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Ceilings: Gender Inequality in Hours, Earnings and Health

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Abstract

One reason gender earning gaps persist is that well-paid jobs presume long work hours, and these are incompatible with family care. Long hours also harm health, and the risks may increase for workers with care and domestic workloads, adding a gendered health penalty. Using representative, longitudinal data from Australia and Germany (144,430–153,659 observations for HILDA and SOEP surveys, respectively, 2002–2022), we model the interconnections between hours and health among men and women aged 25–64 years. Our models include hours spent on care and domestic work, to estimate the points at which working more gains earnings but incurs risks for health and how this may differ by gender. The results show that average health ceilings mirror standard work hours (38 to 43 h per week) in both countries, but this masks wide gender differences. Gender stratified models reveal that long work hours are relatively less harmful for men compared to women, and as work hours lengthen, the penalty to women’s physical and mental health increases. We further show how these differential health harms are linked to extra time spent on family care and domestic work. Our study extends theory on how gender inequality is maintained in organisations and in the labour market, and the need for policy action to limit long work hours.

Keywords Gender inequality · Health · Time use · Work hours · Australia · Germany

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1 Introduction

Because workplaces are a fundamental source of income and influence, they can be powerful generators of inequality. Acker (2006) recognised this inequality ‘superpower’ in her theory of *workplace inequality regimes* (2006). She described multiple mechanisms of such regimes, and how they became detectable when a practice, or set of practices, led to gendered disparities in access to income, resources and opportunity. Although these practices can be, as Acker argues, fluid and modifiable, some appear normal and laudable and are therefore resistant to challenge.

This paper builds on Acker’s ideas, arguing that long work hours are a normal and laudable workplace practice that creates gender inequality in earnings and opportunity. Long hours, defined as working beyond standard full-time hours, are seen by many workplaces and workers as necessary, inevitable and heroic, a sign of commitment and a marker of effort and productivity. These framings justify higher incentives, rewards and salaries for working long hours, and resistance to reining them in. However, the ability to work long hours relies on availability and control over time, a profoundly gendered resource. Such a normal and laudable workplace practice therefore, advantages people who have more control over their time and disadvantages those whose time is constrained.

The connections between long hours and gender earning gaps have been well documented (Doan et al., 2025); however, the role of health as a mechanism maintaining gendered gaps in both work hours and earnings is underexplored. There is an established literature on the health risks posed by long working hours (for example, Pega et al., 2021). We argue that such health risks could be considerably higher for women because of their constrained time. In the context of women’s greater share of ‘unpaid workhours’ in the home, working long hours for pay may result in differentially harmful health trade-offs. We call this a *health ceiling* and expect it to be most apparent in the long-hour jobs, which generally yield higher earnings. If our reasoning is correct, such health ceilings reinforce gendered glass ceilings and represent a hidden mechanism of gender inequality in the workplace.

1.1 Inequality and Hours Spent on (and off) the Job

A striking feature of Acker’s (2006) theory is the unpicking of what appears to be entirely normal and unchallenged ways of working through the lens of gender and the unacknowledged ‘other job’ in the home. Acker notes the much greater pay for individuals as they become senior or occupy roles such as manager or executive. These roles entail responsibilities or capabilities that are viewed as valuable and hard to replace, and this justifies long hours as a requirement. Yet the interlocking of greater pay and excessive hours rests on the assumption of a ‘white man who is totally dedicated to work and who has no responsibilities for children or family’ (p.448). In this way, assumed normal practices in workplaces mesh with inequality and gender divisions in the home.

Workplace expectations for long work hours (and the corresponding penalising of unavailable workers – men or women – see Williams et al., 2013) draw from historical divisions between paid hours in the workplace and unpaid hours in the home. When the International Labour Organisation (ILO) proposed 48 h as the upper limit in 1919, the

convention assumed few constraints on workers' time because the workforce was predominantly male (Olivetti & Petrongolo, 2016; Spurgeon, 2003). When more women entered the labour market, unencumbered assumptions persisted, albeit in a subtler form. Part-time jobs became an option that enabled women to spend time on family care while earning (some) income, but most men continued to work in full-time and long-hour jobs (Gornick and Heron, 2006).

Consequently, although most workforces have become gender-mixed, workhour patterns have stayed gender-divided. Near universally, men work more hours for pay than women do and dominate in jobs that exceed standard full-time hours (Blackden & Wodon, 2006; Ferrant et al., 2014; Gracia et al., 2021; Doan et al., 2025). Men typically spend only about a quarter of the time women spend on care and domestic work (Addati et al., 2018). Conversely, women, when they are in the labour market, predominate in jobs with hours shorter than full-time standards (OECD, 2021). Even when women work full-time, their hours are lower than full-time men's hours (e.g., see data-explorer.oecd.org). These gendered disparities reflect the finite and fixed number of hours households can allocate to paid work or care (Becker, 1965). It is zero-sum, so that one partner's workhours determine how much care they can do, and consequently how much care (or paid work) their partner does (Cha, 2010; Doan et al., 2021, 2022a).

1.2 Long Work Hours and Earnings Inequality

The above section makes the case that working longer full-time hours is normative and relatively unproblematic when there are little care and domestic work to do. As a result, a two-tier labour market has evolved where men work relatively long hours and do relatively less care and domestic work, while women work shorter hours but do more unpaid work in the home. We now turn to the gender gap in income and earnings, and evidence that such time constraints (not skills or education) are critical to maintaining them. Earnings represent the total income gained from employment (measured weekly or annually) and unsurprisingly working short hours or part-time leads to lower earnings than working full-time. This gender gap in weekly or annual earnings is different from gender hourly-wage gaps, which reflect gender-systematic under or over-payment *per hour* but does not consider the relationship between earnings and *number of hours* worked (Blau and Khan, 2017; Cha and Weedon, 2014; Doan et al., 2025).

In labour markets where the best earnings are tied to working longer than the 'standard' full-time hours, the ability to work longer hours becomes a source of competitive advantage to secure the best jobs and wages (O'Neill & O'Reilly, 2010; Williams et al., 2013). Mandel and Semyonov's analysis (2014) of data over the period 1970–2010 illustrates how differential capacity to work long hours is driving gender gaps in earnings. Education and demographic differences were dominant drivers of the gender gap in 1970, whereas work hours explained 4% of the gap. Hours explained a third of the earnings gap by 2010 and are now the dominant driver (Mandel & Semyonov, 2014). Furthermore, gender earnings gaps become even wider in the best-paid percentiles of jobs, where long hours are usual, reinforcing the argument that constrained time, not capability or skills is critical to maintaining gender inequality in the workplace (the gender earning gap is 6–11% wider for top compared to low earning jobs; Blau and Khan, 2017, US data).

1.3 Long Work Hours and Gendered Health Ceilings

So far, we have focused on the rewards for long hours and their incompatibility with care and domestic work as fundamental mechanisms of gender inequality in the workplace. We now turn to an unacknowledged and rarely documented element that may also be at play, and this represents our key contribution. We propose that there is a health risk linked to a lack of time that may be penalising women if they seek to work longer hours, hampering their earnings and opportunities. The role health plays in inequality regimes is notably absent in most theories of gender gaps in earnings, nor is it raised in Acker's (2006) analysis.

Within public health, embodiment (Krieger, 2020) and related theories seek to explain how unfair social processes generate health inequalities. Krieger's (2021) web of influence theory echoes Acker's analysis, describing the creation of inequality through reinforcing systems from structural to individual, across multiple institutions (workplace and in the home, for example), but a key difference is the introduction of health as both an outcome and an input. In terms of long hours, we propose that they can pose unequal health risks because of the unequal time resources of men and women off the job.

Like income, time is a resource for health (Strazdins et al., 2011; Strazdins, 2022) with many of the major drivers of disease and mental health (stress, lack of sleep, lack of exercise, and unhealthy eating), shaped by lack of time as much as lack of income (Venn & Strazdins, 2017). It is not just the amount but the capacity to control time that matters. Because there are only 24 h every day, health harms become more likely as demands increase and where there is little opportunity to defer or control them (see Doan et al., 2022a for an analysis of gendered time constraints and physical activity, also Moen et al., 2013). In the workplace context, we call the hourly point at which a health risk starts the *health ceiling*. This represents the weekly workhour tipping point, whereby each hour worked beyond it deepens a health trade-off.

There is a large literature on the relationship between long hours and health, which our study builds upon (e.g. Bannai & Tamakoshi, 2014, Harvey et al., 2017, Theorell et al., 2015). However, we believe that this evidence is incomplete and potentially biased because most modelling does not consider unpaid hours off the job. Most long hours and health estimates are from samples that are disproportionately male, who do little care and domestic work. For example, the World Health Organisation (WHO) argues that long hours constitute one of the most serious work-related threats to health. They found that working more than 55 h per week generated 3.7% of global deaths and 23 million DALYs from ischemic heart disease and stroke (Pega et al., 2021). The WHO noted that long-hour (paid) jobs were disproportionately worked by men and assumed that men were at greater risk.

Set against this conclusion are studies which disaggregate work hours and health relationships by gender (e.g. Moortel et al., 2020; Virtanen et al., 2012). Dembe and Yao (2016), using 32 years of data, found that women working beyond standard full-time hours (30 to 40 h a week) were at heightened risk for heart disease, non-skin cancer, arthritis, diabetes, lung disease and asthma. In contrast, longer work hours were protective or neutral for men's health (one exception was risk for arthritis after 50+ hours). Thus, existing evidence is contradictory, the gender pattern is mixed, and hour thresholds or ceilings vary. Even when studies find evidence of gender differences, they are unable to explain why.

We propose that an unbiased analysis of long hours must include time spent on domestic work and caregiving in the modelling. Furthermore, if income, health and workhours form an interacting inequality system, it is essential to adjust for this mutual influence, which

few studies do. Doan et al. (2022b) aimed to model wages, work hours and health as a system, and once adjusted for mutual influence, they found that only ‘unencumbered’ workers, mostly men, were able to work long hours without harm. Their study examined only one country, which limits the generalizability of the estimates, and it also did not explore the connection to earnings inequality. Figure 1 illustrates our theoretical argument based on the literature review and our corresponding descriptive analyses (D1-3) and hypotheses (H1 and H2). We now describe in more detail the data and methodological approach used.

2 Data and Methods

2.1 Data Source

To address gender-blindness in our methodological approach, we searched for longitudinal data containing estimates of unpaid work in the home. Representative data, with measures of paid and unpaid hours as well as health and earnings, were only available in the German Socio-Economic Panel (SOEP) and the Australian Household, Income and Labor Dynamics in Australia Survey (HILDA). Thus, our study focuses on these two countries.

Australia and Germany are affluent and large global economies (ranked 13th and 4th in GDP: World Bank, 2023) with different histories and welfare contexts (Gracia et al., 2021). Germany is a *Corporatist* welfare state in Esping-Andersen’s typology (1999), tying welfare benefits to prior earnings and work status, with less emphasis on free markets than *Liberal* regimes (Esping-Andersen, 1999). Australia is characterized as a *Liberal* welfare state with weak regulation of the labor market (Gornick and Heron, 2006, Gracia et al., 2021). Both countries demonstrate similar large gender disparities in work hours and employment earnings. Australian and German women work on average 31.2 and 30.6 h per week, a full day less than their male counterparts (39.6 and 38.7 h, respectively; OECD, 2018). In long-hour jobs, nearly 15% of Australian and 6% of German men work more than 50 h every week, for women it is 6 and 2% respectively (OECD, 2018, 2022).

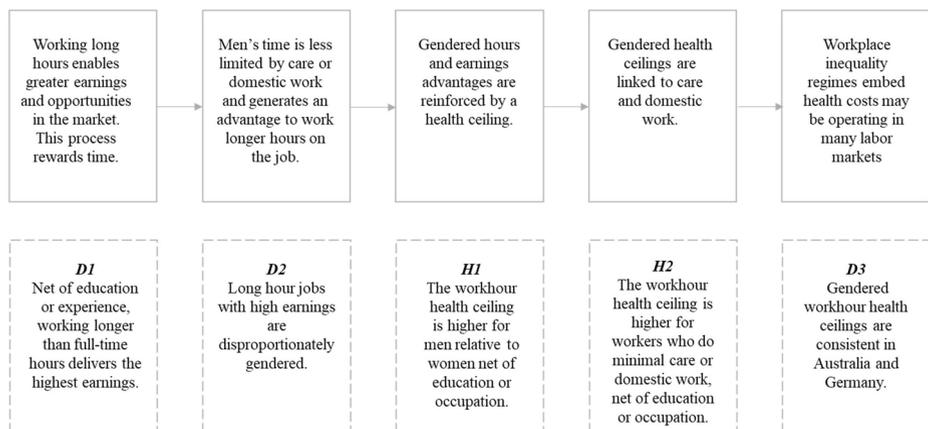


Fig. 1 Theoretical argument with corresponding descriptive analyses and hypotheses for health ceilings and gender inequality regimes

We conducted parallel analyses for both countries, harmonising data as much as possible. However, we do not formally test country differences as some items were measured slightly differently. Instead, we report the extent to which each country shows similar or divergent patterns and present results side by side for the reader. The *Australian* models used waves 2002–2022 of the HILDA survey, a household-based panel study. Each wave contains about 7,000–9,700 households with about 17,000–23,500 individuals with high response rates (>90%, see Summerfield et al. 2019). We limited the sample to employed adults aged 25–64 years with complete data on health, wages, work hours, time use and key covariates. The number of final observations was 144,430 (73,148 male and 71,235 female) over 21 years of data (2002–2022).

The *German* models used the German Socio-Economic Panel (SOEP), another nationally representative household-based panel study (Wagner et al., 2007). SOEP began in 1984, and its subsamples vary across years (Goebel et al., 2019). Our analysis was based on data from version 40 over a comparable period to HILDA. We applied the same restrictions to the SOEP, resulting in 153,659 observations of employed adults aged 25–64 years (77,219 male, 76,440 female). Because most health variables were collected biennially in even-years in SOEP (HILDA collected annually), we used 11 even-year waves for the period 2002–2022 for SOEP and 21 waves for HILDA. The HILDA and SOEP panels were unbalanced due to missing data, attrition, new respondents and different model specifications. We were unable to consider non-binary gender groups, as neither HILDA nor SOEP collected this data.

2.2 Measures

Health The SOEP and HILDA contained the 36-item Short Form (SF-36) Health Survey (Ware & Gandek, 1998). The SF-36 measures mental and physical health, including sub-components (Gandek et al., 2004). While HILDA asked 35 items from the SF-36 item measure, the SOEP asked 12 items, which we matched (Andersen et al., 2007). *Mental health* assessed self-reported vitality, social functioning, emotionally based role limitations, and symptoms of common mental health disorders, such as depression and anxiety. *Physical health* assessed physical functioning, physical-based role limitations, bodily pain, and general health. Items used in HILDA and SOEP for each subcomponent are in Table 2.

Although SOEP and HILDA used comparable items, their coding and computation varied. We re-constructed the SOEP subcomponents of the SF-36 to have the same range as HILDA (0 to 100 (Andersen et al., 2007)). For both HILDA and SOEP, mental and physical health scores were obtained by averaging unweighted subcomponent means, with higher scores indicating better health. The scores are best considered a rank ordering of individuals' (mental or physical) health within each country. Descriptive and psychometric statistics are in Table 3.

Work Hours and Covariates Appendix Table 4 details items and coding for wages, work hours and covariates in the analysis. Wages and work hours were comparable; however, care and domestic hours were measured slightly differently. Both datasets used self-reported measures of time spent on childcare (on a regular, unpaid basis), caring for disabled/elderly relatives, doing domestic errands, outdoor tasks including repairs and gardening, housework, cooking and laundry. HILDA asked for weekly estimates; however, SOEP distin-

guished between weekdays and weekends, which we summed to assess weekly *care and domestic workhours*, top-coded at 80 for both countries. In most instances, we were able to match demographic variables. For a small number of covariates, there were minor differences in codes; however, preliminary analysis showed minimal influence.

2.3 Estimation Methods

Descriptive analyses of earnings, hours and gender. We first describe the extent to which weekly earnings are based on longer hours, net of skills or capability, to establish the first premise of our argument (D1). Ordinary Least Squares (OLS) models predicted weekly wage income as a function of work hours. In these models, we adjusted for established determinants of weekly earnings: education, work experience, occupation and industry (also time and location/state, see Eq. (1) below). We then plotted the results in Fig. 1 and added to them gender proportions for each hour and earnings bracket (D2).

$$\begin{aligned} \text{Weekly Wage (in log)} = & \\ & f(\text{Weekly Workhours, Education, Work Experience,} \\ & \text{Work Experience squared, Occupation, Industry,} \\ & \text{Year, State (or Region for Germany)}) \end{aligned} \quad (1)$$

Predictive analyses of the earnings, hours and health system. Applying Acker's and Kreiger's notions of regimes and webs of influence requires a different methodology from linear, one-directional modelling. To test H1 and H2, we consider work hours and health as a reinforcing two-way inequality system where there are trade-offs and reciprocal causality (e.g., poor health leading to reduced hours or exiting the labour market O'Reilly & Rosato, 2014). We chose Two Stage Least Squares (2SLS) or Instrumental Variable Estimator as the estimation model. We use the average two-digit industry, two-digit occupation work hours,¹ and domestic unpaid time as instruments to predict work hours before estimating the relationship between work hours and health outcomes.

Estimation model. The model is as follows:

$$\text{Health } (H_{it}) = f(T_{it} X_{1it}) \quad (2)$$

$$\text{Weekly work hours } (T_{it}) = f(Z_{it} X_{2it}) \quad (3)$$

The dependent variables were health ($H_{i,t}$; mental or physical score), weekly work hours ($T_{i,t}$), of individual i in year t . We controlled for sets of covariates (X_1, X_2) in the corresponding equations. Two-digit industry average work hours, two-digit occupation average work hours, and domestic unpaid time are used as predictors or instruments ($Z_{i,t}$) to predict market work hours. The test results for instrument validity are presented in Appendix B.

Covariates *Apart from work hours (T), we added work hours squared (T^2) to test non-linear associations and a ceiling after which predicted health worsens. We included work experi-*

¹ We exclude an individual's own work hours from the computation of industry and occupation average work hours to remove the contribution of the individual's own work hours in the industry and occupation average work hours. The estimate is also by year to allow for variation across years within each industry and occupation.

ence and experience squared, gender, country of origin, marital status, education, socioeconomic index for areas (SEIFA), smoking and drinking status, prior self-rated health, and job attributes (shift work, job demand, work flexibility, employment contract type). Location (state/region) and year dummies were adjusted for to capture health differences across geographic locations and years.²

The potential endogenous variables of Eq. (2) were weekly work hours because work hours may affect health, but health also influences how long people can work. For example, poor health workers may not be able to work long hours, while working long hours may harm their health. There is a potential reverse causality between work time and health. That suggests a correlation between the health equation error term and work hours that would bias the relationship between work hours and health outcomes. We use the average two-digit industry work hours, the average two-digit occupation work hours, and the domestic unpaid time as instruments ($Z_{i,t}$) to predict work hours. We assume that these instruments are correlated with work hours (relevance assumption) but not with the error term (i.e., have no *direct* effect on health outcome (exclusion assumption)). The test results for instrument validity are presented in Appendix B. Our test results revealed instruments were strong across all models for the mental health models (endogeneity test $p < 0.05$, large first stage F-values > 200 for all models, weak IV test Cragg-Donald Wald F statistics > 400 for all models, which are substantially greater than the Stock-Yogo critical values. The over-identification tests (Hansen J statistics > 0.29 for all models) suggested that the instruments are not correlated with the error term of the health Eq. (2) (Appendix B). For the physical health models, endogeneity test results show that the workhour variable is endogenous ($p < 0.05$), and the instruments are strong (with large first-stage F-values > 200 for all models, weak IV test Cragg-Donald Wald F statistics > 400 for all models). The over-identification tests (Hansen J statistics > 0.52 for all models) suggested that the instruments are not correlated with the error term of the health equation (Appendix B). These test results suggest that the instruments used to predict work hours are valid.

3 Results

Table 1 describes our two-country sample by demographics, health and time use. Women had poorer mental health relative to men in both countries, and this was consistent across vitality, social functioning, role limitations, and general components. Gender difference in physical health scores was less marked. Hours and earnings patterns were similarly gendered. Australian women worked three-quarters of men's weekly hours and earned 67% of men's wages. German women worked a similar hour ratio but earned 61%. The gender gap in paid hours reversed for care work and domestic work. Australian women's unpaid hours were respectively 169% and 148% of men's, they were 235% and 121% in Germany.

Other covariates show similarities between employed Australians and Germans, although considerably higher percentages of Australian women were tertiary educated compared to men, whereas in Germany the percentages were similar. The practice of working beyond standard full-time hours was widespread in both countries. Over a third of the Australians

² SOEP does not have complete data for alcohol consumption or job demands.

Table 1 Sample characteristics, employed Australians and Germans aged 25-64, 2002-2022

Variable	Australia				Germany			
	Overall		Men	Women	Overall		Men	Women
	Mean	SD	Mean	Mean	Mean	SD	Mean	Mean
Health (0-100)								
Mental health (MCS)	77.1	17.3	78.7	75.4	70.7	16.5	72.3	68.9
Vitality	60.7	19.0	63.0	58.5	53.3	21.4	54.3	52.1
Social functioning	85.7	20.3	87.2	84.3	84.1	22.9	85.9	82.0
Role functioning emotional	87.3	28.7	89.0	85.5	84.1	21.0	85.8	82.1
Mental health	74.6	16.2	75.6	73.5	61.5	19.4	63.2	59.6
Physical health (PCS)	81.0	16.4	81.9	80.0	76.2	17.6	77.5	74.7
Physical functioning	89.4	17.4	90.2	88.5	89.2	14.1	90.2	88.0
Role functioning physical	87.0	28.6	88.9	85.1	77.5	24.3	79.5	75.2
Body pain	76.8	21.0	78.1	75.6	74.8	25.9	76.3	73.1
General health	71.0	18.5	70.7	71.3	63.0	22.2	63.8	62.0
Workhours and wages								
Weekly workhours	38.4	13.0	43.1	33.5	38.13	12.6	42.9	32.6
Weekly wage (AU\$, EU€)*	1604	1111	1906	1282	743	587	905	553
Hourly wage (AU\$, EU€)*	42.2	36.8	44.7	39.8	19.6	24.1	21.7	17.3
Hourly wage (in log)	3.61	0.51	3.66	3.55	2.8	0.59	2.9	2.7
Covariates								
Weekly unpaid hours	29.0	19.4	24.6	33.6	27.9	20.0	22.4	34.2
Care	8.7	14.0	6.5	11.0	10.2	22.9	6.3	14.8
Other domestic work	16.9	12.5	13.7	20.3	17.6	14.1	16.0	19.4
Household and individual characteristics								
Age	42.1	10.7	42.0	42.2	44.2	10.7	44.2	44.3
Gender: Men (%)	52	50	n/a	n/a	53	50	n/a	n/a
Marital status (married/cohabiting=1)	0.73	0.44	0.74	0.72	0.56	0.49	0.57	0.56
Child(ren) under 6 (yes=1)	0.20	0.40	0.22	0.18	0.16	0.36	0.17	0.15
Tertiary education % (yes=1)	0.36	0.48	0.33	0.40	0.26	0.44	0.27	0.26
Socio-economic index (0-100)	59.2	28.0	58.8	59.6	46.4	18.8	46.4	46.4
Overall life satisfaction (0-10)	7.84	1.27	7.83	7.85	7.20	1.70	7.10	7.20
Self-assessed-health (lag) (1 excellent - 5 poor)	2.45	0.86	2.45	2.44	2.50	0.88	2.40	2.50
Country of origin (yes/no)	0.71	0.45	0.71	0.71	0.81	0.39	0.81	0.81
Current smoker (yes=1/no=0)	0.16	0.37	0.18	0.14	0.32	0.47	0.35	0.29
Physical activity (%)	100%		100%	100%	100%		100%	100%
[1] Sedentary (SOEP-Almost never, never)	26.5	44.1	23.6	29.5	27.5	44.6	28.0	26.9
[2] Low (SOEP-Several times a year)	41.3	49.2	40.9	41.7	18.6	38.9	19.9	17.1
[3] Moderate (SOEP >1x month)	21.2	40.9	22.4	19.9	8.1	27.3	8.8	7.4
[4] High (SOEP >1x week)	11.0	31.3	13.1	8.8	45.8	49.8	43.3	48.5
Job characteristics								
Work experience (potential)	23.3	11.2	23.2	23.2	25.8	11.1	25.8	25.8
Industry (one-digit) %	100%		100%	100%	100%		100%	100%
[1] Agriculture	1.8	13.2	2.6	0.9	1.4	11.6	1.9	0.8
[2] Energy	0.6	7.7	0.9	0.2	0.9	9.2	1.2	0.4
[3] Mining	2.0	14.0	3.3	0.7	0.2	4.2	0.3	0.0
[4] Manufacturing	9.9	29.9	14.5	5.1	22.8	42.0	31.0	13.2
[5] Construction	6.5	24.7	11.0	1.8	5.6	23.1	9.2	1.5

Table 1 (continued)

Variable	Australia				Germany			
	Overall		Men	Women	Overall		Men	Women
	Mean	SD	Mean	Mean	Mean	SD	Mean	Mean
[6] Trade	12.3	32.8	13.2	11.3	13.8	34.5	10.8	17.4
[7] Transport	4.6	20.9	6.6	2.5	5.0	21.8	6.6	3.1
[8] Bank & insurance	4.5	20.7	4.1	4.9	3.9	19.4	4.0	3.9
[9] Services	57.8	49.4	43.8	72.6	42.4	49.4	32.0	54.5
[10] Other					4.1	19.8	3.1	5.2
Occupation (one-digit) (%)	100%		100%	100%	100%		100%	100%
[1] Managers	12.7	33.3	15.7	9.4	6.0	23.7	7.6	4.1
[2] Professionals	25.0	43.3	20.8	29.8	19.5	39.7	21.0	17.8
[3] Technicians/associate professionals	17.2	37.7	14.3	20.2	24.5	43.0	19.6	30.1
[4] Clerical	13.0	33.8	7.7	18.9	11.0	31.3	7.2	15.5
[5] Services and sales	10.3	30.3	7.1	13.6	11.2	31.6	5.8	17.6
[6] Skilled agriculture, forestry, and fishing	1.2	10.7	1.9	0.4	1.1	10.3	1.4	0.7
[7] Craft and related trades	7.3	26.0	13.6	0.5	12.2	32.7	20.2	2.7
[8] Plant, machine operators, assemblers	6.7	24.9	11.6	1.4	6.9	25.3	10.7	2.3
[9] Elementary occupation, labourers	6.6	24.8	7.4	5.6	7.3	26.0	5.8	9.1
Observations	144,430							

We used AU\$ for Australia and EUR for Germany, discounted to the 2022 price level

*Average exchange rate 2022 AUD/EUR=0.65. All estimates adjusted with sample weights

and Germans sampled regularly worked beyond standard full-time hours (>40h/week), 11% and 9% worked more than 50 h a week, respectively.

Long Hours and Earning Inequality We first establish whether, net of other determinants, working longer than standard full-time hours (36–40 h per week) delivers greater earnings in Australia and Germany (D1). Table 5 (Appendix C) reports earnings estimates, holding constant education, potential experience, occupation, industry, time and location effects (as seen in Eq. 1). The estimates show that, on average, each hour worked increases earnings by about 3% in Australia and 3.47% in Germany. Figure 2a (Australia) and Fig. 2b (Germany) plot estimated earnings for men and women combined, based on Eq. (1) by work-hour bands. The middle bar (36–40 h per week) denotes the country's legal or standard full-time hours. The right axis is predicted weekly earnings (AUD or EUR), and the left axis plots the percentages of men in each hour band (the inverse percentage is women). Adjusting for the influence of education, experience, industry, occupation, time and state/region effects, we found that working 5–10h beyond full-time standards delivers over 40% increase in earnings. Working an extra 10h or more doubles the earnings from standard full-time hours, net of other drivers of wage rates in both countries.

We next consider the gender patterning of earnings and hours in both countries (D2), plotting the percentage of men (inverted for women) by work-hour bands. Figure 2a and Fig. 2b show proportionally few men in short-hour jobs, and the opposite applies to women (21% men/79% women in Australia, a similar pattern is also seen in Germany). For standard full-time hours, the gap is narrowed (57%men/43%women in Australia, 62/48 men/women in

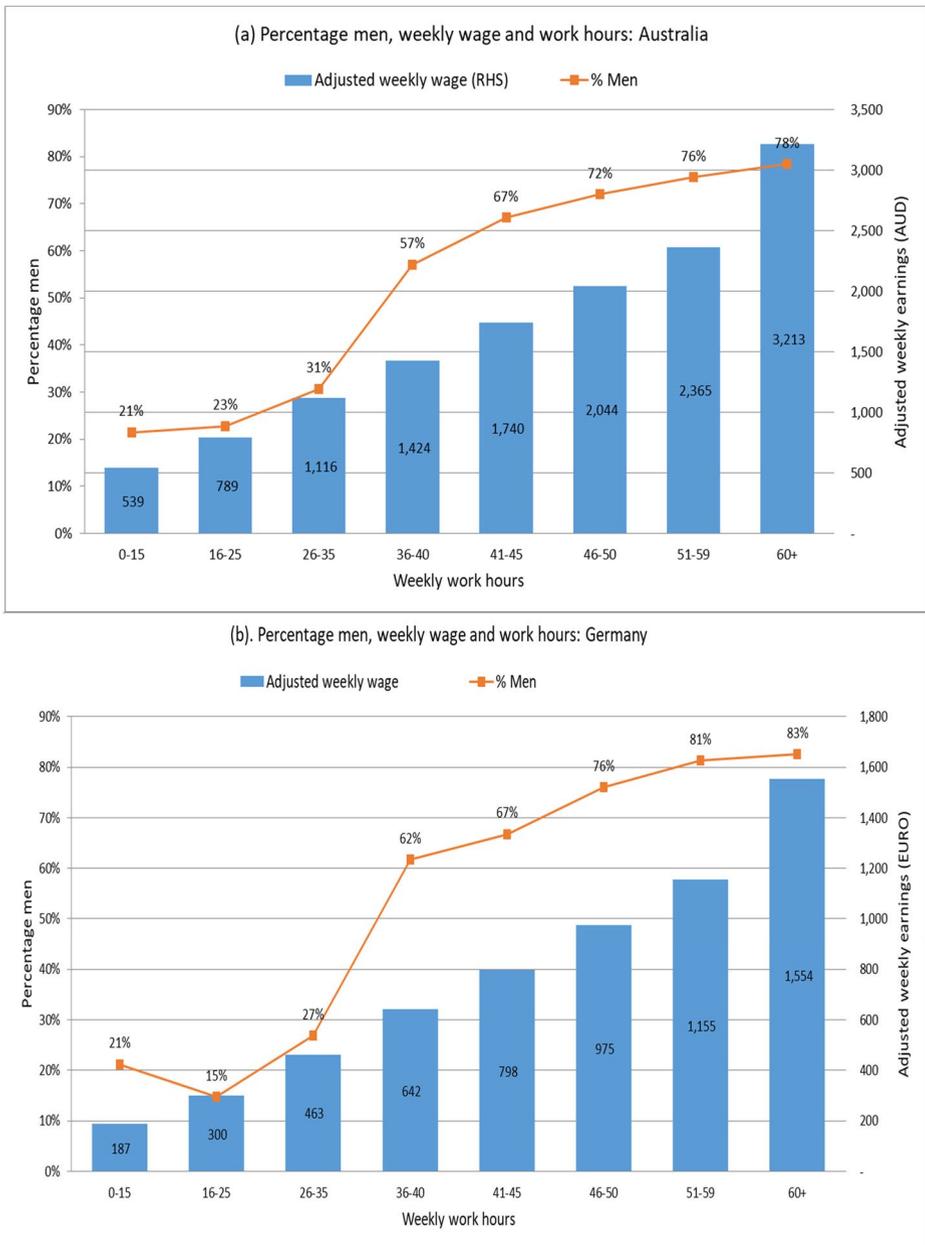


Fig. 2 Gendered hours and wages: employed Australians and Germans aged 25-64, 2002-2022

Germany) while those working long hours are predominantly men (78%men/22%women and 83/17 men/women respectively). Our descriptive findings align with established scholarship on earnings, hours and inequality. We now turn to our novel contribution and consider the role of health.

Long Hours and Health Ceilings Our first hypothesis (H1) is that the male earnings advantage observed above is reinforced by a health ceiling. We start by estimating weekly work-hour points beyond which health declines, averaged for the whole sample, then estimate the ceilings stratified by gender (H1). To test our hypothesis that unequal health ceilings occur because of women's extra care and domestic hours, we further stratify the models by care and domestic work, or domestic unpaid time (H2). The Figures (3a, 3b, 4a, 4b, 5a, and 5b) and appended tables (6, 7, 8, and 9, Appendix C) are summaries to enable comparison, with full estimates available on request. Note that the appended tables report estimates for the whole workforce as well as the stratified estimates.

Physical Health Averaging across men and women, a deterioration in energy, mobility, functioning, and a rise in pain symptoms is observable after working beyond 42 and 39.4 h (Australia and Germany, respectively, Table 6, Appendix C). Stratified estimates reveal a marked gender difference in the physical health ceiling, which the average estimate obscured. Australian men appear able to work up to 46h a week before their physical health declines; Australian women's health ceiling, however, is 7–8h lower, at 38h a week. In Germany, the gender gap is even wider, with German men working up to 44h per week before physical health deteriorates, a 11-hour advantage to German women whose health deteriorates after 33h (Table 6, Appendix C).

We illustrate the intersection of health ceilings, hours, and earnings in Fig. 3a and Fig. 3b by overlaying our descriptive analysis of hours and earnings with the predicted estimates of health ceilings. The Figures show the health gap between men's and women's health curves at each work-hour group. These figures illustrate how, as hours exceed ordinary full-time standards, the health cost to women widens relative to men in both Germany and Australia (D3).

For mental health, the estimates in Table 7 (Appendix C) show similar average ceilings to those estimated for physical health, at 43h a week in Australia and 38h a week in Germany, and these averages mask a wide gender difference. The stratified estimates indicate Australian men can work up to 45h each week without compromising their mental health, whereas women's mental health hits a ceiling at 38h. Similarly, German men can work 4h per week before their mental health shows deterioration, whereas German women's health deteriorates after 33 h. In both countries, men's health ceilings (physical or mental) are higher, but women's ceilings are considerably lower (7–8h gap in Australia, 11-hour gap in Germany). Further, the curve varies by gender, with steep deterioration in women's mental health once they exceed their ceiling. We illustrate the hour, earnings and mental health system in Fig. 4a and Fig. 4b. As hours exceed full-time standards, the mental health costs to women increase relative to men and are considerably wider than those for physical health in both countries (D3).

Our second hypothesis (H2) tests whether unequal time doing care and domestic work underlies gendered health ceilings in the workplace. We therefore estimate health ceilings by care and domestic workloads, stratified by average time spent (within each year of data) for employed people aged 25–64 (see Table 8 for physical health and Table 9 for mental health, Appendix C).

We find that those who spend relatively less time on care and domestic work can work an extra 8 h at their job (up to 46h in Australia or 41h in Germany) before their physical health begins to decline relative to those who do more care and domestic work (Table 8). The same pattern holds for mental health (7h for Australia and 9h for Germany). These ceilings are similar to the gender ceilings and align with those found by Dembe and Yao (2016).

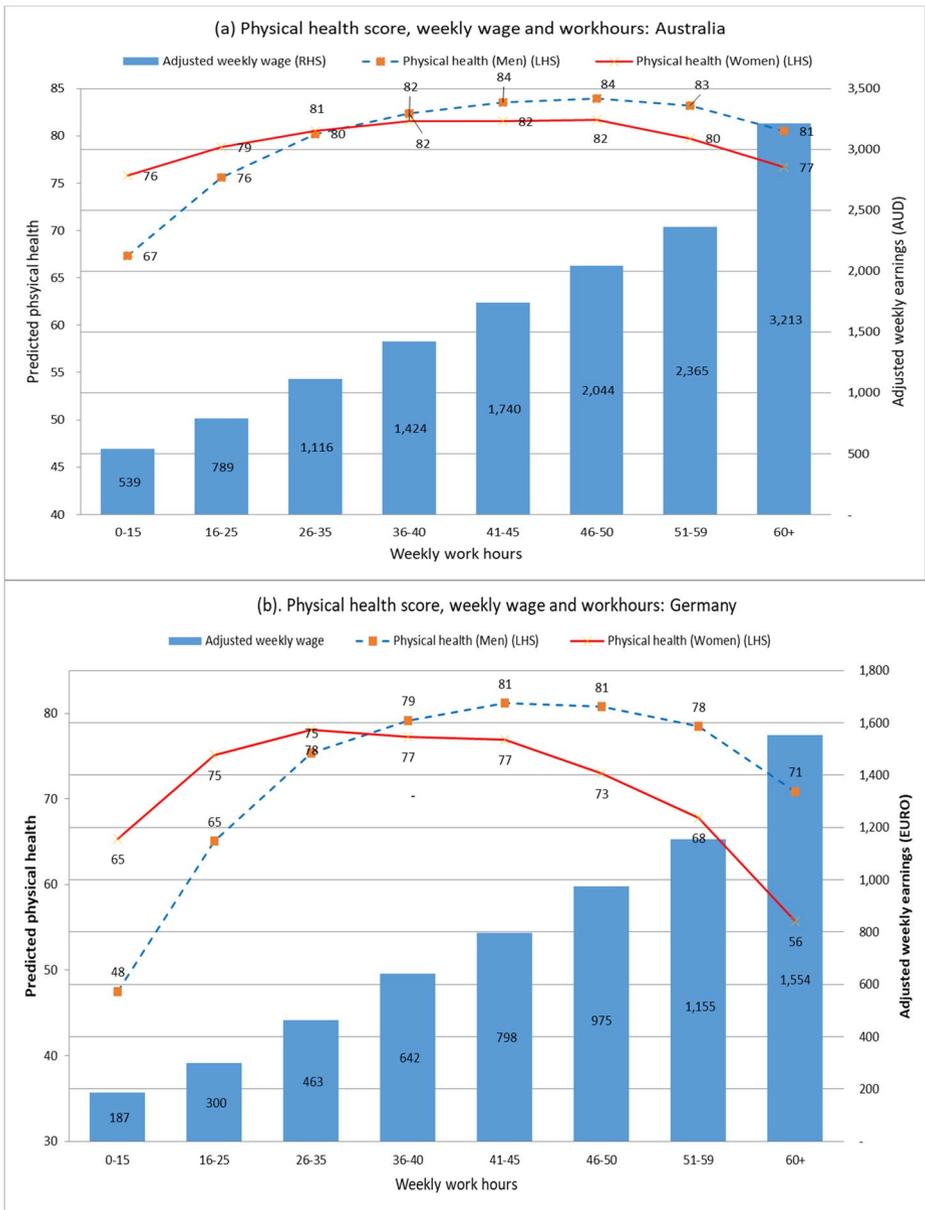


Fig. 3 Physical health scores by gendered hours and wages: employed Australians and Germans aged 25-64, 2002-2022

Gender Differences in the Ceiling Curve We did not anticipate the degree of gender difference in the shapes of the ceiling curves. Estimates showed poor health for men in Australia and Germany in the short-hour ranges of the curves, but men’s curves flatten

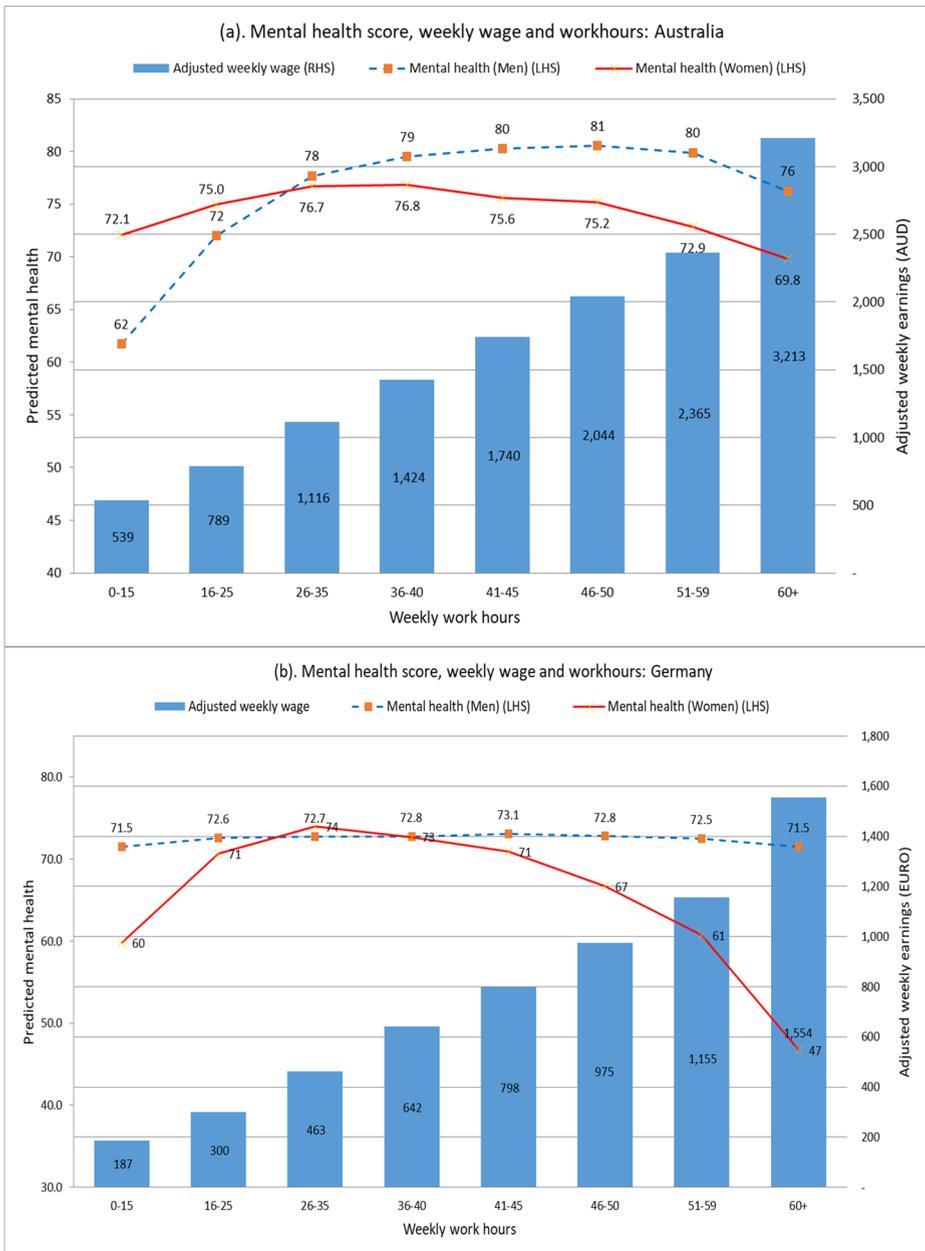


Fig. 4 Mental health scores by gendered hours and wages: employed Australians and Germans aged 25-64, 2002-2022

in long-hour ranges. For women, steeper deterioration in health is observed after they hit the work-hour ceiling, supporting our argument that as hours increase so does the health penalty for women.

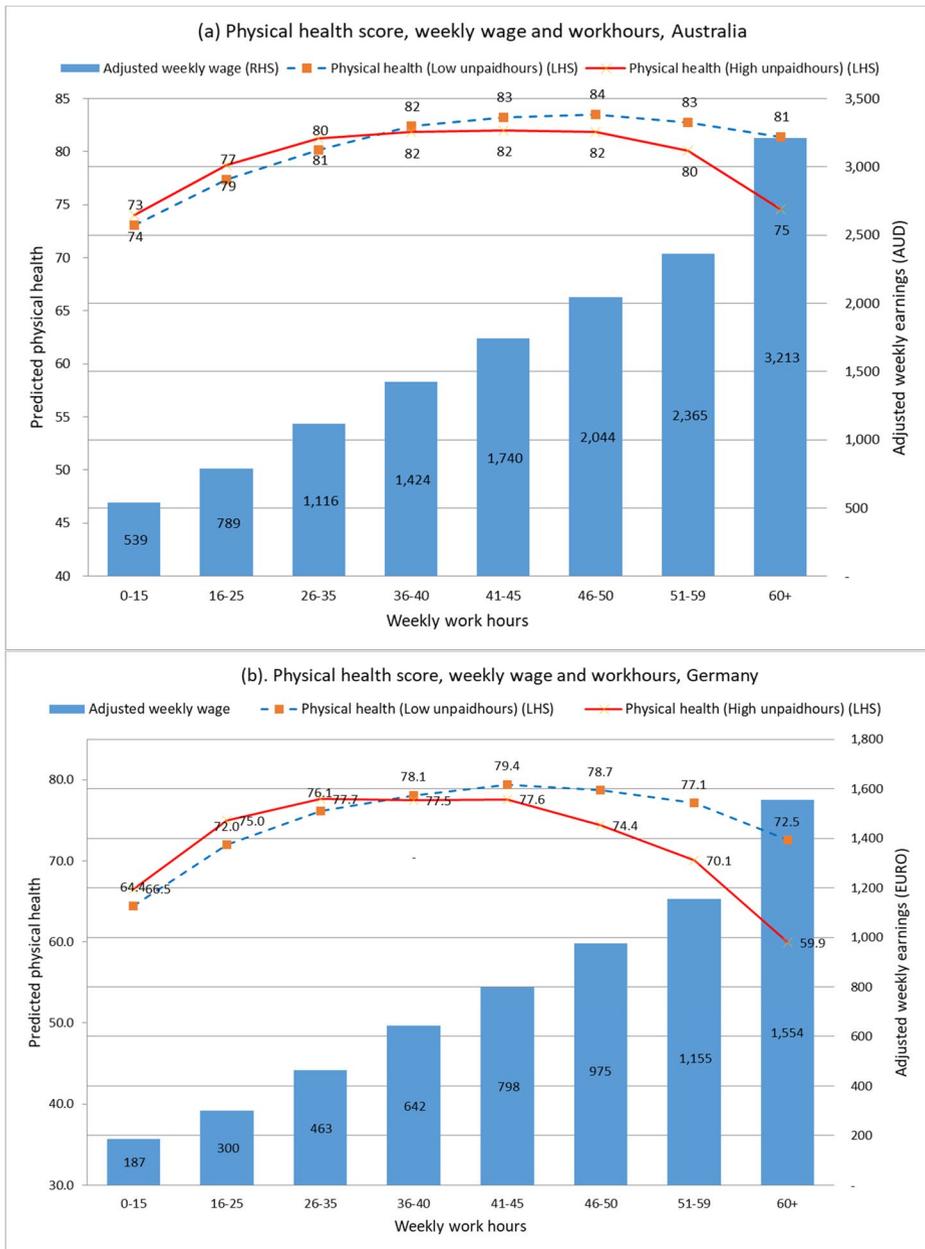


Fig. 5 Physical health scores by unpaid domestic work hours, paid work hours and wages: employed Australians and Germans aged 25-64, 2002-2022. The 36-40h band includes standard full-time hours. The gaps (%) between men’s and women’s health curves were computed as [(men’s health score – women’s health score)/men’s health score] at each work-hour group. Similarly, the gaps (%) between the higher and lower unpaid hours MH curves were computed as [(low unpaid hours MH – higher unpaid hours MH)/lower unpaid hours MH] at each workhour group

4 Discussion

4.1 Findings Summary and Discussion

Our starting point was to consider long work hours through an inequality regime lens. We began by establishing whether the capacity to work extra hours generates higher earnings net of skills, occupation, industry and experience in the two affluent economies we studied. We found that in both Australia and Germany, being able to work more than standard full-time hours doubles employment earnings. We further find that as hours go up, the proportion of women working them declines, so that only one in five women work hours that generate top earnings. These findings align our data with Acker's notions of inequality regimes. They are also consistent with extant research describing the linkage between gender gaps in wages and work hours.

Our unique contribution lies in the conceptualisation of health as a so far unrecognised element of gendered earnings inequality. Using two representative, longitudinal datasets, we find that men, who typically do less care and domestic work, can work the extra hours and attain the higher earnings, without penalising their health the way women do. Men's physical and mental health harms from work were detectable when their weekly hours exceeded 45 or 46. This means that most men face relatively minor health trade-offs if they work long hours to secure the best earnings or opportunities. For women, who typically perform more care and domestic work, physical and mental health ceilings were detectable at lower hours, and these harms steeply increased when they worked beyond them. These differential health ceilings effectively 'give' men about one working day's extra time every week – a health advantage that is invisible and unacknowledged.

4.2 Strengths and Limitations

4.2.1 Methodological Strengths and Limitations

Because we were studying interlocking elements of the inequality regime, we modelled work hours and health as a system. These equation systems reflect Acker's (2006) theoretical stance that there are complex, multiple and reciprocal relationships in gender inequality regimes which standard longitudinal methods do not capture. We are also among the very few studies to model care and domestic hours in analysing the (market-paid) hour and health relationship. Our analytical approach helped us compare health ceilings by gender with ceilings from hours spent on domestic work and care, showing how inequality in the home and inequality in the workplace interact. We believe our efforts to match methodology to theory mean our estimates are more precise and less gender-blind, redressing the evidence base.

There are other explanations of our findings, and some important limitations to consider. Because our study design is observational and based on self-reported data, the associations could be confounded. Although we employed the instrumental variable or 2SLS method, which can allow researchers to claim causality, our current study does not aim to make any causal inferences about the relationship between work hours and health. We further caution against directly comparing estimates for the two countries, given measurement differences among some variables. We note, however, that the ceilings were remarkably consistent in both countries.

While acknowledging that modelling unpaid hours in the home as a predictor of market paid time is an advance, caveats on this measure are also important. Time use for care and domestic work was from a survey measure, using self-reported hours for a usual week. Such survey measures are less precise than daily diary estimates, although they are robust for longitudinal designs (Juster et al., 2003). Care and domestic work are strongly gender-stratified: women were much more likely to be in the above mean strata and men in the below mean strata, so we could not fully disentangle time inequality and gender.

Finally, the relationship between gender, extra hours and high earnings might reflect other, unmeasured capabilities such as motivation, family choice, intelligence or personality. Our models were unable to deal with these unobserved influences but note that they are unlikely to drive the stark gender ratio we find once we adjust for education and occupation. The much greater health harms observed for women as work hours increased could also reflect the ramping up of other gendered and glass ceiling-related ‘exposures’ such as harassment and discrimination, rather than extra hours per se.

4.2.2 Theoretical Strengths and Limitations

What underlies the slow progress towards gender equality in earnings? In countries such as Australia and Germany, there are legal mandates to ensure employers do not discriminate, and growing numbers of workplaces offer flexible start and stop times, part-time work and family-related leave. Other drivers of earnings, such as experience and education, are also largely level, yet in the countries we studied, as in most developed countries, earning gaps persist, and the glass ceiling in opportunity continues. Acker’s (2006) innovation was to show that there is no single answer to this slow progress. Instead, there are multiple processes and mechanisms operating both on the job and in the home. This layered and interlocking system is hard to challenge.

Our contribution is to bring insights from public health, especially ideas of embodiment and time as a resource for health, to the problem of gender inequality in employment. We believe this is important in two ways. First, health broadens the scope of inequality regimes in workplaces - understanding that women face a higher health cost than men when jobs are incompatible with care, may help explain the apparently gendered choices that follow. This health harm may reinforce the power of gender norms and beliefs about intensive parenting and motherhood, because it amplifies the health cost of employment to mothers or caregivers. We think this could shed light on the intractability of the glass ceiling and deepen the analysis of how inequality occurs and persists in well-paid and senior jobs.

Our work complements other scholarship underscoring the power of institutional practices to drive gender norms and behaviours. Pedulla and Thébaud’s (2015) experimental study indicated that men and women calculate work and care preferences based on what is possible, and we suspect health is part of their calculation. Similarly, our study adds weight to the analysis of Padavic and her colleagues (2020), who described how the insistence on long hours by workplaces forces a choice between love and work that is harmful. Rather than confronting this harm and changing the insistence on long hours, they describe how the harms are minimised or denied by firm leadership and employees, and the problem is framed as women doing ‘too much care’. Our study finds that combining long hours of work with care is indeed harmful, and such health harms can only be avoided when care is ‘dis-

avowed', and workers do little of it. We are among the first to quantify the hours at which this either–or choice translates into an embodied mental or physical health harm.

Most gender scholars agree that the coupling of long hours to higher earnings is a difficult barrier to overcome. Workers and employers see long hours as a marker of effort and devotion, and their willingness to go the extra mile. In the context of the job tournament, securing more opportunities or earnings for extra hours seems deserved, and makes long hours synonymous with job status. Managers frame working extra hours as a marker of merit, and workplaces view them as essential to productivity and profitability, with some building their business model upon them (Padavic et al., 2020). These framings contest with the problem that long hours pose for gender equality in the workplace and in the home. Our second contribution to scholarship and, is to bring a health framing, as additional evidence to challenge (and underpin) action on long work hours, into this discussion. The concept of health foregrounds the lives, minds and bodies harmed. The idea that there are discriminatory and so far, unacknowledged health harms from long hours might disrupt framings that the extra status and pay are deserved. Our finding that men have about one-working-day-per-week hour health advantage in the labour market because they do little care and domestic work may further unsettle notions of merit and fairness. Framing long hours as (unfairly) hazardous also dovetails with legal obligation and responsibility. Finally, connecting long hours to workplace health and safety laws as well as gender inequality positions them as a productivity and compensation risk. Bringing public health insights to gender equality scholarship may therefore help strengthen the case against long hours and the cost of workplace inaction. We hope our ideas and findings encourage more interest in health as a mechanism of gender inequality in employment.

Appendix A

Table 2 Mental and physical health items and subcomponent scales

	HILDA	SOEP
Physical health		
Physical functioning (0-100)	Vigorous activities (1-limited a lot, 2-limited a little, 3-not limited at all) Moderate activities (1-3) Lifting or carrying groceries (1-3) Climbing several flights of stairs (1-3) Climbing one flight of stairs (1-3) Bending kneeling or stooping (1-3) Walking more than one kilometer (1-3) Walking half a kilometer (1-3) Walking 100 meters (1-3) Bathing or dressing yourself (1-3)	State of health affects ascending stairs (1-strong; 2-a little; 3-not at all) State of health affects tiring tasks (1-strong; 2-a little; 3-not at all) Have trouble climbing stairs (y/n) Dressing difficult alone (y/n) Difficulty/need help getting in/out bed (y/n) Need help with shopping (y/n) Housework difficult alone (y/n)
Role Physical (0-100)	Cut down the amount of time spent on work or other activities (y/n) Accomplished less than would like (y/n) Were limited in the kind of work (y/n) Had difficulty performing work or other activities (y/n)	Accomplished less due to physical problems (1-5: 1-always, 5-never) Limitations due to physical problems (1-5: 1-always, 5-never)

Table 2 (continued)

	HILDA	SOEP
Body pain (0-100)	Bodily pain in last 4 weeks (1-6: 1-No bodily pain, 6-very severe) How much did pain interfere with normal work (1-not at all, 5-extremely)	Physical pain in last 4 weeks (1-5: 1-always, 5-never)
General Health (0-100)	Self-assessed health (scale 1-5: 1-excellent to 5-poor) Get sick a little easier than others (1- definitely true to 5-definitely false) As healthy as anybody I know (1-definitely true to 5-definitely false) Expect my health to get worse (1-definitely true to 5-definitely false) My health is excellent (1-definitely true to 5-definitely false)	Current self-rated health status (1-5: very good/good/satisfactory/poor/bad)
Mental health		
Vitality (0-100)	Feel full of life (1-6: 1-all of the time, 6-none of the time) Have a lot of energy (1-6) Felt worn out (1-6) Felt tired (1-6)	Used energy in last 4 weeks (1-5: always/often/sometimes/almost never/never)
Social functioning (0-100)	Physical/emotional problems interfered with social activities (1-5: 1-not at all, 5- extremely) Has physical/emotional health interfered with normal social activities (1-5)	Limited socially due to health (1-5: always/often/sometimes/almost never/never)
Role emotional (0-100)	Cut down the amount of time spent on work/ other activities (yes/no) Accomplished less than would like (yes/no) Didn't do work/other activities as carefully as usual (yes/no)	Accomplished less due to emotional problems (1-5: always/ often/ sometimes/ almost never/never) Less careful due to emotional problems (1-5: always/ often/ sometimes/ almost never/never)
Mental health (0-100)	Been a nervous person (1-6: 1-all of the time to 6-none of the time) Felt so down in the dumps nothing could cheer you up (1-6) Felt calm and peaceful (1-6) Felt down (1-6) Been a happy person (1-6)	Run-down, melancholy(depressed/ sad) in last 4 weeks (1-5: always/ often/ sometimes/ almost never/ never) Well-balanced in last 4 weeks (1-5: always/ often/ sometimes/ almost never/never)

HILDA SF36 has 35 sub-items (not 36 as HILDA did not ask a question about 'compared to one year ago, how would you rate your health in general now?'). SOEP questions are not exactly the same questions and scales as those used in HILDA

Table 3 Descriptive statistics for mental and physical health and their subcomponents for employed people aged 25-64 in Australia and Germany (2002-2022)

Panel A: Australian HILDA data						
Variable	N	Mean	SD	Min	Max	Correlation ^a
<i>Mental health</i>	131,303	77.1	17.2	0	100	1.00
Vitality	130,902	60.79	18.9	0	100	0.78**
Social functioning	131,279	85.8	20.3	0	100	0.83**
Role emotional	130,236	87.3	28.4	0	100	0.84**
Mental health	130,905	74.4	16.1	0	100	0.83**
<i>Physical health</i>	131,315	81.0	16.4	0	100	1.00
Physical functioning	130,115	89.4	17.4	0	100	0.69**
Role physical	130,358	87.0	28.6	0	100	0.84**
Body pain	130,613	76.9	21.0	0	100	0.81**
General health	130,383	71.0	18.5	0	100	0.72**
Panel B: German SOEP data						
Variable	N	Mean	SD	Min	Max	Correlation
<i>Mental health</i>	145,813	71.4	16.2	0	100	1.00
Vitality	145,461	54.0	21.4	0	100	0.69**
Social functioning	145,369	85.0	22.4	0	100	0.81**
Role emotional	145,484	84.8	20.7	0	100	0.81**
Mental health	145,772	62.1	19.4	0	100	0.79**
<i>Physical health</i>	156,500	77.3	17.1	0	100	1.00
Physical functioning	156,500	90.2	13.7	0	100	0.69**
Role physical	145,628	78.3	24.0	0	100	0.85**
Body pain	145,511	75.4	25.7	0	100	0.85**
General health	290,737	63.9	22.1	0	100	0.80**

Estimates are unweighted

**p < 0.01

^aCorrelation between summed and subcomponent scores

Table 4 Variable definition and coding

Variable	Definition
Weekly workhours	Actual weekly workhours from all jobs
Weekly wage	Weekly wage earnings from all jobs
Hourly wage	Weekly wage/weekly workhours
Weekly care and domestic hours	Hours usually spent each week caring for own and other's children (on a regular, unpaid basis), caring for disable/elderly relatives, doing domestic errands, outdoor tasks and housework, cooking and laundry.
<i>Household and individual characteristics</i>	
Age	Age of worker in years
Gender	1-Male, 0-Female
Marital status	1-Married or cohabiting, 0-Otherwise
Child(ren) under 6	1-Yes, 0-No
Country of origin	3 groups: 1-Native-born; 2-English speaking country-born (for SOEP: Western world-born); 3-Other country-born
Tertiary education	1-Higher education in SOEP, Bachelor Degree and above in HILDA; 0-otherwise
Socio-economic index	Index of relative socio-economic disadvantage. 0-100: the higher the index the higher the SES status of the household (<i>SEIFA</i> in HILDA and <i>pgisei88</i> in SOEP)
Self-rated-health (lag)	1-5: 1-Excellent, 2-Very good, 3-Food, 4-Fair, 5-Poor (Australia) 1-5: 1-Very good, 2-Good, 3-Satisfactory, 4-Fair, 5-Poor (Germany)
Current smoker	Yes=1, No=0.
Physical activity	<i>Australia</i> : 1-Sedentary, 2-Low, 3-Moderate, 4-High (based on how often participate in physical activity within a week). <i>Germany</i> : 1-Almost never, 2-Several times per year, 3-At least once per month, 4-At least once per week.
<i>Job characteristics</i>	
Work experience	Potential work experience = age <i>minus</i> all schooling years <i>minus</i> 6.
Industry	9 one-digit harmonized industries taken from Cross National Equivalent File from HILDA and SOEP. Includes Agriculture, Energy, Mining, Manufacturing, Construction, Trade, Transport, Bank and Insurance, and Services.
Occupation	9 one-digit harmonised occupations from HILDA and SOEP. Includes Managers, Professionals, Technicians and associate professionals, Clerical support workers, Services and sales workers, Skilled agriculture, forestry and fishing workers, Craft and related trade workers, Plant, machinery operators and assemblers, Elementary occupations and laborers.
State/region	Australia: 6 states and 2 territories Germany: 16 states, East/West Germany
Survey year	2002-2022 (annual) for HILDA, for Germany only even-years between 2002-2022 as in the odd-years SOEP did not collect health data

Appendix B. IV validity tests for 2SLS LIML estimation

	PCS			MCS		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
2-digit level industry	0.0184**		0.0257**	0.0178**		0.0252**
average work hours	(0.0025)		(0.0024)	(0.0025)		(0.0023)

Instruments	PCS			MCS		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
2-digit level occupation	0.0198**	0.0254**		0.0202**	0.0256**	
average work hours	(0.0024)	(0.0022)		(0.0023)	(0.0022)	
Unpaid domestic work	-0.0167**	-0.0164**	-0.0166**	-0.0165**	-0.0163**	-0.0164**
	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)
<i>IV tests</i>						
First stage F-value	217.7	284.1	310	215.4	281.1	306.3
<i>Weak identification test</i>						
<i>Cragg-Donald Wald F statistic</i>	412.9	585.1	553.3	407.6	579.7	542.1
<i>Stock-Yogo critical values: 10% max LIML size</i>	6.46	8.68	8.68	6.46	8.68	8.68
Hansen J stats (overid test) P-value	0.5398	0.2898	0.8883	0.7255	0.5206	0.5171
Endogeneity test (P-value)	0.0001	0.0007	0.0001	0.0105	0.0187	0.0179

Statistically significant at 1% level (**, $p < 0.01$), at 5% level (*, $p < 0.05$), at 10% level (+, $p < 0.10$). For brevity, we present only the IV coefficients in the first stage and the IV tests using Australian data; full estimates of 2SLS are available upon request

Appendix C

Table 5 Weekly wage income (in log) and weekly work hours, 2002-2022, employed Australian and German adults aged 25-64

	Australia		Germany	
	Coefficient	Robust SE	Coefficient	Robust SE
Weekly workhours	0.0296**	0.0002	0.0347**	0.0003
R-squared	0.5329		0.5855	
Prob > F	0.0000		0.0000	

Estimates were adjusted for sample weights; the model controlled for work experience, experience squared, education levels, one-digit industry, one-digit occupation, year and state/region dummies

** Statistically significant at 1% level ($p < 0.01$)

Table 6 Physical health ceilings overall and by gender, employed Australians and Germans aged 25-64, 2002-2022 (2SLS LIML estimator)

	Australia			Germany		
	Overall	Men	Women	Overall	Men	Women
Ceiling hours	42	46	39	38	44	33
Weekly workhours	1.0000** (0.2129)	1.1908* (0.4703)	0.8471* (0.3315)	1.2471** (0.1446)	2.4051* (1.0564)	1.6658** (0.2779)
Weekly workhours ²	-0.0118** (0.0028)	-0.0129* (0.0056)	-0.0108* (0.0048)	-0.0165** (0.0019)	-0.0272* (0.0121)	-0.0252** (0.0042)
Observations	81,193	39,780	41,413	105,195	52,514	52,681

Robust standard errors in parentheses, statistically significant at ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$. We used average 2-digit industry, average 2-digit occupation work hours and unpaid domestic time (Model 1 in Appendix B) as instruments to predict work hours before modelling the relationship between work hours and health outcomes (PCS). Models controlled for work experience, gender, marital status, education, financial distress index, household socio-economic disadvantage index, prior self-assessed health, migration status, job attributes (shiftwork, job demand, work flexibility), smoking and alcohol drinking status, and state (East/West in German) and year dummy variables. Job demand, financial distress and alcohol drinking were not available in many years in the SOEP and were excluded from German models. The IV validity test results are shown in Appendix B.

Table 7 Mental health ceilings overall and by gender, employed Australians and Germans aged 25-64, 2002-2022 (2SLS estimator)

	Australia			Germany		
	Overall	Men	Women	Overall	Men	Women
Ceiling hours	43	45	38	38	42	33
Weekly workhours	0.8583** (0.2223)	1.5429** (0.5474)	0.8731** (0.3280)	1.1505** (0.1346)	0.025 (0.5503)	1.9690** (0.2737)
Weekly workhours ²	-0.0099** (0.0029)	-0.0170** (0.0065)	-0.0115* (0.0040)	-0.0153** (0.0018)	-0.0003 (0.0063)	-0.0298** (0.0042)
Observations	81,427	39,785	41,642	102,199	52,583	51,270

Robust standard errors in parentheses, statistically significant at ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$. We used the average 2-digit industry, average 2-digit occupation work hours and unpaid domestic time (Model 1 in Appendix B) as instruments to predict work hours before modelling the relationship between work hours and health outcomes (MCS). Models controlled further for work experience, gender, marital status, education, financial distress index, household socio-economic disadvantage index, prior self-assessed health, migration status, job attributes (shiftwork, job demand, work flexibility), smoking and alcohol drinking status, and state (East/West in German) and year dummy variables. Job demand, financial distress and alcohol drinking were not available in many years in the SOEP and were excluded from German models. The IV validity test results are shown in Appendix B. The estimate of ceiling hours for German men may be less accurate due to statistical insignificance

Table 8 Physical health ceilings by domestic unpaid hours, employed Australians and Germans aged 25-64, 2002-2022 (2SLS estimator)

	Australia			Germany		
	Overall	High care and domestic hours	Low care and domestic hours	Overall	High care and domestic hours	Low care and domestic hours
Ceiling hours	42	38	46	38	33	41
Weekly workhours	1.0000** (0.2129)	1.6608** (0.5349)	0.8303* (0.4099)	1.2471** (0.1446)	1.4147** (0.3391)	1.0539** (0.2784)
Weekly workhours ²	-0.0118** (0.0028)	-0.0218** (0.0073)	-0.0091+ (0.0051)	-0.0165** (0.0019)	-0.0214** (0.0050)	- (0.0035)
Observations	81,193	32,764	48,429	105,195	37,253	67,942

Robust standard errors in parentheses, statistically significant at ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$. We used average 2-digit industry, average 2-digit occupation work hours and unpaid domestic time (Model 1 in Appendix B) as instruments to predict work hours before modelling the relationship between work hours and health outcomes (PCS). Models controlled further for work experience, gender, marital status, education, financial distress index, household socio-economic disadvantage index, prior self-assessed health, migration status, job attributes (shiftwork, job demand, work flexibility), smoking and alcohol drinking status, and state (East/West in German) and year dummy variables. The IV validity test results are shown in Appendix B

Table 9 Mental health ceilings overall and by domestic unpaid hours, employed Australians and Germans aged 25-64, 2002-2022 (2SLS estimator)

	Australia			Germany		
	Overall	High care and domestic hours	Low care and domestic hours	Overall	High care and domestic hours	Low care and domestic hours
Ceiling hours	43	38	45	38	33	42
Weekly workhours	0.8583** (0.2223)	1.9155** (0.5048)	0.8502+ (0.4689)	1.1505** (0.1346)	1.2670** (0.3135)	0.3356 (0.2763)
Weekly workhours ²	-0.0099** (0.0029)	-0.0250** (0.0069)	-0.0094 (0.0059)	-0.0153** (0.0018)	-0.0191** (0.0046)	-0.004 (0.0034)
Observations	81,427	32,916	48,511	102,199	37,320	68,022

Robust standard errors in parentheses, statistically significant at ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$. We used the average 2-digit industry, average 2-digit occupation work hours and the unpaid domestic time (Model 1 in Appendix B) as instruments to predict work hours before modelling the relationship between work hours and health outcomes (MCS). Models controlled further for work experience, gender, marital status, education, financial distress index, household socio-economic disadvantage index, prior self-assessed health, migration status, job attributes (shiftwork, job demand, work flexibility), smoking and alcohol drinking status, and state (East/West in German) and year dummy variables. Job demand, financial distress and alcohol drinking were not available in many years in the SOEP and were excluded from German models. The IV validity test results are shown in Appendix B. Estimates for low unpaid time are less accurate due to statistical insignificance

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Data Availability The datasets are not publicly available in this paper; however, access to the datasets is available upon approval from the Melbourne Institute for HILDA data and from the German Socio-Economic Panel Survey for the SOEP data.

Ethics Approval The current study uses a secondary dataset with approved data access from the Melbourne Institute. Research Ethics approval was granted by the Australian National University Human Ethics Committee, Ethics Approval Protocol: 2022/701.

Conflict of interest The authors declare that there are no competing interests in conducting this research.

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References

- Acker, J. (2006). Inequality regimes. Gender, class and race in organizations. *Gender and Society, 20*(4), 441–464.
- Addati, L., Cattaneo, U., Esquivel, V., & Valarino, I. (2018). *Care work and care jobs for the future of decent work*. International Labour Organization.
- Andersen, H., Axel, M., Matthias, N., Jürgen, S., & Wagner, G. (2007). Computation of standard values for physical and mental health scale scores using the SOEP version of SF-12v2. *Schmollers Jahrbuch, 127*(1), 171–182.
- Bannai, A., & Tamakoshi, A. (2014). The association between long working hours and health: A systematic review of epidemiological evidence. *Scandinavian Journal of Work, Environment & Health, 40*(1), 5–18.
- Becker, G. (1965). A theory of the allocation of time. *The Economic Journal, 75*(299), 493–517.
- Blackden, M., & Wodon, Q. (2006). *Gender, time use, and poverty in Sub-Saharan Africa*. World Bank Working Paper 73, Washington, D.C.
- Blau, D., & Kahn, L. (2017). The gender wage gap: Extent, trends, explanations. *Journal of Economic Literature, 55*(3), 789–865.
- Cha, Y. (2010). Reinforcing separate spheres: The effect of spousal overwork on men's and women's employment in dual-earner households. *American Sociological Review, 75*(2), 303–329.
- Cha, Y., and, & Kim, W. (2014). Overwork and the slow convergence in the gender gap in wages. *American Sociological Review, 79*(3), 457–484.
- De Moortel, D., Dragano, N., & Wahrendorf, M. (2020). Involuntary full- and part-time work: Employees' mental health and the role of family- and work-related resources. *Societies, 10*(4), Article 81.
- Dembe, A., & Xiaoxi, Y. (2016). Chronic disease risks from exposure to long-hour work schedules over a 32-Year period. *Journal of Occupational and Environmental Medicine, 58*(9), 861–867.
- Doan, T., Thorning, P., Furuya-Kanamori, L., & Strazdins, L. (2021). What contributes to gendered work time inequality? An Australian case study. *Social Indicators Research, 155*(1), 259–279.

- Doan, T., Yu, P., LaBond, C., Gong, C., & Strazdins, L. (2022a). Time for physical activity: Different, unequal, gendered. *Journal of Health and Social Behavior*, 63(1), 37–54.
- Doan, T., LaBond, C., Banwell, C., Timmins, P., Butterworth, P., & Strazdins, L. (2022b). Unencumbered and still unequal? Work hour-health tipping points and gender inequality among older, employed Australian couples. *SSM - Population Health*, 18, 101121.
- Doan, T., Leach, L., & Strazdins, L. (2025). The Economic Costs of Men's Long Work Hours for Women: Evidence on the Gender Wage Earnings Gap from Australia and Germany. *Social Indicators Research*, 179, 1073–1100. <https://doi.org/10.1007/s11205-025-03647-1>
- Esping-Andersen, G. (1999). *Social foundations of postindustrial economies*. Oxford University Press.
- Ferrant, G., Pesando, M., & Nowacka, K. (2014). *Unpaid care work: The missing link in the analysis of gender gaps in labour outcomes*. OECD Development Center.
- Gandek, B., Sinclair, S., Kosinski, M., & Ware, J. (2004). Psychometric evaluation of the SF36 health survey in medicare managed care. *Health Care Financial Review*, 25(4), 5–25.
- Goebel, J., Grabka, M., Liebig, S., Kroh, M., Richter, D., Schröder, C., & Schupp, J. (2019). The German socio-economic panel (SOEP). *Jahrbücher für Nationalökonomie und Statistik*, 239(2), 345–360.
- Gornick, J., & Alexandra, H. (2006). The regulation of working time as work-family reconciliation policy: Comparing Europe, Japan and the United States. *Journal of Comparative Policy Analysis: Research and Practice*, 8(2), 149–166.
- Gracia, P., Han, W., & Li, J. (2021). Nonstandard work schedules in 29 European countries, 2005–15: Differences by education, gender, and parental status. *Monthly Labor Review*, 144: US Bureau of Labor Statistics.
- Harvey, S. B., Modini, M., Joyce, S., Milligan-Saville, J. S., Tan, L., Mykletun, A., Bryant, R. A., Christensen, H., & Mitchell, P. B. (2017). Can work make you mentally ill? A systematic meta-review of work-related risk factors for common mental health problems. *Occupational and Environmental Medicine*, 74(4), 301–310.
- Juster, F., Thomas, O., & Frank, S. (2003). An assessment of alternative measures of time use. *Sociological Methodology*, 33(1), 19–54.
- Krieger, N. (2020). Measures of racism, sexism, heterosexism, and gender binarism for health equity research: From structural injustice to embodied harm—an ecosocial analysis. *Annual Review of Public Health*, 41, 37–62.
- Krieger, N. (2021). *Ecosocial theory, embodied truths and the people's health*. Oxford University Press.
- Mandel, H., & Semyonov, M. (2014). Gender pay gap and employment sector: Sources of earnings disparities in the United States, 1970–2010. *Demography*, 51(5), 1597–1618.
- Moen, P., Kelly, E., & Lam, J. (2013). Healthy work revisited: Do changes in time strain predict well-being? *Journal of Occupational Health Psychology*, 18(2), 157–172.
- O'Neill, O., & O'Reilly, C. (2010). Careers as tournaments: The impact of sex and gendered organizational culture preferences on MBAs' income attainment. *Journal of Organizational Behavior*, 31(6), 856–76.
- O'Reilly, D., & Rosato, M. (2014). Worked to death? A Census-based longitudinal study of the relationship between the numbers of hours spent working and mortality risk. *International Journal of Epidemiology*, 42(6), 1820–30.
- OECD. (2018). *OECD Labor Force Statistics 2018*. OECD Publishing.
- OECD. (2021). *OECD Employment Outlook 2021*. OECD Publishing.
- OECD (2022). *Work-Life balance*. oecd.betterlifeindex.org/topics/work-life-balance/
- Olivetti, C., & Petrongolo, B. (2016). The evolution of gender gaps in industrialized countries. *Annual Review of Economics*, 8(1), 405–434.
- Padavic, I., Ely, R., & Reid, E. (2020). Explaining the persistence of gender inequality: The work–family narrative as a social defence against the 24/7 work culture. *Administrative Science Quarterly*, 65(1), 61–111.
- Pedulla, D. S., & Thébaud, S. (2015). Can we finish the revolution? Gender, work-family ideals, and institutional constraint. *American Sociological Review*, 80(1), 116–139.
- Pega, F., Náfrádi, B., Momen, N. C., Ujjita, Y., Streicher, K. N., Prüss-Üstün, A. M., Descatha, A., Driscoll, T., Fischer, F. M., Godderis, L., Kiiver, H. M., Li, J., Magnusson Hanson, L. L., Rugulies, R., Sorensen, K., & Woodruff, T. J. (2021). Global, regional, and national burdens of ischemic heart disease and stroke attributable to exposure to long working hours for 194 countries, 2000–2016: A systematic analysis from the WHO/ILO Joint Estimates of the Work-related Burden of Disease and Injury. *Environment International*, 154, Article 106595.
- Spurgeon, A. (2003). *Working time: Its impact on safety and health*. International Labour Organization.
- Strazdins, L. (2022). *Time In health promotion and public health*. In *Oxford research encyclopedia of global public health*. Oxford University Press.
- Strazdins, L., Griffin, A., Broom, D., Banwell, C., Korda, R., Dixon, J., Paolucci, F., & Glover, J. (2011). Time scarcity: Another health inequality? *Environment and Planning A*, 43(3), 545–59.

- Summerfield, M., Bevitt, A., Fok, Y. K., Hahn, M., La, N., & Macalalad, N. (2019). *HILDA User Manual–Release 17*. Melbourne Institute of Applied Economic and Social Research. University of Melbourne.
- Theorell, T., Hammarström, A., Aronsson, G., Träskman Bendz, L., Grape, T., Hogstedt, C., & Hall, C. (2015). A systematic review including meta-analysis of work environment and depressive symptoms. *BMC Public Health*, *15*(1), 738.
- Venn, D., & Strazdins, L. (2017). Your money or your time? How both types of scarcity matter to physical activity and healthy eating. *Social Science & Medicine*, *172*, 98–106.
- Virtanen, M., Heikkilä, K., Jokela, M., Ferrie, J. E., Batty, G. D., Vahtera, J., & Kivimäki, M. (2012). Long working hours and coronary heart disease: A systematic review and meta-analysis. *American Journal of Epidemiology*, *176*(7), 586–596.
- Wagner, G., Frick, R., & Schupp, J. (2007). The German socio-economic panel study (SOEP)-Scope, evolution and enhancements. *Journal of Contextual Economics–Schmollers Jahrbuch*, *1*, 139–169.
- Ware, J. E., Jr., & Gandek, B. (1998). Overview of the SF-36 health survey and the international quality of life assessment (IQOLA) project. *Journal of Clinical Epidemiology*, *51*(11), 903–912.
- Williams, J. C., Blair-Loy, M., & Berdahl, J. L. (2013). Cultural schemas, social class, and the flexibility stigma. *Journal of Social Issues*, *69*(2), 209–234.

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