test whether financial strain is related to greater depression, loneliness, pessimism and low self-esteem cross-sectionally, and longitudinally with depression and loneliness over a 3-year period

independently of income in a subsample from the Whitehall II cohort. We also investigated the reverse causal sequence, evaluating whether baseline depression, loneliness and optimism predicted 3-year changes in financial strain.

The impact of financial strain on physical health has been documented in prospective studies of older women. An analysis of the Framingham Study showed that financial strain predicted incident coronary heart disease (CHD) over a 20-year period among employed women (7), while financial strain was associated with 5-year mortality independently of age, income, comorbidities and other factors in a study of 70-79 year old women (8). In the INTERHEART study, financial strain discriminated acute myocardial infarction cases from controls sampled from 262 centers around the world (9), while an inverse association between financial strain and ideal cardiovascular health has been identified in the Women's Health Study (10). Relationships with poor self-rated health and subjective and objective measures of poor sleep have also been described (2, 11-13). In this study, our second aim was to test cross-sectional and longitudinal associations between financial strain and the physical and mental health status scales from the SF-36, hypothesizing that greater financial strain would be linked with poorer health status independently of income.

The link between financial strain and health is further corroborated by studies of biomarkers. For instance, financial strain has been related to higher C-reactive protein concentration in some but not all studies (14, 15), with greater oxidative stress in older women (16), and with fasting glucose among physically inactive individuals (17). In an earlier study, we found that changes in financial strain over a 3-year period were correlated with changes in ambulatory blood pressure

(BP) and the cortisol awakening response (18). Absent from the current evidence base are studies relating financial strain with acute physiological responses to stress. Research on acute cardiovascular, inflammatory and metabolic responses to mental stress have proved valuable in identifying biobehavioral pathways to disease risk (19, 20). The third aim of this analysis was therefore to investigate the association between financial strain and BP, heart rate, plasma interleukin 6 (IL-6) and lipid responses to standardized mental stress test. However, the nature of the relationship is uncertain. Heightened cardiovascular and inflammatory responses to stress have been related to future cardiovascular disorders (20, 21). But negative affective states and chronic health conditions have been linked with reduced cardiovascular responsivity (22, 23) (24, 25). McEwen (26) argued that reduced stress responsivity is a manifestation of chronic allostatic load; it is possible, therefore, that financial strain might be associated with reduced acute stress responsivity.

This study took an outcome-wide approach to analyses, a method involving investigation of the association of specific exposures with a wide set of outcomes (27, 28). It avoids many of the methodological difficulties of exposure-wide studies, and is increasingly used in epidemiological research (29-31).

Method Section

Participants

The participants in this study were recruited from September 2006 through April 2008 from the Whitehall II cohort of British civil servants as part of the Heart Scan Study, an investigation of SES, acute biological responses to stress, and coronary artery calcification (32, 33). No history or

previous treatment for hypertension, inflammatory conditions, coronary heart disease, allergies, anxiety or major depression was a requirement for inclusion in the study. A stratified sampling method was used in order to ensure representation from higher, intermediate, and lower employment grades which serve as markers of SES in the Whitehall II study. The sample consisted of 542 white European men and women between the ages 53 and 76 (M = 62.89 ± 5.65). The study was approved by University College Hospitals Committee on the Ethics of Human Research (IRB), and participants gave full informed consent.

Procedure

Psychosocial measures were assessed using standardized questionnaires, completed at the beginning of the mental stress testing session. Participants were required not to take anti-inflammatory or anti-histamine medications for seven days before testing, and appointments were rescheduled if the person had a cold or infection on day of testing. Additionally, respondents were directed not to drink caffeine or smoke and to avoid vigorous exercise the night before and hours leading up to stress testing.

Volunteers were tested individually in a light and temperature controlled laboratory. A venous cannula was inserted into participants' arm for blood sample collection. Systolic and diastolic BP and heart rate were assessed continuously throughout the activities using a Finometer (Finapres Medical Systems, Amsterdam). The session began with 30 minutes rest, the last 5 min of which provided baseline BP and heart rate readings. The first blood sample was drawn. Two 5-minute behavioral tasks were used as mental stressors: a color-word interference task and mirror tracing activity, administered in random order (33). Participants then rested quietly for 75 minutes,

reading or dozing or watching nature videos, while further blood samples were obtained immediately after tasks and at 45 and 75 minutes after tasks. Subjective ratings of stress were made on a 7-point scale from 1 = *no stress* to 7 = *extreme stress* at baseline, after tasks, and in the recovery period. Coronary artery calcification was measured using electron beam computed tomography (EBCT), but is not included in this report (32). Follow-up data were collected 3 years after mental stress testing from 512 of the original sample, involving repeat administration of selected psychosocial measures, together with further EBCT.

Measures

Financial Strain was measured with an adaptation of the economic strain measure developed by Pearlin et al. (1). This assesses difficulty paying one's bills, being able to provide for one's family in terms of food, etc at the present time. Eight items were included on a scale from 1 to 3 with 1 representing *no difficulty* and 3 *very great difficulty* (Cronbach $\alpha = 0.85$). The full list of items is provided Supplemental Digital Content 1, http://links.lww.com/PSYMED/A686. Ratings were summed and total scores could range from 8 and 24.

Depressive symptoms were assessed using the Center for Epidemiologic Studies Depression Scale (CESD) (34). Scores on this 20-item scale could range from 0-60, with higher ratings indicating greater depression (Cronbach $\alpha = 0.86$). *Positive affect* was measured with the 10 items of the Positive and Negative Affect Scales (PANAS) (35), asking people how they had been recently feeling; ratings ranged from 0-40 with higher values indicating greater positive affect (Cronbach $\alpha = 0.88$). *Loneliness* was assessed using the revised UCLA loneliness scale

(36). Each of the 20 items was rated on a 4-point scale, and total scores could range from 20-80 (Cronbach α = 0.94). We measured *optimism* with the revised Life Orientation Test (37), with scores ranging from 0-24 (Cronbach α = 0.84). *Self-esteem* was assessed with Rosenberg's 10-item scale (38) with scores ranging from 0-30 (Cronbach α = 0.90). *Sense of control* was measured with a single item 'At home, I feel I have control over what happens in most situations' rated from 1 = *strongly disagree* to 6 = *strongly agree. Self-reported physical and mental health* were measured with the combined physical and mental health summary scales from the SF-36 instrument (39). The physical summary score combines ratings on the physical function, role limitations due to physical problems, pain and general health perception scales, while the mental summary score combines the emotional wellbeing, vitality, role limitations due to emotional problems, and social function scales. Scores can range from 0-100 with higher ratings indicating better health. *Sleep problems* were monitored using the Jenkins Sleep Problems Scale, which contains items assessing number of times waking up in the night, difficulty staying asleep, trouble falling asleep, etc (40). Scores could range from 1-6, and the Cronbach α in this population was 0.82. At the 3-year follow-up session the opportunities for assessments were limited, so we only measured depression, loneliness, the SF36 and sleep problem scales.

Covariates in these analyses included age, sex, household income, SES defined by grade of employment, and whether or not the individual was in paid employment at the time of mental stress testing. Total household income was classified into 4 categories: <£20K, £20-39K, £40-59K, and £≥60K. Most of the participants not in paid employment were retired, but others had become homemakers or were seeking employment. Marital status has also been linked with

financial strain (41), so was included as an additional covariate. In sensitivity analyses that took account of the possible impact of negative affectivity biases on the psychosocial outcomes (42), we added the negative affect scale from the PANAS as a covariate.

Cardiovascular data processing and biological assays

Systolic and diastolic BP and heart rate were averaged into five 5-minute trials: baseline, color-word interference task, mirror tracing task, 40-45 min and 70-75 post-stress. Plasma IL-6 at baseline, following tasks, and at 45 and 75 minutes post-stress was assayed using a Quantikine high sensitivity two-site enzyme-linked immunosorbent assay (ELISA) from R&D Systems (Oxford, UK). The sensitivity of the assay ranged from 0.016 to 0.110 pg/ml and the intra and inter assay CVs were 7.3% and 7.7% respectively. Total and high-density lipoprotein (HDL) cholesterol were measured at baseline, following tasks and at 45 minutes post-stress within 72 h in serum stored at -48^{C} using enzymatic colorimetric methods.

Statistical Analyses

Financial strain scores ranged from a minimum of 8 (the lowest possible score) to 20, but were skewed towards lower values. We therefore categorized participants into three groups: no financial strain (score 8), some financial strain (score 9 or 10), and moderate/severe financial strain (11 or greater). Differences in covariates (age, sex, grade of employment, income, marital status and paid employment) between financial strain and no strain groups were compared using analysis of variance for continuously distributed variables and χ^2 tests for categorical variables. The associations between financial strain and psychosocial and health-related factors were analyzed using analysis of covariance with age, sex, grade of employment, income, marital status

and paid employment as covariates. P values indicate the significance of linear contrasts across financial strain groups. Longitudinal relationships between baseline financial strain and 3-year follow-up measures again involved analysis of covariance and tested two models. Model 1 involved the covariates included in the cross-sectional analyses, while in model 2 we added the baseline value of the outcome included as an additional covariate.

Systolic BP, diastolic BP, heart rate, and subjective stress were analyzed with repeated measures analysis of covariance, with financial strain as the between-person factor, trial (baseline, average task, 40-45 min and 70-75 min) as the within-person factor, with age, sex, grade of employment, income, marital status and paid employment as covariates. The Greenhouse-Geisser correction was applied when appropriate, but uncorrected degrees of freedom are presented in the results. Plasma IL-6, total and HDL-cholesterol were also analyzed using repeated measures analysis of covariance, although in this case there were only three trials, since these variables were not analyzed at 75 min after tasks. Acute changes in lipids and IL6 were not adjusted for hemoconcentration since no changes in hematocrit were observed (43). The data were stratified by sex in sensitivity analyses, but there were no differences between men and women in the results, so these analyses are not presented.

We also conjectured that behaviors such as smoking, physical activity and alcohol consumption, together with body mass index, might be mediators of associations between financial strain and emotional and physiological outcomes. In preliminary analyses, we therefore assessed relationships between financial strain and smoking status, frequency of vigorous and moderate physical activity, alcohol consumption over the past week, and body mass index.

However, none of the associations were significant in covariate-adjusted analyses, so health behaviors were not included in the final models presented.

Analyses were carried out using SPSS v26 and STATAv15.

Results

Financial strain levels were low on average, with 58% of respondents reporting no strain at all. The mean financial strain scores were 8 ± 0, 9.31 ± 0.47, and 13.16 ± 2.44 in the no, some, and moderate/severe strain groups. The associations between financial strain and the covariates included in these analyses are summarized in Table 1. There were no differences in age, sex distribution, marital status or employment status between people who did and did not report financial strain. However, financial strain was significantly associated with SES (defined by grade of employment) and with lower household income. Thirty individuals did not take part in the 3 year follow-up assessment. This group was older on average from those followed-up (mean 65.47 ± 6.3 vs 62.73 ± 5.6 years), and were less likely to have been in paid employment at baseline. But there were no differences in sex balance, grade of employment, household income, marital status or financial strain between those who did and did not participate on follow-up.

Financial strain and psychosocial and health-related factors

There were strong cross-sectional associations between financial strain and depressive symptoms, positive affect, loneliness, optimism, self-esteem and sense of control (Table 2). Participants reporting financial strain had more depressive symptoms, greater loneliness, and lower positive affect, optimism, self-esteem and sense of control than those with no financial

strain, after adjustment of age, sex, grade of employment, household income, marital status and paid employment. The linear contrasts were all significant at p <0.001. There were also significant differences in the physical and mental health subscales of the SF-36 and in reported sleep problems, with financial strain being positively related to poorer reported health and more sleep problems.

Longitudinal associations over 3 years are summarized in Table 3. After adjustment for age, sex, grade of employment, household income, marital status and paid employment, financial strain was related to more depressive symptoms, greater loneliness, poorer physical and mental health on the SF-36. and more sleep problems. However, after baseline levels of the outcome variables were added in model 2, these associations were no longer significant except for the loneliness finding. This indicates that the longitudinal relationships largely reflected persistent links between financials train and psychosocial and health variables.

We tested for the reverse temporal sequence by regressing financial strain at follow-up on each of the psychosocial and health-related measures at baseline, with standard covariates plus baseline financial strain in the model. The results summarized in Table S2 (Supplemental Digital Content 1, http://links.lww.com/PSYMED/A686) show no significant associations, indicating that financial strain at baseline predicted longitudinal relationships with psychosocial and health-related factors, but not *vice versa*.

In sensitivity analyses, the negative affect scale from the PANAS was included as an additional covariate. All the cross-sectional associations between financial strain and psychosocial and

health factors described in Table 2 remained significant.

Acute physiological stress responses

The tasks elicited acute increases in subjective ratings of stress, from an average baseline of 1.41 ± 0.77 at baseline to 4.15 ± 1.43, returning to low levels during the post-stress recovery period (1.37 ± 0.77), ($F(3, 1500) = 9.38$, $p < 0.001$). Subjective stress responses did not differ with financial strain. Systolic BP levels across the mental stress testing session are summarized in Figure 1 (upper panel). Systolic BP increased during task trials, returning towards baseline in the post-task period. There was a significant interaction between financial strain and trial in the repeated measures analysis of variance ($F(6,1491) = 2.76$, $p = 0.022$), characterized by a strong quadratic contrast ($F(2,497) = 7.15$, $p < 0.001$), after adjustment for income, age, sex, grade of employment, marital status, and paid work. There was no difference in systolic BP at baseline, but the financial strain groups showed reduced responses during tasks. This was confirmed by analysis of change scores between baseline and task periods which were greater in the no financial strain (mean 32.34 mmHg, 95%CI 30.64-34.04) than the some financial strain (mean 28.95 mmHg, 95%CI 26.40-31.51) and moderate/severe strain groups (mean 27.26 mmHg, 95%CI 24.09-30.44, $p = 0.007$). Systolic BP levels did not differ during the recovery period.

The comparable diastolic BP analysis showed similar results, with a significant financial strain by trial quadratic contrast ($F(2,496) = 4.81$, $p = 0.009$). As shown in Figure 1 (lower panel), diastolic BPs did not differ at baseline, but task responses were greater in the no financial strain (mean increase 14.88 mmHg, 95%CI 14.08-15.67) than the some strain (mean increase 13.10 mmHg, 95%CI 11.90-14.30), and moderate/severe financial strain groups (mean increase 13.51

mmHg, 95%CI 12.04-14.99, p = 0.034) after adjustment for income, age, sex, grade of employment, marital status, and paid work. The significant differences in BP responses remained robust after additional adjustment for negative affect.

Heart rate increased from an average 66.53 ± 9.89 bpm at baseline to 75.26 ± 10.75 during tasks, returning to lower levels at 45 minutes (mean 64.59 ± 8.39 bpm) and 75 minutes (mean 64.76 ± 8.37 bpm) after tasks. However, this pattern did not vary with financial strain. Plasma concentration of IL-6 also increased following tasks, from a baseline of 1.33 ± 0.83 pg/L to 1.75 ± 1.11 pg/L at 75 minutes (F (3,1434 = 4.08, p = 0.018), but responses were again not related to financial strain. Nor were there differences in total or HDL-cholesterol responses to stress across financial strain groups.

Discussion

These analyses of a sample of healthy older men and women showed that financial strain was associated cross-sectionally with more depressive symptoms, lower positive affect, greater loneliness, and lower optimism, self-esteem and sense of control, independently of objective financial status and other covariates. Financial strain was also related to poorer self-rated physical and mental health on the SF-36 health survey, and with more sleep problems. Longitudinally, financial strain at baseline was linked with greater depressive symptoms, loneliness, sleep problems, and poorer physical health status 3 years later, independently of demographic covariates, but not of baseline levels of the outcome variable. Associations with financial strain remained significant after additional adjustment for negative affect, suggesting that findings were unlikely to be a result of negative affectivity bias. Financial strain was also

associated with reduced systolic and diastolic BP responses to acute mental stress, but there were no differences in heart rate reactivity or plasma IL-6 and lipid responses to stress.

The cross-sectional links between financial strain and depression and low self-esteem corroborate previous findings (2, 3), while extending the connections to loneliness, low optimism, low positive affect, and sense of control. The fact that these associations were independent of objective financial status confirms that the psychological experience of having insufficient funds to meet needs is not simply a reflection of low resources. The study sample had relatively high levels of affluence on average. All the participants had been employed in the British civil service, and those who were not in paid employment had retired rather than being unemployed and seeking work. Much of the financial strain was reported by participants at or above UK national household income (median around £26,000 in 2006-8), and only 20% had incomes ≤£20,000 (roughly corresponding to the relative poverty threshold in the UK). Even though a larger proportion of respondents in the financial strain group fell in this category (34.9%), around two-thirds of the financial strain group therefore had incomes above this level. This confirms that in this study, financial strain was a function of the balance between income and expenditure, rather than poverty. The origin of financial strain among more affluent participants is not clear, but social comparison with peers may lead to expenditure that cannot be supported by available resources.

Cross-sectional analyses are vulnerable to reverse causation. It is possible, for example, that people who are depressed or pessimistic and who feel they have little control in their lives will also report greater financial strain. The longitudinal analyses showed that baseline financial

strain predicted negative emotional states 3 years later. However, only loneliness was independently associated with financial strain after baseline levels had been taken into account. For the other variables detailed in Table 3, the inclusion of baseline values into the analytic models eliminated the independent links with financial strain. The psychosocial variables were relatively stable over time ($r \geq 0.60$), leaving little scope for financial strain to exert an influence on change. However, we tested whether financial strain at 3 years was predicted by baseline psychosocial factors, health or sleep problems, independently of baseline financial strain. None of the associations was significant (Table S2, Supplemental Digital Content 1, http://links.lww.com/PSYMED/A686). The study sample was carefully selected to exclude people with existing health problems, making poor health unlikely to confound the link between financial strain and future health. The findings therefore support the notion that financial strain may have affected health and emotional wellbeing in this study, rather than the reverse.

The analysis of physiological responses to acute emotional stress showed that greater financial strain was associated with reduced systolic and diastolic BP reactions to behavioral tasks. There were no differences in post-stress recovery, or in heart rate reactivity and recovery. These findings were independent of grade of employment and income, so do not reflect the links with objective SES that have previously been identified (33, 44). Nor were there differences between financial strain groups in subjective stress responses to tasks, so the pattern of BP responses does not appear to relate to individual differences in subjective experience. However, it should be noted that subjective experience was measured with a single rating repeated at various time points during the test session, and a more comprehensive assessment might have yielded different results. It would therefore appear that the reduced BP reactivity is a direct correlate of

chronic financial strain. The explanation for this pattern is uncertain. It has been argued that blunted cardiovascular reactivity is related to suboptimal fronto-limbic activation and is linked with impaired motivation (45). Blunted cardiovascular reactivity has been related to factors such as negative affectivity and adverse life experiences (24, 46, 47). However, most of this work has been focused on heart rate reactions to acute mental stress, and we found no differences in heart rate responses. Another explanation is that reduced BP reactions are a manifestation of chronic allostatic load. According to this model, both attenuated post-stress recovery and reduced responsivity may arise through the deterioration of autonomic and neuroendocrine regulatory processes accompanying severe allostatic load (26). We showed in an earlier study that BP reactions to acute stress were reduced in people with type 2 diabetes compared with controls (25), and similar processes may have operated in this study.

Contrary to our expectations, we found no relationship between financial strain and plasma IL-6 or lipid increases following stress. Other studies have observed an inverse association between IL-6 and affective wellbeing and optimism (48, 49), while depression is related to elevated IL-6 in many studies (50). Greater inflammation is also related to lower income and education (51), but it is possible that inflammatory processes are more strongly associated with objective indices of SES than with financial strain.

This study involved a sample of older men and women of European descent, and similar results might not emerge with other sectors of the population. The relatively good health of participants was evident in the average SF-36 scores of 82.73 and 80.01 for the physical and mental health composite scales, and we do not know whether associations with financial strain would be

amplified among individuals in poorer health. Longitudinal information was only available for a limited number of variables, and the psychophysiological stress testing results were cross-sectional. Wealth is a valuable objective indicator of financial resources at older ages, but was unfortunately not measured in this study. The study took an outcome-wide approach to analysis because we were interested in the associations between financial strain an a number of psychosocial, health and biological outcomes (28). We did not correct for multiple comparisons among interrelated outcomes, although the cross-sectional associations detailed in Table 2 survived Bonferroni correction. The findings endorse the importance of financial strain as a chronic stressor that has implications for mental and physical health. The balance between income and outgoings is relevant at a societal level independently of objective measures of affluence and SES.

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Figure legends

Figure 1 Mean levels of systolic BP (upper panel) and diastolic BP (lower panel) in mmHg across baseline, task, and recovery periods 40-45 and 70-75 min following tasks, in the three groups. No financial strain: ● solid line; some financial strain: ♦ dotted line; moderate/severe financial strain: ▲dashed line. Error bars are standard errors of the mean.

Figure 1

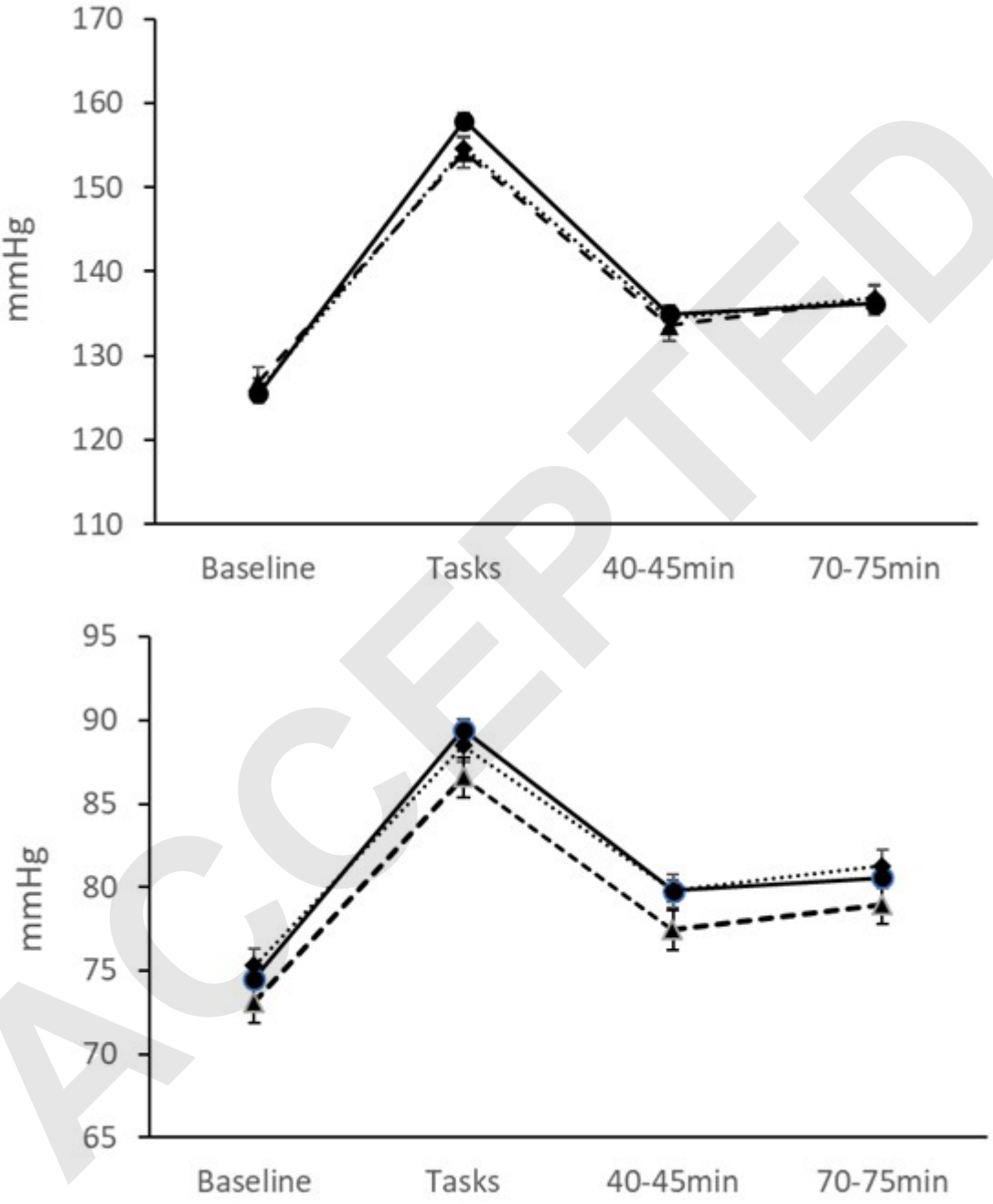

Table 1. Financial Strain and Covariates

	Total N = 542	Moderate/Severe Financial Strain N = 91	Some Financial Strain N= 135	No Financial Strain N = 316	p-value[1]
Age	62.88 ± 5.65	62.57 ± 5.74	63.15 ± 6.20	62.86 ± 5.39	0.75
Sex					
Men	293 (54.1%)	48 (52.7%)	73 (54.1%)	172 (54.4%)	0.79
Women	249 (45.9%)	43 (47.3%)	62 (45.9%)	144 (45.6%)	
Grade of Employment					
Higher	208 (38.4%)	16 (17.6%)	48 (35.6%)	144 (45.6%)	<0.001
Intermediate	212 (39.1%)	47 (51.6%)	53 (39.3%)	112 (35.4%)	
Lower	122 (22.5%)	28 (30.8%)	34 (25.2%)	60 (19.0%)	
Household income					
<20K	109 (20.7%)	33 (37.1%)	32 (24.4%)	44 (14.3%)	<0.001
20-39K	211 (40.0%)	35 (39.3%)	56 (42.7%)	120 (39.1%)	
40-59K	105 (19.9%)	13 (14.6%)	25 (19.1%)	67 (21.8%)	
≥60K	102 (19.4%)	8 (9.0%)	18 (13.7%)	76 (24.8%)	
Marital Status					
Married	348 (64.4%)	60 (65.9%)	84 (62.2%)	204 (65.0%)	0.97
Not married	192 (35.6%)	31 (34.1%)	51 (37.8%	110 (35.0%)	
Paid Employment					
No	336 (62.0%)	49 (53.8%)	83 (61.5%)	204 (64.6%)	0.071
Yes	206 (38.0%)	42 (46.2%)	52 (38.5%)	112 (35.4%)	

[1]p for linear contrast across financial strain categories

Table 2. Financial strain and psychosocial and health-related factors: cross-sectional associations

	Total Mean ± SD	Financial Strain Category (95% C.I.)			p-value[1]
		Moderate/Severe	Some	None	
Depression (CESD) (n = 524)	6.60 ± 6.47	8.61 (7.25-9.97)	7.31 (6.22-8.40)	5.70 (4.98-6.43)	0.001
Positive affect (PANAS) (n= 521)	23.30 ± 6.36	21.69 (20.25-23.02)	21.96 (20.88-23.03)	24.35 (23.64-25.06)	0.001
Loneliness (UCLA) (n = 524)	34.55 ± 10.64	37.89 (35.75-40.03)	36.54 (34.83-38.24)	32.71 (31.57-33.85)	<0.001
Optimism (LOT) (n = 525)	15.75 ± 4.00	14.03 (13.20-14.85)	14.95 (14.30-15.61)	16.59 (16.15-17.03)	<0.001
Self-Esteem (Rosenberg) (n = 525)	21.63 ± 4.63	20.50 (19.54-21.47)	20.70 (19.93-21.47)	22.36 (21.85-22.85)	0.001
Sense of Control (n = 523)	5.03 ± 0.96	5.05 (4.85-5.25)	5.14 (4.98-5.30)	5.44 (5.33-5.55)	0.001
SF36 Physical Health (n = 525)	82.73 ± 14.04	79.58 (76.60-82.57)	81.76 (79.37-84.14)	84.07 (82.48-85.66)	0.011
SF36 Mental Health (n = 525)	80.01 ± 12.76	74.33 (71.65-77.01)	78.89 (76.75-81.03)	82.15 (80.72-83.57)	<0.001
Sleep Problems (Jenkins) (n = 525)	2.39 ± 1.09	2.88 (2.65-3.11)	2.46 (2.27-2.64)	2.22 (2.10-2.34)	<0.001

Adjusted for age, sex, grade of employment, household income, marital status and paid employment

[1]p for linear contrast across financial strain categories

Table 3. Financial strain and psychosocial and health-related factors: longitudinal associations

	Financial Strain Category (95% C.I.)			p-value[1]
	Moderate/Severe	**Some**	**None**	
Depression (CESD) (n = 496)				
Model 1	8.42 (7.07-9.78)	6.16 (5.08-7.25)	5.48 (4.76-6.20)	<0.001
Model 2	7.20 (6.10-8.30)	5.92 (5.05-6.79)	5.94 (5.36-6.52)	0.053
Loneliness (UCLA) (n = 494)				
Model 1	37.81 (35.60-40.02)	34.42 (32.66-26.17)	31.30 (31.14-32.47)	<0.001
Model 2	34.92 (33.57-36.23)	33.21 (32.14-34.27)	32.69 (31.98-33.40)	0.006
SF36 Physical Health (n = 497)				
Model 1	77.28 (74.01-80.55)	80.06 (77.46-82.66)	83.05 (81.32-84.78)	0.003
Model 2	79.40 (76.59-82.21)	80.43 (78.21-82.65)	82.28 (80.79-83.76)	0.083
SF36 Mental Health (n = 497)				
Model 1	73.78 (70.64-76.91)	79.27 (76.78-81.75)	80.96 (79.30-82.62)	<0.001
Model 2	77.77 (75.11-80.45)	79.55 (77.47-81.63)	79.67 (78.28-81.07)	0.23
Sleep Problems (Jenkins) (n = 495)				
Model 1	2.92 (2.68-3.16)	2.51 (2.31-2.70)	2.23 (2.10-2.35)	<0.001
Model 2	2.51 (2.34-2.69)	2.48 (2.34-2.61)	2.36 (2.27-2.45)	0.14

Model 1: Adjusted for age, sex, grade of employment, household income, marital status, paid employment.

Model 2: Additionally adjusted for baseline level of the outcome variable

[1]p for linear contrast across financial strain categories