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Leveraging naturally occurring variation in financial stress to examine associations with inflammatory burden among older adults

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Abstract

Background—Financial strain is associated with earlier disability and mortality, but causal links are underexplored, partly because it is unethical to randomise people to financial stress. This study leverages naturally occurring random variation in days since monthly Social Security payment arrival among older adults to test associations with inflammatory biomarkers.

Methods—Biomarker data, including tumour necrosis factor (TNF)- α , interleukin (IL)-6 and C reactive protein (CRP), was collected from 2155 non-working healthy adults aged 70–79 years, participating in the Health, Aging and Body Composition Study. Days since payment arrival was independent of all demographic, socioeconomic or health characteristics measured in this study. Restricted cubic spline models estimated associations separately for each week of the month, stratified by financial strain status (interaction term p value for TNF- α model <0.05).

Results—Among financially strained older adults, more days since payment arrival was associated with higher TNF- α levels during the first week of the month (coefficient=0.102). Associations with IL-6 and CRP differed depending on the degree of financial strain (interaction term p values <0.05). Those with low, but not high, strain had lower levels of IL-6 (coefficient=−0.152) and CRP (coefficient=−0.179) during the first week.

Conclusions—Days since monthly payments were associated with inflammatory cytokines among older adults who have difficulty making ends meet financially and associations depended on financial strain severity, suggesting that results are attributable to monthly variation in financial stress. Future research should examine whether more frequent Social Security disbursement would modify financial strain and inflammatory biomarkers.

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INTRODUCTION

Approximately one-third of US older adults report chronic financial strain,¹ defined as difficulty making ends meet each month.² Chronic financial strain predicts earlier disability and mortality among older adults independent of income.³⁻⁵ Chronic financial strain is believed to trigger inflammation because related chronic stressors, such as unemployment⁶ and low income,⁷ are associated with elevated interleukin (IL)-6 and C reactive protein (CRP), and these biomarkers, in turn, predict disability and mortality.⁸⁹ However, causal links are not well tested. Among individuals with chronic financial strain, levels of financial stress likely fluctuate over time in response to available household income, and naturally occurring variation could be leveraged to elucidate mechanisms linking financial stress and health. For example, low-income adults, particularly those with chronic financial strain,¹⁰ typically reduce household spending at the end of the month.¹⁰⁻¹² End-of-the-month spending reductions are most pronounced for food, home repairs and medical expenses,¹⁰⁻¹² suggesting that individuals may temporarily forego basic necessities. Importantly, low-income adults have lower caloric intake, fewer servings of fruits and vegetables¹³ and 27% more hypoglycaemia-related hospital admissions in the last versus first week of the month.¹⁴ These findings link monthly financial constraints to blood glucose levels. Whether end-of-the-month financial constraints increase inflammatory biomarkers is unknown. This is an important gap because financial stress is more strongly associated with functional limitations than other types of stress¹⁵ and may affect health differently. As examples, financial stress is characterised by uncontrollability and social stigma, which provoke stress response mechanisms in laboratory testing,¹⁶ and, unlike other types of stress, the effect of financial stress on poor health is not explained by risky health behaviours.¹⁷

This study leverages naturally occurring variation in days since 3rd of the month Social Security payment arrival among older adults reliant on these payments. Social Security is paid to over 90% of older adults and is the main source of income for about two-thirds of those recipients.¹⁸ Thus, days since Social Security payment arrival could be a good measure of temporal variation in financial stress among older adults. Importantly, the number of days between Social Security payment arrival and a research study clinic visit likely varies at random, allowing this study to exploit a randomly distributed exposure. This study first tests whether days since payment arrival is associated with lower and then higher inflammatory biomarkers over the month among older adults experiencing chronic financial strain and not among those without financial strain. This study investigates three biomarkers capturing similar but distinct inflammatory mechanisms that independently predict mortality.¹⁹ IL-6 and tumour necrosis factor (TNF)- α are cytokines regulated by nuclear factor- κ B protein²⁰ and CRP is triggered by IL-6.²¹ Second, since financial stress may not be relieved by a monthly payment for older adults with severe financial strain, the study tests whether payment arrival is more strongly associated with biomarkers among those with lower financial strain.

METHODS

Sample

The Health, Aging and Body Composition (Health ABC) Study is a prospective cohort study designed to investigate incident disability among community-dwelling older adults aged from 70 to 79 years (n=3075). Potential participants from designated zip code areas surrounding Memphis, Tennessee, and Pittsburgh, Pennsylvania metropolitan areas were identified from a random sample of White Medicare beneficiaries and all age-eligible Black community residents. Individuals were excluded if they reported difficulty walking one-quarter mile, climbing 10 steps or performing activities of daily living. This study uses baseline data collected between April 1997 and June 1998. Participants provided informed consent. These analyses were approved by the Johns Hopkins Medicine Institutional Review Board.

Health ABC Study is the ideal study to answer the research question because all participants were eligible for Social Security benefits for at least 5 years prior to May 1, 1997. Beneficiaries enrolled prior to this date receive their payments on the 3rd of the month. Therefore, Social Security payment dates are known. Also, the Health ABC Study excluded individuals with cancer or disabilities that can alter or overwhelm physiologic response to financial stress. Participants who worked for pay (n=746, 24%) were excluded from analyses because days since earned income payment arrival was not measured and Social Security may not be the primary income source for this group. Individuals who worked for pay were younger (mean age in years=73 (SE=0.10) vs 74 (SE=0.06)) with higher incomes (eg, 21% vs 14% had incomes US\$50 000) and were more likely to be men (60% vs 45%) than those who did not work for pay but did not differ with regard to race, financial strain status or food insecurity. Individuals with CRP levels >10 µg/mL (n=116) who have a high likelihood of active infection²²²³ and those taking exogenous corticosteroids (n=58) were excluded because of interference with physiologic response to financial stress. Analyses included the remaining 2155 Health ABC Study participants.

Variables

Morning blood samples were collected after an overnight fast. Specimens were frozen at -70°C and shipped to the Health ABC Study core laboratory at the University of Vermont. TNF-α, IL-6 and CRP were measured in duplicate by ELISA using frozen-stored serum or plasma with methods described in detail elsewhere.²⁴ The lower detectable limits for cytokines were 0.10 pg/mL and 0.18 pg/mL, for IL-6 and TNF-α, respectively. The CRP assay was standardised according to the WHO's First International Reference Standard, with a sensitivity of 0.08 µg/ mL and the lower detectable limit was 0.007 µg/mL. Interassay variabilities for IL-6, TNF-α and CRP were 10.3%, 15.8%, and 8.0%, respectively.

The exposure of interest was days since Social Security payment arrival, which was calculated as the difference in days between the clinic visit date (or blood draw date if done on a different day), and the most recent Social Security payment arrival date, based on published Social Security payment calendars for 1997 and 1998. At that time, 75% of payments were distributed by direct deposit. (For details, see <https://www.ssa.gov/>)

[history/ssa/ssa2000chapter5.html](https://history.ssa/ssa2000chapter5.html)). Therefore, days since Social Security payment arrival can be readily estimated.

As in prior work,² chronic financial strain was measured by asking ‘How well does the amount of money you have take care of your needs?’ (very well, fairly well or poorly) and ‘In general, how do your finances usually work out at the end of the month?’ (some, just enough or not enough money to make ends meet). The two items were correlated ($r=0.52$). For 127 participants who were missing data for one of the two questions, the observed value for the other question was imputed prior to summing scores. Chronic financial strain was categorised as none (scores of 0), low (scores of 1) or high (scores 2–4) and a separate dummy variable was created to indicate presence of any chronic financial strain.

In this study, days since payment arrival is used as a measure of monthly variant financial stress. Associations between payment arrival and biomarkers are hypothesised to vary depending on chronic financial strain. This study accounts for food insecurity (ie, any lack of money to buy needed food) and blood glucose (mg/dL) because they are also likely monthly variant,¹⁴²⁵ and their variability may be associated with inflammatory changes (see online supplementary figure 1).²⁶²⁷ The serum glucose assay had a lower limit of 20 mg/dL and interassay variability of 1.2%

Additional demographic, socioeconomic and health-related characteristics were used to test the assumption that days since payment arrival was randomly distributed. Demographic factors included age, sex and race (White (reference), Black). In addition to chronic financial strain and food insecurity, socioeconomic characteristics included income (<US\$10 000 (reference), US\$10 000 to <US\$25 000, US\$25 000 to <US\$50 000 and US\$50 000) and number of financial assets (checking/savings account, money market, certificate of deposits, investment property, business/farm, stock/mutual funds, retirement plans, other investments). Household size was measured because it may reflect more income sources and different financial needs. Health-related characteristics included waist circumference (in cm), usual walking speed (m/s) based on fastest rate of three 6-meter walk trials, current smoking status, any alcohol consumption over the past year, depressive symptoms based on Center for Epidemiologic Studies Depression Scalescore,²⁸ presence of anxiety based on the Hopkins Symptom Checklist²⁹³⁰ and number of chronic conditions with an inflammatory component (heart disease, asthma/chronic obstructive pulmonary disease, arthritis, congestive heart failure, diabetes or gout).

Statistical analysis

Each outcome was winsorized at the 99.9th upper percentile to account for one to two values that were far above the reliably detectable range. Multiple imputation by chained equations among all Health ABC Study participants was employed with 20 replications to address missing data whenever imputation was supported by the data for variables with missing data (all biomarker variables, income, assets, food insecurity, depression, anxiety, glucose, walking speed, smoking status, drinking status, chronic financial strain and its interaction terms with days since payment arrival). In addition to the variables listed above, imputation used other biomarker values from years one and two of the Health ABC Study, study site, home ownership, education, receipt of subsidised food, corticosteroid use, working status,

stressful life event and interactions between financial strain and depression. Missing data rates for the analytic sample were highest for income (12.5%) and assets (9.5%) and were <4% for all other independent variables. Missing data rates for IL-6, CRP and TNF- α were 5.0%, 1.3% and 6.6%, respectively. Values were imputed for 5% of observations for all variables.

To evaluate our assumption that days since payment arrival was randomly distributed in the sample, we first tested its bivariate associations with all demographic, socioeconomic and health-related variables listed above. Then, restricted cubic spline models³¹ were used to test hypothesised associations between days since Social Security payment arrival and inflammatory biomarkers in linear regression models with robust SEs. Restricted cubic spline models examine non-linear associations using piecewise regression. Therefore, the slope is allowed to vary over the month and separate coefficients for each week of the month are reported. One set of models compared hypothesised associations among those with financial strain to those without, using interaction terms among the total sample. Another set of models tested whether associations differed depending on the degree of chronic financial strain using interaction terms among those experiencing strain. Next, regression models were stratified by chronic financial strain to test hypothesised associations.

RESULTS

The average number of days since monthly Social Security payment arrival in this sample ($n=2155$) was 14.65 days ($SE=0.19$) (table 1). The average age was about 74 years and 60% of the sample experienced some degree of chronic financial strain. Additional sample characteristics are described in table 1. None of the demographic, socioeconomic and health-related characteristics measured in this study were associated with days since payment arrival (table 1). Higher degree of chronic financial strain was associated with higher average levels of IL-6 and CRP but not TNF- α (table 2). IL-6 and CRP were moderately correlated ($r=0.40$) but TNF- α was weakly correlated with both IL-6 ($r=0.21$) and CRP ($r=0.13$).

Associations with days since Social Security payment arrival differed depending on presence of financial strain for TNF- α (table 3 and depicted in figure 1 by comparing the no-strain group to low-strain and high-strain groups) during the first week after payment arrival (interaction term p value=0.028). Among financially strained older adults, each additional day since payment arrival was associated with higher TNF- α levels during the first week of the month (coefficient=0.1017, $p=0.028$) (table 3). IL-6 and CRP were not associated with days since payment arrival in either group.

Among participants with chronic financial strain, associations with days since Social Security payment arrival differed depending on degree of financial strain for IL-6 and CRP (table 4 and depicted in figure 1 by comparing the no-strain, low-strain and high-strain groups for IL-6 and CRP) during the first week after payment arrival (interaction term p values= 0.032 and 0.004, respectively) and for CRP during the second week (interaction term p value= 0.041). Among older adults experiencing low levels of chronic financial strain (table 4), each additional day since payment arrival was associated with lower levels of IL-6

(coefficient=-0.1515, p=0.048) and CRP (coefficient=-0.1788, p=0.006) during the first week after payment arrival.

Sensitivity analyses

Sensitivity analyses addressed four issues. First, additional models tested interaction terms between payment arrival with food insecurity and blood glucose, but no interaction was found (results not shown). Second, separate models adjusted for demographic, socioeconomic and health-related characteristics to address possible residual confounding. In adjusted models, inferences remained unchanged except that there was no association between payment arrival and IL-6 during the first week and instead an association with higher CRP during the second week among those with low chronic financial strain (online supplementary tables 1 and 2). Third, since assets may provide income that arrives throughout the month an interaction between assets and payment arrival was tested but not found. Finally, since larger households may have different financial needs and resources, an interaction between household size and payment arrival was tested but not found.

DISCUSSION

This study leveraged naturally occurring variation in the number of days since 3rd of the month Social Security payment arrival among older adults. As in prior studies, this study found that individuals with chronic financial strain have higher average levels of inflammatory biomarkers than their peers,³²⁻³⁴ and these results build on prior studies by finding that these levels differ over time during the week after Social Security payments arrive. These results provide evidence of monthly variation in inflammatory biomarkers among older adults with chronic financial strain that can be readily appreciated in figure 1. Notably, payment arrival was only associated with biomarkers among older adults with financial strain and associations depended on financial strain severity, suggesting that results are due to beginning-of-the-month changes in financial stress.

Unlike prior studies reviewed earlier that found end-of-the-month dietary and glucose differences,¹³¹⁴ this study found beginning-of-the-month differences in inflammatory biomarkers. Lower levels of IL-6 and CRP among older adults who have just enough money each month suggest that the arrival of the monthly payment may relieve financial stress for these households. Although the association with IL-6 was not found in adjusted analyses, the unadjusted models may be less biased because treatment assignment appears to be random. This study also contributes to the literature by showing that the severity of financial strain, and not just the presence of financial strain, is relevant to inflammatory biomarkers. Older adults with the most severe financial strain had the highest levels of IL-6 and CRP overall, and these levels did not differ over the month. These results suggest that the monthly Social Security payment is insufficient for relieving financial stress among those who do not have enough money to make ends meet each month.

Interestingly, results in this study differed across the biomarkers. Consistent with studies of other chronic stressors,⁶⁷ chronic financial strain is associated with higher IL-6 and CRP but not TNF- α in this study. Also, in this study, each additional day is associated with higher levels of TNF- α , but lower levels of IL-6 and CRP during the first week after payment

arrival, and results for IL-6 and CRP were only found among older adults with low financial strain. Differences in results across biomarkers are noteworthy because they may elucidate the specific physiologic mechanisms triggered by financial stress. One possible explanation for the differing directions of association is that IL-6 has been shown to suppress TNF- α ³⁵; the increasing levels of TNF- α after payment arrival may be in response to decreasing levels of IL-6. Alternatively, TNF- α , which responds to acute stress,³⁶³⁷ may respond differently after adaptation to a chronic stressor.

These results build on a prior study that showed that behavioural factors do not account for the effect of financial strain on poor health¹⁷ by suggesting that physiologic pathways, including inflammatory cytokines, may account for the consistent relationship between financial strain and mortality, disability, ageing-related outcomes that have been found in prior studies.³⁵³²³⁸³⁹ These results build on that work by suggesting that financial stress varies over time, highlighting that it is a modifiable social determinant of health. This is important because programmes such as Medicaid, the Supplemental Nutrition Assistance Program and the Low Income Home Energy Assistance Program already exist that are intended to improve financial well-being for low-income households. Strengthening these programmes and targeting resources towards those with greatest financial stress may improve stress-related health outcomes for older adults. Results from this study suggest that Social Security, other entitlement programmes and public benefit programmes consider changing the timing and/ or frequency of payments to assist older adults in meeting their monthly needs.

Strengths and limitations

This study did not measure anti-inflammatory biomarkers, which limits interpretation of physiologic regulation and feedback mechanisms. Also, days since payment arrival is used as a proxy for financial stress, but other exposures such as social stressors may vary monthly, although comparison of financially strained to non-strained individuals strengthens our inferences about underlying mechanisms. Chronic financial strain duration is unknown and the measure may misclassify degree of financial stress because it may reflect coping ability in addition to the financial stress itself. Financial stress may be misclassified among those who have income from assets or pensions, although this study is strengthened by finding that associations do not differ depending on assets. Survival bias may have affected these results because of the selection of a healthy cohort of older adults. However, selection of a healthy cohort strengthened our inferences with regard to reverse causality, since costly conditions and disability may induce financial stress. Cost-related medication non-adherence was not measured and may account for monthly variation in inflammatory biomarkers.

CONCLUSIONS

In this study, more days since monthly Social Security payment arrival is associated with higher TNF- α levels among healthy older adults experiencing chronic financial strain at the beginning of the month, and associated with lower levels of CRP and IL-6 among those who have just enough money to make ends meet each month. Importantly, associations between payment arrival and inflammatory biomarkers differed depending on the presence and

severity of chronic financial strain, suggesting that financial difficulties may explain these findings. Together, these results suggest that increases in financial stress over time may contribute to accumulated disadvantage in inflammatory burden among older adults.⁴⁰ These results may partly account for earlier physiologic ageing among older adults experiencing financial challenges.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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What is already known on this subject

- One-third of US older adults experience financial strain, defined as difficulty making ends meet. Financial strain is consistently associated with earlier disability and mortality. However, causal mechanisms are not understood. This gap is important because existing programmes can improve financial strain but not all eligible older adults use these programmes.

What this study adds

- This study leveraged naturally occurring random variation in exposure to financial stress among healthy older adults likely reliant on monthly Social Security payments. Those with financial strain have increasing TNF- α and decreasing IL-6 and CRP during the first week after Social Security payment. No associations were found among those without financial strain, suggesting that results are due to beginning-of-the-month changes in financial stress. These results strengthen causal inferences linking financial stress with inflammatory biomarkers, highlighting the importance of relieving financial strain for older adults.

Figure 1.

Predicted mean inflammatory biomarker levels based on the number of days since receiving Social Security payment arrival with 95% CIs for interleukin (IL)-6 (top row), TNF- α , tumour necrosis factor (TNF)- α (middle row) and C reactive protein (CRP) (bottom row), among Health, Aging and Body Composition Study participants not working for pay. Predicted values were obtained from restricted cubic spline regression models stratified by chronic financial strain level (none, low, high).

Table 1

Selected sample characteristics and their bivariate associations with days since Social Security payment arrival among Health, Aging and Body Composition Study participants not working for pay (n= 2155)

	Sample estimates	P value testing association with days since payment arrival*
Mean days since Social Security payment arrival (SE) (range 0–30)	14.65 (0.19)	
Age (SE) (range 68–80)	73.82 (0.06)	0.347
Gender (%)		0.283
Men	982 (46)	
Women	1173 (54)	
Race (%)		0.578
White	1296 (60)	
Black	859 (40)	
Chronic financial strain (%)		0.314
None	845 (41)	
Low	592 (29)	
High	636 (31)	
Family income (%)		0.616
<US\$10 000	262 (14)	
US\$10 000 to <\$25 000	749 (40)	
US\$25 000 to <\$50 000	590 (31)	
US\$50 000	280 (15)	
Food insecurity (%)		0.792
No	1930 (93)	
Yes	144 (7)	
Mean number of financial assets (SE) (range 0–7)	1.88 (0.04)	0.850
Mean number of other household members (SE) (range 0–30)	0.84 (0.01)	0.496
Smoke (%)		0.154
No	1938 (90)	
Yes	215 (10)	
Drink (%)		0.068
No	1661 (77)	
Yes	486 (23)	
Mean number of chronic conditions (SE) (range 0–5)	1.06 (0.03)	0.551
Mean fasting glucose, in mg/dL (SE) (range 49–449)	101.76 (1.00)	0.354
Mean walking speed, m/s (SE) (range 0–1.98)	1.17 (0.01)	0.746
Mean waist circumference, cm (SE) (range 15–225)	99.37 (0.29)	0.582
Mean depression score (SE) (range 0–43)	4.84 (0.12)	0.060
Anxiety symptoms (%)		0.942
No	1755 (82)	
Yes	393 (18)	

* Obtained from linear regression models using days since payment arrival as the dependent variable.

Multiply imputed data used to obtain estimated values.

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Table 2

Mean inflammatory biomarker levels based on degree of chronic financial strain among Health, Aging and Body Composition Study participants not working for pay (n= 2155)

	No chronic financial strain (40%)	Low financial strain	High financial strain	P value
Mean IL-6 (pg/mL) (SE)	2.13 (0.06)	2.40 (0.08)	2.55 (0.09)	<0.001
Mean TNF- α (pg/mL) (SE)	3.51 (0.06)	3.51 (0.07)	3.44 (0.06)	0.449
Mean CRP (μ g/mL) (SE)	2.06 (0.06)	2.28 (0.07)	2.40 (0.08)	<0.001

Multiply imputed data used to obtain estimated values. P values were obtained from ordered logistic regression comparing mean biomarker value across chronic financial strain groups. CRP, C reactive protein; IL-6, interleukin 6; TNF- α , tumour necrosis factor- α .

Table 3

Restricted cubic spline regression beta coefficients representing associations between days since Social Security payment arrival with inflammatory biomarkers among Health, Aging and Body Composition Study participants not working for pay, stratified by chronic financial strain status (n= 2149)

	No chronic financial strain coefficient (p value)	Chronic financial strain coefficient (p value)	P value for interaction term testing heterogeneity by presence of financial strain*
IL-6 (pg/mL)	(n= 824)	(n= 1195)	
Week 1	0.0065 (0.893)	-0.0405 (0.492)	0.537
Week 2	0.0204 (0.949)	0.0779 (0.840)	0.909
Week 3	-0.1334 (0.875)	-0.0672 (0.947)	0.960
Week 4	0.3404 (0.734)	-0.1780 (0.878)	0.736
TNF- α (pg/mL)	(n= 814)	(n= 1180)	
Week 1	-0.0467 (0.342)	0.1017 (0.028)*	0.028*
Week 2	0.3259 (0.357)	-0.5134 (0.100)	0.075
Week 3	-0.7752 (0.421)	1.1630 (0.149)	0.122
Week 4	0.6020 (0.614)	-0.9764 (0.271)	0.287
CRP (μ g/mL)	(n= 838)	(n= 1210)	
Week 1	0.0518 (0.249)	-0.0664 (0.151)	0.067
Week 2	-0.3334 (0.274)	0.2788 (0.365)	0.157
Week 3	0.8088 (0.329)	-0.5136 (0.529)	0.255
Week 4	-0.6744 (0.519)	0.1327 (0.890)	0.570

* Tested by interaction between any financial strain with days since payment arrival spline term among all study participants.

CRP, C reactive protein; IL-6, interleukin 6; TNF- α , tumour necrosis factor- α .

Coefficients were obtained from linear regression models with a restricted cubic spline term for days since Social Security payment arrival with knots at days 7, 14, 21 and 28.

Table 4

Restricted cubic spline regression beta coefficients representing associations between days since social security payment arrival with inflammatory biomarkers among Health, Aging and Body Composition Study participants not working for pay and experiencing chronic financial strain (n=1228)

	Low chronic financial strain coefficient (p value)	High chronic financial strain coefficient (p value)	P value for interaction term testing heterogeneity by degree of financial strain *
IL-6 (pg/mL)	(n= 584)	(n= 617)	
Week 1	-0.1515 (0.048) *	0.0943 (0.285)	0.032 *
Week 2	0.6369 (0.198)	-0.6165 (0.297)	0.094
Week 3	-1.3891 (0.286)	1.5790 (0.305)	0.129
Week 4	0.9779 (0.510)	-1.6495 (0.348)	0.239
TNF- α (pg/ mL)	(n= 574)	(n= 612)	
Week 1	0.1303 (0.063)	0.0665 (0.253)	0.470
Week 2	-0.8720 (0.067)	-0.1229 (0.752)	0.215
Week 3	2.2706 (0.065)	0.0072 (0.994)	0.148
Week 4	-2.5611 (0.057)	0.5710 (0.610)	0.070
CRP (μ g/mL)	(n= 590)	(n= 626)	
Week 1	-0.1788 (0.006) *	0.0732 (0.234)	0.004 *
Week 2	0.8015 (0.061)	-0.3961 (0.354)	0.041 *
Week 3	-1.6642 (0.144)	1.0052 (0.376)	0.087
Week 4	0.9731 (0.472)	-1.0694 (0.425)	0.268

* Tested by interaction between any financial strain with days since payment arrival spline term among all participants with chronic financial strain.

CRP, C reactive protein; IL-6, interleukin 6; TNF- α , tumour necrosis factor- α .

Coefficients were obtained from linear regression models with a restricted cubic spline term for days since Social Security payment arrival with knots at days 7, 14, 21 and 28.