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RESEARCH ARTICLE

Perceived stress in relation to working hours and caring responsibilities: A cross-sectional study during the COVID-19 pandemic

[version 1; peer review: 1 approved with reservations]

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Abstract

Introduction

Stress is associated with adverse physical and mental health outcomes. While work hours have been linked to health and stress outcomes, part-time work may be used to manage work and care responsibilities and thus potentially reduce stress. We examined this relationship in the Netherlands, where part-time work is very common among women, during the COVID-19 pandemic – a period when stress levels were potentially high(er).

Methods

Data included 1,220 men and women in the Netherlands aged 24 to 64 years from the COGIS-NL study (Wave 2, June 2020) and other modules of the Longitudinal Internet studies for the Social Sciences panel. Kitagawa-Oaxaca-Blinder decomposition analyses were used to analyse gender differences in perceived stress in relation to weekly work hours (<20 hours, short part-time; 20-34 hours, long part-time; 35 hours or more, full-time). Cross-sectional ordinary least squares regression analyses further tested these associations, and any potential mediation by perceived work-life balance, controlling for

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age, educational level, family situation, and employment situation.

Results

Gender differences in stress can be attributed to differential effects of part-time employment on men and women's perceived stress levels. Long part-time work hours were associated with lower stress levels for women, but not for men, and it was only associated with lower stress levels for mothers with co-resident minor children and not for women without. Perceived work-life balance was independently associated with stress but did not mediate the relationship between work hours and stress.

Conclusions

Higher stress levels among women are likely attributable to differential effects of part-time work on men and women's stress levels. Working fewer hours (<35) buffered perceived stress for mothers, but not for fathers or individuals without co-resident minor children. Although perceived work-life balance was associated with perceived stress, it did not influence the relationship of work hours with stress.

PLAIN LANGUAGE SUMMARY

This study explores how work hours and caregiving responsibilities relate to stress levels in men and women during the COVID-19 pandemic, with a focus on the Netherlands—a country with high levels of part-time work. It examines how gender and caregiving roles influence stress, particularly whether working fewer hours can reduce stress. Key findings include: women experienced higher stress levels than men, and this was not simply because women were more likely to work part-time. Instead, stress was influenced by how work hours impacted men and women differently. For women, working 20–34 hours per week (long part-time) was linked to lower stress compared to full-time work, but working very short hours (less than 20) did not reduce stress further. For men, work hours were not strongly linked to stress levels. We also find that caregiving roles matter: Women with children living at home benefited the most from working part-time, as it seemed to help them balance work and caregiving responsibilities. However, women without children at home did not experience the reduction in stress. Men's stress levels were not significantly affected by the number of hours they worked, regardless of caregiving responsibilities. Finally, people's perceived work-life balance matters. Feeling like work and caregiving were balanced was associated with lower stress, especially for those with children at home. However, this balance did not explain the link between work hours and stress—it had its own independent impact. The study highlights the importance of understanding caregiving responsibilities when designing policies to reduce stress, particularly for working parents. It suggests that supporting flexible work arrangements, especially for caregivers, could help reduce stress during times of crisis. However, long-term

strategies should consider the career and financial impacts of reduced work hours, especially for women.

Keywords
Caregiving; Gender; Stress; Work-life balance; Work hours

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Introduction

Higher stress levels have been associated with adverse physical and mental health outcomes[1], including cardiovascular disease, depression[2], and several unhealthy behaviours[3] and work hours have been linked to such health and stress outcomes[4]. Besides long and unsociable work hours, which have been associated with higher stress levels and burnout risks[5], higher stress levels have mostly been reported by full-time workers[6]. Part-time work may be used to manage work and care responsibilities, thus reducing stress, although it may have negative long-term consequences, such as career penalties and increased economic dependency[7,8].

Paradoxically, while women in most industrialized countries are more likely than men to work part-time, they are more likely to report higher stress levels[1,9,10]. These gender differences in stress may relate to parenthood and other care responsibilities, which are key contributing factors to stress[11]. The association between parenthood or other care responsibilities and stress varies for women and men[9]. For example, motherhood is more strongly associated with difficulties in combining paid work and care than fatherhood, and also with higher stress levels[12].

Stress levels were significantly impacted by the COVID-19 pandemic and measures taken to limit the spread of SARS-CoV-2[13]. For example, higher stress levels have been reported by adults who stopped working during the pandemic compared to those who continued working[14]. Perceived stress also increased for many individuals who worked from home, due to a blurring of the boundaries between their work and private life[15]. Other studies also suggested higher stress levels for individuals combining work and care during the early months of the pandemic[16,17].

Yet stress levels experienced by men and women during the pandemic differed. These gender differences in stress levels are potentially mediated by differences in work-care responsibilities, which the pandemic may have amplified[18]. For example, mothers in the Netherlands experienced higher levels of work pressure and greater difficulty in balancing work and care than fathers[18]. Amongst highly educated mothers, perceived work-life balance was worse for those without a partner than for those with a partner[19]. Although some men started to spend more time on childcare and household tasks during the pandemic compared to before[20], women continued doing more[21,22].

Working reduced hours has the potential to buffer the effects of stress, during the pandemic or otherwise. Yet consideration is needed for gender differences as part-time work is a decidedly female phenomenon. There is significant variation in working hours among women[8,23] and much less variation in working hours among men. Studying this relationship in the Netherlands, with the highest levels of part-time work in industrialized countries[24], allows us to analyse in more detail the relationship between short and long part-time hours and stress levels than what can be studied in most other countries with lower part-time work rates.

We use representative, cross-sectional survey data to study differences in perceived stress levels related to gender and work hours in the Netherlands in June 2020, as COVID-19 pandemic containment measures were relaxed. We further examine whether perceived work-life balance mediates the relationship between work hours and perceived stress. In extant studies on work-life balance, the focus is often on parents with children rather than individuals with other caring responsibilities (e.g., for sick family members)[25]. These individuals experience more stress than individuals who do not have such care responsibilities[26], and caregivers often work reduced hours as a means of combining work and care[27]. We include this group in our study to provide a more nuanced understanding of work hours, gender and stress in relation to caregiving.

As the work-care situation of many individuals may have changed due to the pandemic, it provides a unique setting to study the mediating effect of work-life balance in relation to care. Much extant literature focuses on women's reconciliation of work and care in relation to the number of weekly worked hours[8,28]. Our study contributes to the literature by decomposing the effects of weekly working hours, as well as analysing these relationships for men and women separately, while accounting for differences between short and long part-time working hours. These empirical insights can be used to develop effective public health interventions targeting the reduction of stress during societal upheavals, such as pandemics.

Methods

Data

Data were collected within the Longitudinal Internet studies for the Social Sciences (LISS) panel[29]. The full LISS panel consists of approximately 7,500 individuals from 5,000 households based on a probability sample of Dutch households using register data. We used data collected in the second wave of the project "COVID Gender Inequality Survey Netherlands" (COGIS-NL; retrospective data for June 2020 collected in July 2020). Wave 2 sampled 1,602 respondents, of which 1,229 responded (response rate: 76.7%). Respondents who were either in paid employment themselves or cohabited with an employed partner were included. This criteria resulted in the exclusion of 9 respondents as they were either unemployed (not due to the COVID-19 pandemic) and did not have a have a partner or cohabited with a unemployed partner (not due to the COVID-19 pandemic). This study additionally used LISS data on work hours prior to the pandemic from the 'Effects of the outbreak of COVID-19' module[30], and the core module 'Background variables' for data on gender, age, educational level, living arrangement, number of children, and economic activity. The final analytic sample was 920 respondents, 466 women and 454 men, following the exclusion of respondents with missing data

(e.g. 163 women and 86 men dropped due to missing information on work hours). More detailed information on sample selection is provided in the Extended Data, S1.

Variables

Our dependent variable was perceived stress, measured using the question: "All in all, how much stress did you experience in daily life, in the month of June?". Responses were measured on a scale from 0 (no stress at all) to 10 (a lot of stress).

The main exposure, actual weekly work hours, was calculated by aggregating two questions on work hours. The first asked for hours worked per week in early March (pre-pandemic). The second question asked how many hours more or less the respondent worked per week during June compared to before the pandemic. Using the combined measure, we distinguished working patterns of less than 20 hours, 20–34 hours, and 35 or more hours per week. This classification is commonly applied in analyses of Dutch data to distinguish between short-hours part-time work, long-hours part-time work, and full-time work, respectively[28].

Several covariates were included in the analyses: age (linear), educational level, and several covariates capturing the family and employment situation. We distinguished three levels of completed education: low (primary, lower and upper secondary), mid (intermediate vocational) and high (higher vocational and tertiary). Respondents' family situation was measured by whether they lived with a partner (yes/no) and/or co-resided with minor children (<18 years, yes/no). With respect to the respondent's and their partner's employment situation, we differentiated between working as an employee and other (working in a family business, self-employed or other).

Finally, our mediator variable, perceived work-life balance, was measured with the following item: "How easy or difficult was it to combine your paid work with [care and support for people around you/your care responsibilities] in the month of June?" The five answer categories ranged from very easy to very difficult, but the respondents could also opt for the answer 'not applicable'. Whereas a question about combining work and care responsibilities is often only asked to those caring for children, the question here was also asked to respondents without children and their answers could therefore reflect other care responsibilities, such as informal caregiving. Detailed information on the variables used is available in S2.

Analysis

Our analysis proceeded in six steps. We first studied to what extent the difference in perceived stress for men and women could be attributed to differences in part-time versus full-time work hours, using a Kitagawa-Oaxaca-Blinder decomposition[31–34]. Here, we combined the two part-time categories into one general part-time category, due to the small sample of men who work less than 20 hours a week. In a second step, we used ordinary least squares regression (OLS) to estimate the difference in perceived stress by weekly working hours, controlled for background variables, family situation, and employment situation. Whether to use OLS or ordered logit models for an ordinal outcome variable has been debated. However, as the differences between the two were minimal for our models (results available upon request), we relied on OLS for the ease of interpretation. Third, we examined whether perceived work-life balance mediated the relationship between work hours and perceived stress levels following a Baron and Kenny[35] approach to mediation analysis. Fourth, we repeated the main analysis for respondents with and without co-resident minor children as the type of care responsibilities can differ greatly depending on the presence of children. Fifth, we used a Kitagawa-Oaxaca-Blinder decomposition again, but now to decompose the difference in stress across the two work hours categories (i.e., part-time and full-time) to study the attribution of the other factors to differences in stress. Finally, in a sixth step, we conducted several sensitivity analyses to examine the robustness of the results. These sensitivity analyses included different specifications of the outcome variable, a different source for pre-pandemic work hours, and a different cut-off for part-time work hours. These sensitivity analyses did not change the interpretation of our results (S3). Data were analysed using Stata/SE version 16.1 (StataCorp, College Station, TX, US). The R Project for Statistical Computing would offer an open source software alternative,

Results

On average, the perceived stress levels reported by women (4.65, 95% confidence interval [CI]: 4.42, 4.87) were higher than those reported by men (4.18, 95% CI: 3.94, 4.42). On the other hand, average working hours per week were higher among men than among women (39.3 and 32.1, respectively).

The majority of women in our sample worked part-time (Table 1): 45% worked 20-34 hours and 14% less than 20 hours a week. The remaining 41% worked full-time (i.e., 35 hours or more). Approximately 38 percent of women found it easy to combine work and care, in contrast to 18 percent of women who reported it was difficult. Perceived stress levels were lowest for women working 20–34 hours.

Among men, working part-time was less common (Table 1): 18% worked 20–34 hours and 6% less than 20 hours a week. Most men (76%) worked full-time. More than 40 percent of men found it easy to combine work and care and 17 percent of men reported it was difficult. Perceived stress levels were fairly similar for men regardless of their weekly working hours.

Kitagawa-Oaxaca-Blinder decomposition: part-time/full-time employment and gender differences in stress

This first decomposition analysis examined whether the observed gender difference in stress comes from 1) differences in the distribution of part-time/full-time employment between men and women; 2) differences in the effect of part-time/full-time employment on stress; or 3) a combination of the two. The gender difference in average stress levels was 0.47 (4.65 minus 4.18, with a 95% CI: 0.14, 0.80, Table 2); women experienced higher stress levels than men. However, the difference in men and women's stress levels was not attributable

Table 1. Distributions of stress, number of work hours and perceived work-life balance.

		Women (n=466)		Men (n=454)	
		%	Average stress level (95% CI)[b]	%	Average stress level (95% CI)[b]
Perceived stress	0 – No stress at all	6.4		9.3	
	1	7.3		8.2	
	2	10.5		15.4	
	3	9.4		10.8	
	4	8.4		8.8	
	5	14.0		9.7	
	6	15.2		16.5	
	7	19.7		11.9	
	8	6.9		6.8	
	9	1.3		0.7	
	10 – A lot of stress	0.9		2.0	
	Average (standard deviation)	*4.65 (2.46)*	*4.65 (4.42, 4.87)*	*4.18 (2.59)*	*4.18 (3.94, 4.42)*
Number of hours worked per week[a]	Less than 20 hours	13.7	4.80 (4.23, 5.36)	6.0	4.19 (3.17, 5.20)
	20 to 34 hours	45.1	4.16 (3.83, 4.48)	18.1	3.99 (3.40, 4.58)
	35 or more hours	41.2	5.13 (4.78, 5.48)	76.0	4.22 (3.95, 4.49)
	Average (standard deviation)	*32.1 (13.1)*		39.3 (12.5)	
Perceived work-life balance	Very/Quite easy	37.8	3.73 (3.38, 4.08)	42.1	3.27 (2.93, 3.62)
	Neither easy nor difficult	33.1	4.76 (4.41, 5.11)	24.5	4.55 (4.09, 5.01)
	Very/Quite difficult	17.6	6.37 (5.95, 6.78)	17.4	6.11 (5.67, 6.56)
	Not applicable	11.6	4.70 (3.99, 5.42)	16.1	3.89 (3.30, 4.48)

Note: The italic rows indicate the average levels of perceived stress levels as well as average work hours, respectively, with their standard deviation. %: percentages, 95% CI: 95% confidence intervals. [a] Respondents with weekly work hours higher than 80 hours a week or less than 0 hours in their main job were excluded from the sample (see Extended Data S1 in for sample selection). [b] The average stress levels by work hours and work-life balance are also presented in a figure in Extended Data S4. See S5 for the distribution and average levels of stress for the other covariates.

Table 2. Kitagawa-Oaxaca-Blinder decomposition for gender differences in stress by part-time employment.

		Average stress levels
Men		4.18 (3.94, 4.42)
Women		4.65 (4.42, 4.87)
Difference		*0.47 (0.14, 0.80)*
		Decomposition results
Endowments (difference in distribution)		-0.06 (-0.26, 0.13)
Coefficients (difference in effect)	Part-time/full-time employment	0.48 (-0.06, 1.03)
	Constant (unknown factors)	0.27 (-0.30, 0.84)
	Total	0.75 (0.39, 1.12)
Interaction		-0.22 (-0.47, 0.03)

to differences in the distribution of part-time/full-time employment (the endowment is not statistically significant; -0.06, 95% CI: -0.26, 0.13). Rather, the difference in stress is likely to be influenced by the differential effect of part-time/full-time employment on men and women's perceived stress levels (0.48, 95% CI: -0.06, 1.03, p=0.082).

Work hours and stress

Given the differential effect of part-time employment on men and women's perceived stress levels, the following models analysing the association between part-time employment and stress are shown for men and women separately. This additionally allows for more detail in part-time work hours among women.

Multivariate regressions confirmed that perceived stress was lower among women working 20–34 hours (Table 3, Model 1) than full-time working women. However, stress levels of women working less than 20 hours did not differ from those working 20–34 hours or from those working full-time (Wald test: F(1, 463)=3.42, Prob>F=0.07). Accounting for age, educational level, family situation, and employment situation only marginally affected observed differences in perceived stress between women working 20–34 hours and those working full-time, but strengthened observed differences in stress levels for those working less than 20 hours and those working 20–34 hours (Wald test: F(1, 456)=4.50, Prob>F=0.03).

For men, the multivariate regressions confirmed that perceived stress did not vary depending upon working hours (Model 1). Accounting for age, educational level, family situation and employment situation (Model 2) did not change these associations.

Perceived work-life balance and its possible mediating effect

Average stress was lowest for women perceiving work-life balance as easy and highest for those finding it difficult (Table 1). For men, stress levels also varied by perceived work-life balance: they were lowest for those perceiving work-life balance as easy and highest for those finding it difficult, similar to the results for women. Perceived work-life balance had an independent association with stress, but no association was found between work hours and perceived work-life balance (S6). As a result, for both men and women, including perceived work-life balance only marginally changed the differences in perceived stress by work hours (Table 3). These results confirm that perceived work-life balance does not mediate the association of weekly work hours and perceived stress; rather it is independently associated with stress.

Variation in stress by the presence of co-resident minor children

As type of care responsibilities may greatly depend on the presence of minor children in the household, we repeated the analysis for men and for women with and without co-resident minor children (Table 4). Working 20–34 hours was associated with lower stress levels for women with co-resident minor children, but not for women without. No association between work hours and perceived stress was found for men, irrespective of the presence of children in the household.

Perceived stress was higher when work-life balance was perceived as difficult for all men and women, thus irrespectively of having co-resident minor children. When work-life balance was perceived as easy or when it was not applicable, it was associated with lower stress levels for men and women with children but not for those without co-resident minor children.

Kitagawa-Oaxaca-Blinder decomposition of stress by part-time/full-time employment

Lastly, to determine how much of the difference in stress levels experienced by working part-time/full-time can be attributed to the explanatory variables, including work-life balance, we estimated separate Kitagawa-Oaxaca-Blinder decompositions for men and women (Table 5). For men, the difference in average stress levels between those working part-time (4.04, 95% CI: 3.51, 4.56) and full-time (4.22, 95% CI: 3.95, 4.50) was small and statistically insignificant (-0.19, 95% CI: -0.75, 0.41). Their decomposition results therefore provide few insights, and their results are therefore included in S8. For women, a large difference in stress levels was observed between women who work part-time and women who work full-time: -0.82 (95% CI: -1.28, -0.36). This means that the average stress level was 0.82 points higher for women working full-time compared to those working part-time. The differences in the distributions of the explanatory variables ('endowments') did not explain the difference in stress by part-time/full-time employment, neither independently nor all together. However, the difference in stress levels was largely explained by the differential effects of the explanatory variables as well as the unknown factors (-0.70/-0.82=85%). Considering the specific explanatory variables separately, we note that only education had a statistically significant effect.

Discussion

Men and women experienced different levels of stress during the COVID-19 pandemic, with women experiencing higher stress levels than men. This gender difference in stress is not attributable to gender differences in the gender distribution of part-time/full-time employment. Rather, the gender difference in stress is partially attributable to the differential effect part-time employment has on men and women's stress levels. Looking at men and women separately, the difference in stress observed between women working part-time versus full-time can be largely explained by the differential effects of our explanatory variables as well as unknown factors.

Work-life balance does not mediate the relationship between work hours and stress, neither for men or women, but it is directly associated with their stress levels. For both men and women, perceiving work-life balance as easy was associated with less stress only if there were minor children living in the household, but perceiving it as difficult was associated with higher stress levels for all men and women.

Table 3. **Perceived stress levels and work hours and all other exposures.**

		Women (n=466)			Men (n=454)		
Model		**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
_cons		5.13 (4.79, 5.47)	6.02 (4.74, 7.29)	6.11 (4.88, 7.34)	4.22 (3.95, 4.50)	4.21 (2.75, 5.67)	4.94 (3.56, 6.32)
Number of hours worked per week	Less than 20 hours[a]	-0.33 (-1.02, 0.35)	-0.25 (-0.96, 0.46)	-0.23 (-0.89, 0.43)	-0.04 (-1.06, 0.98)	0.07 (-0.96, 1.10)	-0.03 (-0.98, 0.91)
	20 to 34 hours	-0.97 (-1.45, -0.50)	-0.99 (-1.46, -0.51)	-0.87 (-1.31, -0.43)	-0.24 (-0.86, 0.39)	-0.25 (-0.89, 0.38)	-0.34 (-0.92, 0.25)
	35 or more hours	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
	Wald test: <20 vs. 20 to 34 hours[b]	*F(1,463)=3.42, p=0.07*	*F(1,456)=4.50, P=0.03*	*F(1,453)=3.90, p=0.049*	*F(1,451)=0.12, p=0.73*	*F(1,444)=0.30, P=0.58*	*F(1,441)=0.32, p=0.57*
Age			-0.01 (-0.04, 0.02)	-0.01 (-0.04, 0.01)		-0.00 (-0.03, 0.03)	-0.01 (-0.04, 0.02)
Educational level	Low		-1.34 (-2.02, -0.65)	-1.12 (-1.76, -0.48)		-0.27 (-0.99, 0.44)	-0.18 (-0.84, 0.48)
	Mid		Ref.	Ref.		Ref.	Ref.
	High		-0.00 (-0.49, 0.48)	0.01 (-0.45, 0.47)		0.18 (-0.37, 0.72)	0.22 (-0.32, 0.75)
Living with partner	No		-0.02 (-0.97, 0.94)	0.25 (-0.64, 1.15)		-0.34 (-1.20, 0.51)	-0.56 (-1.35, 0.23)
	Yes		Ref.	Ref.		Ref.	Ref.
Children	No		-0.33 (-0.82, 0.15)	-0.38 (-0.85, 0.09)		0.21 (-0.34, 0.77)	0.22 (-0.32, 0.75)
	Yes		Ref.	Ref.		Ref.	Ref.
Employment status	Employee		Ref.	Ref.		Ref.	Ref.
	Family business / Self-employed / Other		-0.32 (-0.91, 0.28)	-0.33 (-0.88, 0.23)		-0.36 (-1.22, 0.49)	-0.37 (-1.16, 0.41)
Partner's main activity	In paid employment		Ref.	Ref.		Ref.	Ref.
	Not in paid employment		0.05 (-0.84, 0.93)	-0.10 (-0.93, 0.73)		-0.36 (-1.22, 0.49)	0.64 (0.02, 1.26)
Perceived work-life balance	Very / Quite easy			-1.02 (-1.51, -0.53)			-1.33 (-1.89, -0.76)
	Neither easy nor difficult			Ref.			Ref.
	Quite / Very difficult			1.46 (0.86, 2.06)			1.57 (0.87, 2.27)
	Not applicable			-0.01 (-0.72, 0.70)			-0.78 (-1.53, -0.04)

Note. Ref: Reference category. Results from linear regression, table showing coefficients with 95% confidence intervals. [a] Respondents with weekly work hours higher than 80 hours a week or less than 0 hours in their main job were excluded from the sample, N=19 excluded for full sample. [b] For each model, a Wald test was done to test the difference between "Less than 20 hours" and "20 to 34 hours". [c] This category includes individuals who indicated their primary occupation is to attend school or study, to take care of the housekeeping, or to do something else.

Table 4. **Perceived stress levels and all exposures by presence of children in the household.**

		Women		Men	
		With children in the HH (n=264)	Without children in the HH (n=202)	With children in the HH (n=255)	Without children in the HH (n=199)
_cons		7.26 (5.54, 8.98)	4.31 (2.53, 6.08)	5.96 (4.06, 7.85)	4.35 (2.27, 6.42)
Number of hours worked per week[a]	Less than 20 hours	-0.36 (-1.17, 0.45)	-0.40 (-1.61, 0.82)	0.55 (-0.59, 1.69)	-1.00 (-2.68. 0.68)
	20 to 34 hours	-1.20 (-1.80, -0.61)	-0.53 (-1.21, 0.14)	-0.67 (-1.48, 0.15)	-0.07 (-0.94, 0.80)
	35 or more hours	Ref.	Ref.	Ref.	Ref.
	Wald test: <20 vs. 20 to 34 hours[b]	*F(1, 252)=4.78, p=0.03*	*F(1, 190)=0.05, p=0.82*	*F(1, 243)=3.22, p=0.07*	*F(1, 187)=1.03, p=0.31*
Age		-0.03 (-0.06, 0.01)	0.00 (-0.03, 0.04)	-0.04 (-0.08, 0.01)	0.01 (-0.04, 0.05)
Educational level	Low	-0.63 (-1.46, 0.20)	-1.57 (-2.57, -0.58)	0.40 (-0.48, 1.28)	-0.77 (-1.76, 0.23)
	Mid	Ref.	Ref.	Ref.	Ref.
	High	-0.24 (-0.82, 0.35)	0.28 (-0.47, 1.03)	0.54 (-0.12, 1.19)	0.02 (-0.80. 0.83)
Living with partner	Yes	Ref.	Ref.	Ref.	Ref.
	No	-0.23 (-1.55, 1.08)	0.38 (-0.91, 1.67)	-1.06 (-2.48, 0.36)	-0.47 (-1.71, 0.77)
Employment status	Employee	Ref.	Ref.	Ref.	Ref.
	Family business / Self-employed / Other[c]	-0.66 (-1.30, -0.02)	0.18 (-0.93, 1.29)	-0.96 (-1.97, 0.05)	0.13 (-1.14, 1.40)
Partner's main activity	In paid employment	Ref.	Ref.	Ref.	Ref.
	Not in paid employment	-0.15 (-1.23, 0.94)	0.09 (-1.19, 1.37)	0.49 (-0.22, 1.20)	0.75 (-0.51, 2.01)
Perceived work-life balance	Very / Quite easy	-1.34 (-1.96, -0.73)	-0.66 (-1.45, 0.14)	-1.61 (-2.31, -0.92)	-0.93 (-1.92, 0.05)
	Neither easy nor difficult	Ref.	Ref.	Ref.	Ref.
	Quite / Very difficult	1.41 (0.67, 2.16)	1.49 (0.49, 2.50)	1.45 (0.56, 2.34)	1.69 (0.54, 2.85)
	Not applicable	-1.67 (-3.06, -0.28)	0.61 (-0.26, 1.48)	0.32 (-1.11, 1.75)	-0.96 (-1.95, 0.04)

Note. Ref; Reference category. Results from linear regression, table showing coefficients with 95% confidence intervals. S7 shows the distribution of the sample. [a] Respondents with weekly work hours higher than 80 hours a week or less than 0 hours in their main job were excluded from the sample, N=19 excluded for full sample. [b] For each model, a Wald test was performed to test the difference between "Less than 20 hours" and "20 to 34 hours". [c] This category includes individuals who indicated their primary occupation is to attend school or study, to take care of the housekeeping, or to do something else.

Table 5. **Kitagawa-Oaxaca-Blinder decomposition for differences in stress by part-time employment for women.**

		Average stress levels
Part-time emp.		4.31 (4.02, 4.59)
Full-time emp.		5.13 (4.77, 5.49)
Difference		*-0.82 (-1.28, -0.36)*

		Decomposition results
Endowments	Age	-0.003 (-0.03, 0.02)
	Educational level: low	-0.03 (-0.13, 0.07)
	Educational level: mid	0.03 (-0.03, 0.10)
	Educational level: high	-0.05 (-0.13, 0.03)
	Living with partner	-0.06 (-0.24, 0.12)
	Co-resident minor child	0.12 (-0.02, 0.26)
	Employee	0.05 (-0.07, 0.16)
	Partner is employed	0.02 (-0.08, 0.13)
	Perceived work-life balance: (Very) Easy	-0.06 (-0.16, 0.04)
	Perceived work-life balance: Neutral	-0.00 (-0.03, 0.02)
	Perceived work-life balance: (Very) Difficult	-0.03 (-0.12, 0.07)
	Perceived work-life balance: Unknown	0.001 (-0.03, 0.04)
	Total	*-0.012 (-0.30, 0.30)*
Coefficients	Age	-0.91 (-3.11, 1.30)
	Educational level: low	0.18 (0.05, 0.31)
	Educational level: mid	-0.17 (-0.37, 0.03)
	Educational level: high	-0.41 (-0.74, -0.08)
	Living with partner	0.46 (-0.87, 1.79)
	Co-resident minor child	-0.23 (-0.67, 0.21)
	Employee	0.82 (-0.26, 1.91)
	Partner is employed	-0.21 (-1.37, 0.94)
	Perceived work-life balance: (Very) Easy	-0.04 (-0.28, 0.20)
	Perceived work-life balance: Neutral	0.07 (-0.16, 0.29)
	Perceived work-life balance: (Very) Difficult	0.03 (-0.13, 0.19)
	Perceived work-life balance: Unknown	-0.03 (-0.18, 0.11)
	Constant	-0.26 (-2.97, 2.45)
	Total	*-0.70 (-1.15, -0.26)*
Interaction	Age	-0.01 (-0.06, 0.03)
	Educational level: low	0.03 (-0.06, 0.11)
	Educational level: mid	-0.02 (-0.08, 0.03)
	Educational level: high	0.05 (-0.03, 0.12)
	Living with partner	0.07 (-0.14, 0.28)
	Co-resident minor child	-0.09 (-0.27, 0.09)
	Employee	-0.10 (-0.25, 0.05)
	Partner is employed	-0.02 (-0.15, 0.03)
	Perceived work-life balance: (Very) Easy	-0.01 (-0.05, 0.02)
	Perceived work-life balance: Neutral	0.003 (-0.02, 0.02)
	Perceived work-life balance: (Very) Difficult	-0.003 (-0.02, 0.02)
	Perceived work-life balance: Unknown	0.01 (-0.04, 0.06)
	Total	*-0.11 (-0.37, 0.16)*

Note. Results for men are included in S8.

Lastly, the relationship between perceived stress and work hours differs by care responsibilities, but only for women. Working fewer weekly hours can buffer perceived stress for mothers, but variation in working hours does not matter for women without co-resident minor children. Variation in weekly work hours was not related to perceived stress for men with or without co-resident minor children, however we interpret this finding with caution due to the overlapping confidence intervals.

Methodological considerations

A key strength of this study was the detailed analysis of the relationship between weekly work hours and perceived stress for men and women. Using probability-based data for the Netherlands, a country with the highest level of part-time work[36], we were able to decompose gender differences in perceived stress in relation to part-time/full-time employment. We could also decompose differences in perceived stress according to work hours, thereby assessing the potential for part-time work as a coping strategy for men and women balancing work and care responsibilities during the COVID-19 pandemic. The high variation in part-time work hours in the Netherlands allowed for a nuanced understanding of weekly work hours in relationship to perceived stress. Finally, a strength of this study is that it also included individuals with care responsibilities outside of childcare for co-resident minor children. As such, it extends existing research focused on work-life balance of parents alone.

Our study design is cross-sectional and as a result does not account for potential changes in work hours or care situations throughout the pandemic, nor does it allow for estimations of the causal direction of the relationships studied. Future research could focus on the extent to which work hours fluctuated throughout the pandemic, or throughout time in general, to better understand the longitudinal relationship between work hours and perceived stress. A further advancement would be to account for couple-level dynamics in working hours, which could be an important buffer or stressor for individuals[37], allowing for greater analysis into the gendered dynamics of the relationship between work hours and stress. We also rely on self-reported measures of weekly working hours, perceived work-life balance and perceived stress levels, which can be susceptible to respondent bias.

Discussion of main findings

Women had higher perceived stress levels than men, which is likely attributable to differential effects of part-time employment on men and women's perceived stress levels. For women, perceived stress was lower among those working 20–34 hours a week than full-time employed women. However, perceived stress levels were not different for women working less than 20 hours. The often precarious nature of short part-time work hours[8] could explain the similarities in perceived stress levels between this group and other women. An alternative explanation is potential selection effects or the voluntary nature of part-time work, which differs across and within countries[8].

The absence of an association between weekly work hours and perceived stress levels for men may reflect a power issue. Part-time working men remain a small group, also in the Netherlands. Additionally, some men may have worked fewer hours than usual due to the pandemic, therefore those working part-time may have done this involuntary[8]. This means there could be a null-relationship, in which more stress due to employment and wage insecurity counteracts the lower stress due to a better work-life balance.

The models stratified by the presence of minor children in the household demonstrate that the protective association between working 20–34 hours and perceived stress levels was only observed for women with co-resident minor children, and thus not for women without co-resident minor children. Working part-time may particularly offer mothers a means of reconciling work and care responsibilities[28]. For women without co-resident minor children, working less than full-time may be the result of other factors that could influence their stress or mental health, e.g., providing informal care[38,39]. Working part-time hours did not result in lower stress levels for men, irrespective of the presence of children in the household. It is well-established that women spend more time than men providing care for children and others (e.g., elderly family members)[40]. The pandemic has strengthened these gender differences in care provision in many countries[41], including the Netherlands[42].

Our results further showed that perceived work-life balance did not mediate the relationship between work hours and perceived stress, but was rather independently associated with stress. This suggests the presence of a behavioural-based mechanism (weekly work hours) and a perception-based mechanism (perceived work-life balance). On the one hand, perceiving work-life balance as easy was associated with lower stress levels, but only when there were minor children present in the household. This could be because employers found it easier to lower their expectations for parents than for people with other care tasks, which are often less visible. Conversely, perceiving work-life balance as difficult was associated with higher stress levels, irrespective of whether children were present in the household.

Conclusions

Women report higher perceived stress than men in the Netherlands, a difference likely attributable to the differential effect of part-time employment on men and women's stress levels. Part-time employment appears to primarily buffer perceived stress for mothers, but not for women without minor co-resident children or men. Perceiving work-life balance as easy is directly associated with lower stress levels but work-life balance did not mediate the relationship between work hours and perceived stress. These results offer robust, nuanced empirical results on the relationship between perceived stress levels and weekly working hours for men and women both with and without caregiving responsibilities during the COVID-19 pandemic.

Hence, our study offers insights to policymakers interested in mitigating the negative effects of a pandemic. It suggests that attention is needed for variation in caregiving responsibilities and people's capability to (temporarily) manage these responsibilities through reduced working hours. Interventions may be needed to mitigate the stress experienced by those workers with caregiving responsibilities who are unable to adjust working hours as well as interventions aimed at mitigating the long-term effects of work hour reductions[7,8]. Our study also provides avenues for future research into potential differences in behavioural and perception-based mechanisms and the differential impact on perceived stress, a strong risk factor for poor (mental) health.

Declarations

Ethics approval and consent to participate

The work presented here has been approved by the Faculty Ethics Review Committee, Faculty of Social and Behavioural Sciences, Utrecht University on 11 May 2020, approval number: 20-269. Ethical approval for data collection rests with CentERdata, the LISS-panel administrator, who conducts an internal review process for LISS questionnaires and requires all respondents to sign a written, online informed consent form before participating in the panel. The minimum age of our respondents is 24 years. We provide the age range of our respondents (24 to 64 years) in the abstract, the manuscript and in S2 (Age). For a possible sensitivity analysis, we decided to construct 10-year age groups using a common classification, which would mean that our youngest respondents would fall in the category "15 to 24 years", and therefore this age group was mentioned in the Appendix. However, there are no minors included in the analysis. Additionally, all methods were carried out in accordance with relevant guidelines and regulations.

Consent for publication

Not applicable.

Availability of data and materials

The authors do not own the data, which remain with the Dutch Longitudinal Internet Studies for the Social Sciences. These data are publicly available free of charge for scientific or policy relevant (non-commercial) research through the LISS archive (www.lissarchive.nl); https://doi.org/10.57990/qn3k-as78. Persons interested in using the datasets used and/or analysed during the current study can request access to the LISS archive by signing a statement confirming that they agree to the rules and conditions, outlined here.

All code required for data preparation and replication of the analysis can be found on the project page of the Open Science Framework (OSF) repository (see Extended Data).

Extended data

The Extended data are available in the Open Science Framework (OSF) under the project page: "Perceived stress in relation to working hours and caring responsibilities: A cross-sectional study during the COVID-19 pandemic" with doi 10.17605/OSF.IO/K8U6B[43]. This project contains the following Extended data: 1) Extended data file, containing all supplemental files referred to in the manuscript; 2) STROBE checklist, outlining the key aspects of the manuscript and where they can be found; 3) Analytical code, which contains the code detailing the integration of data and all analysis described in this manuscript. Note that all files are publicly available under CC-BY 4.0 license.

Authors' contributions

KH and MY conceptualized the research idea. KH prepared the data analysis. All authors discussed the results, contributed to, read and approved the final manuscript.

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This study, in its introduction, focuses on the COVID-19 period. Cross-sectional studies often face challenges in generalizing their results. Therefore, it's helpful to highlight the potential implications of this study in a similar situation to COVID-19, or one involving part-time workers. Is it true that more people in the Netherlands work part-time? Why is it interesting that women are the focus? The method presented also shows that there are almost equal numbers of male respondents. Why not also discuss men? The discussion doesn't yet highlight the interesting findings in the Netherlands, and why both men and women are discussed, even though the introduction seems to prioritize women.

Is the work clearly and accurately presented and does it engage with the current literature?
Yes

Is the study design appropriate and is the work technically sound?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Yes

Are all the source data and materials underlying the results available?
Yes

If applicable, is the statistical analysis and its interpretation appropriate?
Yes

Are the conclusions drawn adequately supported by the results?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Human resource management

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.