ORIGINAL ARTICLE

Working hours and mental health in Australia: evidence from an Australian population-based cohort, 2001–2012

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▶ Additional material is published online only. To view please visit the journal online (http://dx.doi.org/10.1136/oemed-2014-102791).

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Received 21 December 2014
Revised 4 May 2015
Accepted 29 May 2015
Published Online First 22 June 2015

ABSTRACT

Objectives This paper assesses the impact of working less than or more than standard full-time hours on mental health, as well as possible differences in this relationship by gender and skill level.

Methods The study design was a longitudinal cohort with 12 annual waves of data collection over the period 2001–2012, yielding a sample of 90 637 observations from 18 420 people. Fixed effects within-person regression was used to control for time invariant confounding. The Mental Component Summary of the Short Form 36 (SF-36) measure was used as the primary outcome measure. Working hours over the preceding year was measured in five categories with standard full-time hours (35–40 h/week) as the reference.

Results Results indicated that when respondents were working 49–59 h (−0.52, 95% CI −0.74 to −0.29, p<0.001) and 60 h or more (−0.47, 95% CI −0.77 to −0.16, p=0.003) they had worse mental health than when they were working 35–40 h/week (reference). The difference in mental health when working 49–59 h was greater for women than for men. There were greater declines in mental health in relation to longer working hours among persons in higher compared to lower occupational skill levels.

Conclusions Study results suggest the need for employers and governments to regulate working hours to reduce the burden of mental ill health in the working population.

What this paper adds?

- Long working hours have been associated with worse mental health across a number of occupational groups. Most have assessed long working hours as a dichotomous variable and studies have been conducted within specific occupational contexts.
- This study assesses working hours as a graded variable, which allowed us to investigate the effects of a range of working hours: those working less than standard average hours, moderately above average standard average hours, and for very long working hours.
- This study was able to use a causally robust methodology to assess within-person change; comparing the impact of working less than or more than standard average hours to working standard average working hours over a 12-year period.
- This is relevant for workplace policy and prevention, suggesting the need for interventions addressing the impact of sustained long working hours on mental health.

There has been considerable research interest in the relationship between working hours and health. A recent systematic review[1] documented associations between long working hours (defined as working over 40 h a week) and a range of health outcomes. This review found consistent evidence that long working hours are associated with an increase in depression, anxiety, sleeplessness, and coronary heart disease, while evidence is less consistent regarding the relationship between working hours and circulatory disease and diabetes.[1–3] To some extent, discrepancies between studies may be explained by differences in country context or sample composition (eg, occupational groups, gender and socioeconomic status). For example, a recent meta-analysis found a relationship between longer working hours and type 2 diabetes only in low socioeconomic groups.[4] A Spanish study reports that the relationship between mental health and long working hours is stronger among women rather than men.[5] This aligns with evidence from the Whitehall studies, which also suggests that risk of depression is particularly elevated among women, possibly because they bear a disproportionate amount of work at home in addition to work stress.[6] The effect of longer working hours on mental health may also be mediated by increased duration or likelihood of exposure to psychosocial job stressors, as well as reduced time available for recovery from work.[1]

Relatively few studies on working hours and mental health have been conducted in general labour market cohorts, with most studies being conducted in one organisation[6–8] or in specific industries[1 9] or occupations.[10] Another key point that has not been adequately addressed in past research is the effects of working *less* than the average number of working hours in a week. Inadequate or underemployment (defined by the Australian Bureau of Statistics[11] as being available to work more hours than currently employed) has been associated with increased depression, alcohol use and suicide.[12–15] Hence, understanding the potential contribution of working less than standard full-time hours to mental health may be a particularly important area of future research.

To cite: Milner A, Smith P, LaMontagne AD. *Occup Environ Med* 2015;**72**:573–579.

The objective of this study was to focus on the effects of long working hours on mental health, as well as the effects of working less than standard full-time hours in Australia. Currently, 21% of Australian men and 6% of Australian women work very long hours[16] (defined as working for a length of time which exceeds standard full-time work hours). This is above the average for other OECD countries.[16] The main research question is: is working more or less than standard full-time hours (35–40 h/week) associated with worse mental health? To answer this research question, we use a fixed effect within-persons approach, which compares the mental health of a person when they are working standard full-time hours (34–40 h) compared to when the person is working less (under 34 h a week) or greater than standard full-time hours (41–48, 49–59, over 60 h).

METHODS

Data source

The Household, Income and Labour Dynamics in Australia (HILDA) survey is a longitudinal, nationally representative study of Australian households established in 2001. It collects detailed information annually from more than 13 000 individuals covering more than 7000 households.[17] The response rate to wave 1 was 66%.[17] The survey covers a range of dimensions including social, demographic, health and economic conditions using a combination of face-to-face interviews with trained interviewers and a self-completion questionnaire. Although data are collected on each member of the household, interviews are only conducted with those older than 15 years of age.

The initial wave of the survey began with a large national probability sample of Australian households occupying private dwellings.[17] Interviews were sought in later waves with all persons in sample households who had turned 15 years of age. Additional persons have been added to the sample as a result of changes in household composition. For example, if a household member left his or her original household (eg, children left home, or a couple separated), he/she formed an entirely new household, including all persons living with the original sample member. Inclusion of these new households is the chief method in which the HILDA survey maintains sample representativeness. A top-up sample of 2000 people was added to the cohort in 2011 to allow better representation of the Australian population using the same methodology as the original sample (ie, a three-stage area-based design).[18] The response rates for the HILDA survey are above 90% for respondents who have continued in the survey, and above 70% for new respondents being invited into the study.[17] The main variables examined in this study were available in all annual waves of HILDA (2001–2012).

Outcome variable

The Mental Component Summary (MCS) of the Short Form 36 (SF-36) measure was used as the primary outcome measure. The MCS represents a summary measure of mental health and well-being, and is comprised of four scales: mental health, emotional role, vitality and social functioning, which are derived from 14 questions.[19] The SF-36 is a widely used self-completion measure of health status, and has been validated for use in the Australian population, and to detect within-person change over time.[19] The SF-36 in the HILDA survey has been shown to be psychometrically sound, with good internal consistency, discriminant validity and high reliability.[19] We used the standardised version of the SF-36. The mean score on the MCS in HILDA was approximately 49.8, with a SD of 10.3, a minimum of 4.4 and a maximum of 73.9. Scores run from 1 to 100. Higher scores represent better mental health.

Exposure variable

The main exposure variable is the average number of hours worked in a person's main job per week (97% of people in the sample held one job only). This was split into five groups (34 or less, 35–40, 41–48, 49–59, and over 60 h), with 35–40 h (standard full-time hours) used as the reference category.[20] The categorical approach to measuring working hours also allowed us to investigate non-linear relationships, and the possibility of either positive or detrimental effects of working less than or more than 35–40 working hours in a week.

Other variables assessed in the model

The model also included a number of likely confounders, selected on the basis of past literature.[21] These included age (measured continuously) and household structure (couple or lone adult residing with dependents; couple without dependents; lone person without dependents; and a group or multiple person household). We also included employment arrangement (permanent, casual or labour hire, fixed term contract or self-employed); occupational skill level (low (sales, machinery workers and labourers), medium (technical and trade workers, community and personal service workers, and clerical and administration workers), and high (managers and professionals) according to the Australian and New Zealand Standard Classification of Occupations occupational groupings);[22] weekly household income; and presence of a long-term health condition, disability or impairment (yes/no). Gender and occupational skill level were also assessed as effect moderators of the relationship between working hours and mental health.[21] We also examined the relationship between actual working hours and (mean) reported satisfaction with working hours descriptively. Satisfaction with working hours was not included in the fixed effects model because it is likely to be a mediator on the causal pathway from changes in working hours to changes in mental health. For example, a person may experience a change in their working hours, which leads to a change in their level of satisfaction with working hours which then influences their mental health.

Analysis

Longitudinal linear fixed effects regression models were used to estimate the association between working hours (as an ordinal variable) and MCS score within individuals. Fixed effects regression models describe differences in MCS score associated with less than or greater than standard full-time hours worked compared with that individual's mean MCS score when they were working the average number of working hours in a week. These models provide an indication of within-person effects, where each individual acts as their own control, and estimates are not confounded by time-invariant personal, demographic and environmental factors.[23] Fixed effects models are particularly useful where time-invariant confounding is likely to create bias in causal estimates. For example, mental health may be affected by within-person factors such as personality. We repeated the main analysis on the four subscales comprised in the MCS (see online supplementary table S1).

We controlled for time-variant factors by including a number of relevant covariates into the fixed effects models. Including these in fixed effect models accounted for individual change in these variables that might influence the relationship between working hours and mental health. We assessed the effect of working hours on MCS contemporaneously based, in part, on previous research showing that changes in psychosocial job

stressors were associated with the greatest changes in a scaled measure of mental health over a 1-year time frame.[24]

We tested the hypothesis that the association between working hours and mental health differed by occupational skill level using an interaction term in fixed effects models, and examined this using the likelihood ratio test and inspection of significance values of interaction terms in the model. We assessed the possibility that the relationship between working hours and mental health differed by gender using the same analytical technique. The relationship between reported actual average working hours and mean satisfaction with working hours was also assessed in descriptive analysis, as mentioned above.

Analytical sample and missing data

There were 19 880 employed people (105 223 observations) in the HILDA study. Those included in the analytical sample had information on hours worked (19 859 persons, 104 948 observations), MCS (18 545 persons, 91 850 observations), and other covariates (18 420 persons, 90 637 observations). The final sample represented 18 420 people. Those excluded from the analytical sample (7.92%) were more likely to be in lower skilled groups, over 60 years and women, compared with those included in the sample.

RESULTS

The sample characteristics of the people contributing to the model can be seen in table 1. At the time of their entry into the survey, over 40% of those in the sample were aged 34 years and under, while 30% were aged 35–40 years. There was a slightly greater number of men compared with women included in the sample. Occupational skill level was fairly evenly distributed between low, medium and high skilled occupations. The largest proportion of people worked less than standard full-time hours (35–40 h). Table 1 also shows the characteristic of the sample in their final contributing wave. As can be seen, people in the sample got older, were more likely to be living in a couple relationship with dependents, had attained higher skill levels in their jobs, and were more likely to be working permanently with average standard full-time hours.

Over 50% of female observations were working 34 h or less in a week (compared with 18.53% of male observations) (table 2). A greater number of male observations worked more than standard full-time hours than female observations. The majority of observations for those in lower skilled occupational groups were for working 34 h or less, or the standard full-time hours. For both, men and women, a greater number of observations for those in the highest occupational skill level groups were working longer than standard full-time hours than those in lower skill level occupations.

Scores of the MCS by working hours can also be seen in table 2. No clear differences in mean MCS scores were noted between work-hours groups. Importantly, this descriptive table presents combined within-person and between-person pooled

Table 1 Characteristics of the analytic sample, baseline and final contributed wave (persons=18 420)

Characteristic	Observations at baseline wave	Per cent	Mean MCS	Observations at final wave	Per cent	Mean MCS
Age in years						
29 or under	7841	42.57	47.80	6075	32.98	47.60
30–44	5841	31.71	48.25	5347	29.03	48.30
45–59	3913	21.24	49.91	5147	27.94	49.49
60 and over	825	4.48	53.42	1851	10.05	52.80
Gender						
Male	9306	50.52	49.76	9306	50.52	49.80
Female	9114	49.48	47.50	9114	49.48	47.89
Household structure						
Couple without dependents	7703	41.82	48.97	6682	36.28	49.00
Couple with dependents	6156	33.42	49.52	6878	37.34	49.84
Lone	2044	11.1	47.20	2731	14.83	47.66
Group/multihousehold	1243	6.75	47.48	985	5.35	47.45
Lone with dependents	1274	6.92	45.86	1144	6.21	45.90
Occupational skill level						
Low	6006	32.61	48.43	4953	26.89	48.26
Medium	6971	37.84	48.45	7249	39.35	48.67
High	5443	29.55	49.13	6218	33.76	49.54
Usual hours worked						
34 or under	7811	42.4	48.03	6990	37.95	48.15
35–40	5576	30.27	48.87	6383	34.65	49.10
41–48	2196	11.92	49.28	2123	11.53	49.54
49–59	1721	9.34	49.22	1827	9.92	49.47
60 and over	1116	6.06	49.67	1097	5.96	49.55
Employment arrangement						
Permanent	8715	47.31	48.92	9939	53.96	49.12
Casual/labour hire	5824	31.62	47.86	4274	23.2	47.68
Fixed term contract	1310	7.11	48.24	1413	7.67	48.93
Self-employed	2571	13.96	49.69	2794	15.17	49.66

MCS, Mental Component Summary.

Table 2 Usual working hours (annually) in the main job and scores of the Short Form 36 (SF-36) Mental Component Summary (MCS), observations for persons included in the analytic data set, by gender, and occupational skill level, the Household, Income and Labour Dynamics in Australia (HILDA) study, 2001–2012*

	Mean MCS (SD)	Low % (observations=13 115)	Med % (observations=16 350)	High % (observations=17 382)	Total % (observations=46 847)
Male					
34 or under	50.0 (9.30)	30.96	15.2	12.29	18.53
35–40	50.1 (9.02)	33.56	44.47	30.61	36.27
41–48	50.3 (8.64)	14.56	19.2	19.58	18.04
49–59	50.2 (8.64)	11.85	14.15	22.77	16.7
60 and over	50.0 (9.41)	9.08	6.98	14.76	10.45
Female					
34 or under	48.4 (9.87)	71.68	53.31	37.43	51.38
35–40	48.7 (9.65)	21.15	35.93	32.95	31.75
41–48	48.8 (9.64)	3.85	6.98	13.13	8.56
49–59	48.1 (10.19)	2.28	2.84	10.93	5.67
60 and over	48.7 (9.86)	1.05	0.94	5.56	2.64

*Notes: low=low occupational skill (sales, machinery workers, and labourers); medium=medium occupational skill (technical and trade workers, community and personal service workers, and clerical and admin workers); high=high occupational skill (managers and professionals).

cross-sectional data, as distinct from the fixed effects analysis below which assesses within-person differences only.

Results of the bivariate and multivariate fixed effects regression models can be seen in table 3. There was an average of five waves included for each person in the analysis. The bivariate associations indicate that working 49–59 h was associated with a −0.46 difference in scores of the MCS (95% CI −0.72 to −0.21, p<0.001) while working over 60 h was associated with a 0.48 decline (95% CI −0.82 to −0.13, p=0.007) compared to when a person was working standard full-time hours. There was

Table 3 Fixed effect regression model regarding working hours in main job (annually) on scores of the Short Form 36 (SF-36) Mental Component Summary, the Household, Income and Labour Dynamics in Australia (HILDA) study, 2001–2012 (persons=18 420, observations=90 637)*

	Bivariate			Multivariate		
	Coefficient	95% CI	p Value	Coefficient	95% CI	p Value
Usual hours worked						
35–40 h	1			1		
34 or under	0.01	−0.21 to 0.23	0.945	0.01	−0.19 to 0.22	0.897
41–48	−0.11	−0.31 to 0.10	0.301	−0.09	−0.28 to 0.09	0.336
49–59	−0.46	−0.72 to −0.21	<0.001	−0.52	−0.74 to −0.29	<0.001
60 over	−0.48	−0.82 to −0.13	0.007	−0.47	−0.77 to −0.16	0.003
Income	0.01	0.01 to 0.01	<0.001	0.01	0.01 to 0.01	0.003
Household structure						
Couple without dependents	1			1		
Couple with dependents	0.38	0.18 to 0.59	<0.001	0.26	0.05 to 0.47	0.015
Lone	−0.93	−1.26 to −0.61	<0.001	−0.99	−1.31 to −0.66	<0.001
Group/multihousehold	−0.42	−0.83 to −0.01	0.045	−0.48	−0.89 to −0.07	0.022
Lone with dependents	−1.32	−1.78 to −0.86	<0.001	−1.28	−1.74 to −0.82	<0.001
Long-term health condition	1−0.72	−0.95 to −0.50	<0.001	1−0.9	−1.11 to −0.70	<0.001
Age	0.08	0.06 to 0.11	<0.001	0.087	0.06 to 0.10	<0.001
Occupational skill						
Low	1			1		
Medium	0.78	−0.16 to 0.32	0.529	0.02	−0.20 to 0.24	0.856
High	−0.05	−0.32 to 0.22	0.722	−0.09	−0.34 to 0.17	0.506
Employment arrangement						
Permanent	1			1		
Casual/labour hire	−0.04	−0.24 to 0.16	0.691	0.06	−0.15 to 0.27	0.583
Fixed term contract	0.10	−0.13 to 0.33	0.414	0.12	−0.11 to 0.35	0.307
Self-employed	−0.05	−0.35 to 0.26	0.765	−0.05	−0.35 to 0.26	0.759
Constant	49.42	49.31 to 49.53	<0.001	46.65	45.86 to 47.45	<0.001

*Notes: 95% CI=95% upper and lower CIs, p value=significance value. Constant is for usual hours worked in main job. Average observations per person included in the analysis=5; maximum observations=12, minimum=2.

no significant difference in the MCS when a person worked 34 h or under. After adjusting for other covariates, the decline in MCS associated with working 49–59 h increased slightly (−0.52, 95% CI −0.74 to −0.29, p<0.001), while the coefficient associated with working 60 h or more decreased slightly (−0.47, 95% CI −0.77 to −0.16, p=0.003). Results regarding the subscales of the MCS can be seen in online supplementary table S1. These results suggest that the main analysis results are mainly driven by the mental health and role vitality subscale, that is, there are declines in mental health once a person is working 49 h or more compared to when they are working standard full-time hours. Working less than standard hours was associated with a significant decline in mental health on the social functioning and role emotional scales. However, these results must be viewed with caution given that the subscales are very skewed and are not improved by transformation.

There was evidence of significant effect modification by gender ($x^2(4)=25.30$, p<0.001) and occupational skill level ($x^2(8)=23.19$, p=0.0031); hence the models were stratified. As can be seen in table 4, there was evidence that those working in the highest skilled occupational groups (ie, managers and professionals) experienced the strongest association between mental health and working hours. Working 49–59 h was associated with MCS scores 0.69 lower (95% CI −1.04 to −0.34, p<0.001), and working 60 h and over was associated with MCS scores 0.54 lower (95% CI −0.99 to −0.09, p=0.02) than working 35–40 h/week. Those working in a medium-skill occupation also experienced lower mental health when working a greater number of hours than 35–40 h, but results were not statistically significant. There was no evidence that working longer hours was associated with differences in mental health for those in the lowest occupational group.

Results stratified by gender can also be seen in table 4. Compared with when they were working standard full-time hours, women (−0.89, 95% CI −1.34 to −0.44, p<0.001) and men (−0.35, 95% CI −0.61 to −0.09, p=0.007) both experienced a decline in the MCS when working 49–59 h. Linear combination of coefficients indicated that the difference in the MCS when working 49–59 h for women was significantly greater than the difference for men (difference of −0.53; 95% CI −0.98 to −0.08, p=0.020). Only men experienced a decline in the MCS when working over 60 h (−0.54, 95% CI −0.89 to −0.20, p=0.002) compared to when they were working standard full-time hours, although the difference between estimates for men and women in this group was not statistically significant. We would note the small number of women working over 60 h/week.

Results showing the relationship between satisfaction with hours and actual working hours can be seen in table 5. This shows that generally, those who reported the highest level of satisfaction were working standard average full-time hours. The second highest levels of satisfaction were reported by those working 34 h or under. The lowest level of satisfaction was reported by those working 60 h or over. Sensitivity analyses, excluding those with more than one job, showed results consistent with the main results of the paper (ie, a reduction in mental health in relation to working 49–59 h and over 60 h; no significant difference in mental health when working 34 h and under, or 41–48 h).

Table 4 Fixed effect regression model regarding working hours in main job (annually) on scores of the Short Form 36 (SF-36) Mental Component Summary, the Household, Income and Labour Dynamics in Australia (HILDA) study, 2001–2012, results stratified by occupational skill level and gender (persons=18 420, observations=90 637)*

		Coefficient	95% CI	p Value
35–40 hours	Reference	1		
34 or under	Lowest skill	0.09	−0.36 to 0.53	0.708
	Medium skill	−0.08	−0.43 to 0.28	0.668
	High skill	0.23	−0.13 to 0.59	0.213
41–48	Lowest skill	−0.12	−0.57 to 0.33	0.61
	Medium skill	0.06	−0.24 to 0.37	0.688
	High skill	−0.29	−0.60 to 0.01	0.059
49–59	Lowest skill	−0.18	−0.75 to 0.39	0.527
	Medium skill	−0.36	−0.76 to 0.05	0.083
	High skill	−0.69	−1.04 to −0.34	<0.001
60 or over	Lowest skill	−0.01	−0.73 to 0.71	0.97
	Medium skill	−0.54	−1.17 to 0.08	0.097
	High skill	−0.54	−0.99 to −0.09	0.02
35–40	Reference	1		
34 or under	Females	−0.1	−0.37 to 0.18	0.483
	Males	0.25	−0.04 to 0.55	0.094
41–48	Females	−0.17	−0.51 to 0.17	0.325
	Males	−0.02	−0.24 to 0.20	0.866
49–59	Females	−0.89	−1.34 to −0.44	<0.001
	Males	−0.35	−0.61 to −0.09	0.007
60 or over	Females	0.04	−0.63 to 0.71	0.905
	Males	−0.54	−0.89 to −0.20	0.002

*Notes: 95% CI=95% upper and lower CIs, p Value=significance value. Adjusted for household weekly income, age, household structure, presence of a long-term health condition, and employment full or part-time. Average observations per person included in the analysis=5; maximum observations=12, minimum=2.

DISCUSSION

The results of this study support an association between long working hours (specifically working over 49 h) and lower scores on the MCS measure of mental health. There was no evidence that working less than standard full-time hours was related to a change in mental health across the sample in this study. Results also suggest that people in the highest skilled occupational groups experienced the greatest declines in mental health when their working hours increased. There was also evidence that the effects of long working hours differed for men and women. While the differences observed were small, the within-person analysis approach would suggest that these estimates are less subject to bias than previous studies.

Previous research has suggested a number of explanations for the relationship between long working hours and mental health.

Table 5 Satisfaction with working hours (0=totally dissatisfied, 10=totally satisfied) and usual hours worked in a week, the Household, Income and Labour Dynamics in Australia study, 2001–2012

	Mean satisfaction with working hours	95% CI
Usual hours worked		
34 or under	7.45	7.43 to 7.48
35–40	7.59	7.57 to 7.61
41–48	7.04	7.00 to 7.07
49–59	6.39	6.35 to 6.43
60 and over	5.75	5.69 to 5.81

Some of the most consistent evidence suggests that long working hours leads to less sleep and time to 'recover' from the demands of a job, leading to worsening mental health.[25 26] Aside from the loss of time for sleep, long working hours may reduce the time available for other leisure-related activities, further resulting in a decline in mental health.[1] It is also possible that long working hours leads to worse health behaviours, and has been associated with increased risk of depression, alcohol use and suicide.[27 28] Hence, there could be multiple pathways through which the effect of long working hours produces a decline in mental health.

Consistent with evidence from other OECD countries, it was far more common for men to work longer weekly hours than women.[16] However, previous evidence has suggested that women are more affected by long working hours than men.[1 5 21] Our study found that both women and men experienced declines in mental health when working 49–59 h, but the difference in mental health was significantly greater for women than men. There are at least two potential pathways that might lead to a greater impact of extended working hours on mental health among women compared with men. Women are more likely than men to have household and other family responsibilities outside of work. Combining these roles with longer working hours may reduce the time available for women to recover from stressful paid plus unpaid work, including interrupted sleep schedules.[29 30] Women and men working extended working hours may do so in different occupations[31] or work contexts, which could present different profiles of mental health-relevant stressors, differing in the stressors they are exposed too (eg, low job control vs bullying), the intensities or levels of these exposures, or both. Stated differently, the differential effect of longer working hours could, in part, reflect longer duration of exposure to disproportionately higher levels of hazards to mental health. For example, we have previously shown that there is a higher prevalence of low job control among Australian working women compared with men,[32] and that job control is related to mental health in the HILDA cohort.[33] It should be noted that these are not competing hypothesised pathways, but may act together to increase the effect of longer working hours on mental health among women relative to men.

We did also find that men experienced lower scores on the MCS when working more than 60 h in a week, while the relationship between working more than 60 h a week and mental health was not statistically significant among women. Given the small sample of women working 60 or more hours per week, we did not have the statistical power to explore this relationship further. However, this reduced effect of working hours on mental health among women with the longest working hours may represent a selection effect, as either women with greater levels of support outside of work, or who are by some other means less susceptible to the effects of longer working hours can remain working more than 60 h/week for an extended time period. Neither women nor men experienced a significant difference in mental health when working less than standard full-time hours, though this might differ if data on desired versus actual hours was available to be incorporated into the analysis.

Our findings regarding worse outcomes in higher skilled occupations aligns with research from the USA, which suggests that higher skilled work required greater commitment and 'face time' than other occupational groups (Schor, 1991).[34] Hence, this group is likely to suffer from exhaustion, greater job-family problems, as well as poorer heath.[34 35] Evidence from the HILDA study is consistent with this assertion, as generally, working hours appeared to increase in line with skill level. There is a lack of evidence of decline in mental health among lower skilled workers in relation to long working hours. Our descriptive analyses also suggest that these persons are more likely to work less than standard full-time hours. As documented in a UK study, lower skilled workers may be more likely to be compensated for additional working hours, while long working hours are simply an expectation among those in higher skilled jobs.[21] Basing on this, it may be the case that lower skilled workers may be more likely to work longer hours on a voluntary/optional basis, as well as on being rewarded financially when they work longer hours, and therefore, do not experience an associated decline in mental health.

The limitations of this study include the fact that both the exposure and the outcome were self-reported, and so, possibly affected by common method variance or dependent misclassification bias;[1 9] however, this would be, to some extent, controlled by the fixed effects analysis, for example, to the extent that biases in reporting is person-related and time-invariant. Owing to limitations of the data available, we classified exposure based only on the reported main job, thus underestimating exposure for respondents with more than one job. Our sensitivity analyses show similar results after these people were excluded. Further, we would emphasise that relatively few people reported having more than one paid job. The fixed effect regression approach maximised causal inference in that people in the analysis acted as their own control. Exposure to working hours and mental health are modelled contemporaneously in our models (measured in the same wave). We would argue that the effects of longer (or shorter) working hours on mental health are likely to be contemporaneous, or to occur within a period less than a year, rather than manifesting over a 12-month period or longer. Some support for this view is provided by a Dutch panel study of four annual waves showing that changes in job strain were associated with the greatest changes in a scaled measure of mental health over a 1-year time frame.[24] While longer lags might be appropriate for discrete diagnoses or diagnosable outcomes (eg, depression), we would argue that shorter time frames are more appropriate for scaled outcome measures. We acknowledge that this introduces the potential for reverse causality (ie, poor mental health could influence working hours). However, if reverse causality is occurring it would bias our results toward the null rather than increase the effect reported. This is because the available evidence suggests that mental health problems results in people working fewer hours or leaving the workforce altogether, rather than working longer hours.[36 37]

We would also acknowledge that our analysis did not assess variations in the timing or duration of exposure, and hence does not investigate possible effects of lagged impacts on mental health, or the influence of sustained or cumulative exposure to long working hours. We would suggest these as useful areas of future research. Last, we did not have data on whether changes in working hours were voluntary or not. This is likely to be an important aspect for understanding the relationship between working hours and mental health. We did conduct additional analyses to assess the relationship between satisfaction with working hours and reported working hours. This analysis indicated that those persons working more than standard full-time hours were less satisfied than those who were working 35–40 h. This is consistent with satisfaction with working hours acting as a mediator in the relationship between working hours and mental health.

In conclusion, working longer than standard full-time hours is associated with a decline in mental health. Long working

hours appeared to have a particularly detrimental effect on women, and those working in higher occupational skill levels. These findings are relevant for workplace policy and prevention, acknowledging that the results of this study need to be considered in combination with estimates of the impact of sustained long working hours. Future work in this area should focus on workplace-level interventions that target working hours to examine the impact of these changes on employee mental health. This type of research would provide stronger evidence on the causal direction between working hours and mental health, as well as provide employers with practical solutions and strategies to reduce working hours.

Acknowledgements This paper uses unit record data from the Household, Income and Labour Dynamics in Australia Survey. The HILDA Project was initiated and is funded by the Australian Government Department of Social Services and is managed by the Melbourne Institute of Applied Economic and Social Research (Melbourne Institute). The findings and views reported in this paper, however, are those of the author and should not be attributed to either DSS or the Melbourne Institute. The data used in this paper was extracted using the Add-On Package PanelWhiz for Stata. PanelWhiz (http://www.PanelWhiz.eu) was written by Dr John P Haisken-DeNew (john@PanelWhiz.eu).

Contributors AM conceived the article, downloaded data, conducted analysis, retrieved all bibliography and wrote the initial draft. ADL and PS contributed to the conception and design of the initial design and contributed to the drafting. All authors made substantial contributions to the final draft.

Funding This work was supported by the Australian National Health and Medical Research Council (NHMRC) through both project grant (#375196) and postdoctoral research fellowship support to AM through an NHMRC Capacity-Building grant (#546248). This study also received centre grant funding grant (#15732) from the Victorian Health Promotion Foundation Melbourne, Victoria (Australia). PS is supported by a Research Chair in Gender, Work and Health from the Canadian Institute of Health Research. The funding sources had no involvement in the study design; collection, analysis and interpretation data; the writing of the report; or in the decision to submit the paper for publication.

Competing interests None declared.

Ethics approval Australian Government Department of Social Services.

Provenance and peer review Not commissioned; externally peer reviewed.

Data sharing statement This paper uses unit record data from the Household, Income and Labour Dynamics in Australia (HILDA) Survey. The HILDA project was initiated and is funded by the Australian Government Department of Social Services (DSS), and is managed by the Melbourne Institute of Applied Economic and Social Research (Melbourne Institute). Data is available upon request from the Melbourne Institute of Applied Economic and Social Research (Melbourne Institute).

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Supplementary Table 1. Fixed effect regression model regarding working hours in main job (annually) on scores of the SF 36 MCS subscales, the HILDA study, 2001 to 2012, multivariate results

		Coef	95 % CI	p value
Vitality				
Usual hours	35 to 40 hours	1		
Worked	34 or under	0.29	-0.06, 0.63	0.101
	41-48	-0.37	-0.69, -0.05	0.023
	49-59	-1.54	-1.92, -1.17	<0.001
	60 over	-2.31	-2.86, -1.76	<0.001
Mental health				
Usual hours	35 to 40 hours	1		
Worked	34 or under	-0.16	-0.45, 0.14	0.309
	41-48	-0.05	-0.33. 0.24	0.752
	49-59	-0.63	-0.97, -0.29	<0.001
	60 over	-0.52	-0.98, -0.05	0.029
Social-Functioning				
Usual hours	35 to 40 hours	1		
Worked	34 or under	-0.52	-0.94, -0.10	0.015
	41-48	0.32	-0.07, 0.71	0.111
	49-59	0.06	-0.39, 0.51	0.788
	60 over	0.52	-0.14, 1.18	0.119
Role-Emotional				
Usual hours	35 to 40 hours	1		
Worked	34 or under	-1.26	-1.88, -0.64	<0.001
	41-48	0.14	-0.44, 0.72	0.636
	49-59	-0.16	-0.85, 0.53	0.646
	60 over	0.53	-0.43, 1.5	0.278

Notes: 95% CI= 95% upper and lower confidence intervals, P value= significance value. Adjusted for household weekly income, age, household structure, presence of a long term health condition, and employment full or part time.