Humanities & Social Sciences Communications

ARTICLE

https://doi.org/10.1057/s41599-022-01410-2 OPEN

Work intensity and workers' sleep: A case of working Australians

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Experiencing poor sleep quality affects an individual's health and wellbeing. Sleep quality is well evidenced to be influenced by work conditions such as long work hours, work stress and shift work, but there is little evidence on the relationship between high work intensity and sleep quality. Using data from the Household, Income and Labour Dynamics in Australia (HILDA) survey waves 2013 and 2017, this study applies lagged models to investigate whether experiencing poor sleep, a derived comprehensive measure of sleep quality, is associated with work intensity. This study uses a nationally representative sample of 13,661 working Australian individuals aged 25–64 and finds a strong positive association between work intensity and sleep quality, with an individual's sleep quality worsening as their work intensity increased. The association between work intensity and sleep quality is even stronger than that between long work hours and sleep quality. This suggests a potential benefit for the development and implementation of workplace policies that seek to reduce work intensity. Doing so could help address challenges surrounding sleep in Australia and lead to better work and health outcomes for individuals, workplaces and broader society.

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Introduction

More than half of the Australian adult population experiences at least one sleep condition that affects their ability to live healthy lives (Reynolds et al., 2019). Sleep quality not only affects an individual's health, but also has far broader impacts affecting workplaces, productivity and the Australian population. It is estimated that poor sleep accounts for 3.2% of Australia's total burden of disease and costs the economy US$35.4 billion per year (Streatfeild et al., 2021).

Sleep quality is influenced by working conditions, particularly long work hours and shift work. Working very long hours, generally considered more than 60 h per week in Australia (ABS, 2021), is associated with both reduced sleep duration and quality (Virtanen et al., 2009; Nakashima et al., 2011; Kim and Lee, 2015). Shift workers and workers with high workloads and job stress are more likely to experience disturbed sleep (Akerstedt et al., 2002a; Akerstedt et al., 2002b; Deng et al., 2020).

Only 56.4% of Australians over the age of 15 consider themselves to be in excellent or very good health (ABS, 2018). While sleep can directly impact wellbeing, sleep has also been linked with many common health conditions (Bjorvatn et al., 2007; Cho et al., 2013; Miyata et al. 2013; Moraes et al., 2013; Rahe et al., 2015). Poor sleep affects a large portion of the Australian population. In a study of more than 2000 Australian adults, 59.4% reported experiencing at least one symptom of poor quality sleep at least three times a week, with findings remaining consistent by age and gender. Despite this, only 30% of respondents had discussed sleep with a healthcare professional in the past year (Reynolds et al., 2019). Further, Medicare Benefit Scheme (MBS) data shows that 0.67% of Australian adults claimed a Medicare diagnostic sleep disorder (AIHW, 2021). Evidently, while many Australians experience poor sleep quality, few seek professional consultancy or treatment.

Long work hours, work stress, and shift work in relation to health more generally and also sleep quality have been extensively researched (Härmä et al., 2018; Nakashima et al., 2011; Virtanen et al., 2009; Kim and Lee, 2015), however, there is little evidence on the association between work intensity and sleep quality. Long weekly working hours are associated with shortened hours of sleep and difficulty falling asleep (Virtanen et al., 2009; Nakashima et al., 2011; Kim and Lee, 2015). Workers with long work hours report having less time for sleep or that they are too tired resulting in them taking longer to mentally unwind before bedtime (Meijman et al., 1992; Sluiter, 1999). Although work hours are integral to understanding the relationship between working conditions and sleep quality and are related to work intensity (Piasna, 2018), the number of hours worked does not necessarily reflect work intensity. As such, for the purposes of this study, work hours will be considered as a possible confounder and controlled for.

Shift work has been linked to sleep quality and sleep duration with workers on night shift are more likely to experience disturbed sleep (Deng et al., 2020; Akerstedt et al., 2002a; Akerstedt et al., 2002b). Evening and early morning shift work are also associated with difficulties in falling asleep (Härmä et al., 2018). Poor sleep quality may be attributed to disruptions to normal circadian rhythm in shift workers (James et al., 2017). Interestingly, some evidence from shift workers suggests shift work was associated with feelings of fatigue and sleepiness rather than poor sleep quality which was associated with high work intensity (Härmä et al., 2018; Kalimo et al., 2000). Consequently, studies investigating working conditions more generally may benefit from considering shift work as a confounding to be controlled for in analyses.

Working conditions such as high work demands, workload, job strain and job stress affect sleep quality (Kalimo et al., 2000; Akerstedt et al., 2002a; De Lange et al., 2009; Cropley et al., 2006 Lallukka et al., 2010). Often, these characteristics manifest into the notion that there is too much to do with an onus on working quickly to achieve all work requirements resulting in high work intensity. However, there is little evidence on the association between work intensity and sleep quality with initial research suggesting that there may be a reciprocal relationship between work intensity and sleep (Van Laethem et al., 2015).

Sleep quality is an important aspect of Australia's population health research, noting more than half of the adult population suffers from poor quality sleep (Reynolds et al., 2019). Given the paucity of evidence examining work intensity and sleep quality, not only will our research deepen our understanding of how working conditions impact the Australian population but may contribute to the design and implementation of policies and regulations targeting the improvement individuals' and the populations health, and the Australian economy. From a workplace perspective, developing this knowledge would lead to increased productivity and staff retention. For example, policies that aim to improve working conditions such as reducing workload, work intensity, time pressure and long hours are likely to benefit promote better sleep quality, influencing vitality, mental health and generally health and ultimately increase productivity (Doan et al., 2022; Gillet et al., 2020). From a health perspective, this research is needed to urgently address a health condition that impacts wellbeing of a large proportion of the population in Australia. As there are a wide array of negative health and economic impacts associated with poor sleep, it is important to further understand factors that may influence the sleep quality.

Research hypotheses. This paper aims to investigate the relationship between high work intensity and sleep quality in order to provide information for the design and implementation of better workplace policies and ultimately improve sleep quality for individuals. This is tested by modelling the association between work intensity and sleep quality. It is hypothesised that individuals who work under higher work intensity conditions are more likely to experience poorer sleep quality.

Data and methods

Data and variables

Data and sample. This study uses data from the Household, Income and Labour Dynamics in Australia (HILDA) Survey, a nationally representative study initiated in 2001. The HILDA collects data on health, employment and family circumstances from more than 17,000 Australians annually. Further information on the survey design can be found in the HILDA User Manual located on the University of Melbourne webpage: https://melbourneinstitute.unimelb.edu.au/hilda/.

Four waves were included in the analysis, waves 2013 and 2017 as they were the only waves collecting sleep data, and waves 2012 and 2016 for time-lagging models. Data were restricted to employed people aged 25 to 64 years with complete data for our variables. Continuous variables (sleep hours and work hours) were top coded to remove extreme outliers. The final sample size includes 13,661 observations.

Measures of sleep quality. Good quality sleep includes sufficient sleep duration (between 7 and 9 h per night for adults), falling asleep without difficulty and experiencing no sleep disturbances (Hirshkowitz et al., 2015). Sleep quality outcomes can vary depending on the use of subjective or self-rated measures of more objective measures such as number of hours slept (Bassett et al., 2015) with this difference potentially explained by variation in an

individual's own perception of what is sufficient or other difficult. For example, Nakata (2011) found that obtaining less than 6 h of sleep per night or experiencing subjectively insufficient sleep in combination with long work hours, was associated with higher incidences of depression. In this instance, individuals who, by standard definition, slept enough hours per night but considered their sleep to be inadequate experienced the same negative impacts as those who objectively did not sleep enough. Consequently, our sleep measure combines both subjective sleep ratings and objective measure of sleep hours to better capture sleep quality.

The HILDA survey collected a range of self-reported sleep measures including "During the past month, how often have you had trouble sleeping because you cannot get to sleep within 30 min" and "how often have you taken medicine to help you sleep during the past month" with possible responses of (1) Not during the past month; (2) Less than once a week; (3) Once or twice a week; (4) Three or four times a week; (5) Five or more times a week. Participants were also asked "How would you rate your sleep quality overall in the past month" with response options of (1) Very good; (2) Fairly good; (3) Fairly bad; (4) Very bad. A constructed sleep hour variable "hours of sleep per week" incorporating data on work schedules and hours of sleep on workdays, non-workdays, weekends and naps were also reported in HILDA. As both sleep hours and sleep distribution contribute to sleep quality (Virtanen et al., 2009), we combined these variables using the Principal Component Analysis (PCA) method to create a unique sleep quality measure, our main study outcome. The sleep quality variable constructed using the PCA method has some negative values (negative minimum value of −2.04), therefore, for ease of interpretation, 2.04 was added to the existing sleep variable in a linear scale to convert negative values to positive (Table 1). Before constructing a unique measure of sleep quality, the Cronbach's Alpha was used to compute the scale reliability coefficient. The estimated scale reliability coefficient was greater than the universally used criterion of 0.70 (Lance et al., 2006).

Measures of work intensity. Work intensity is defined as the pace of activity at work in relation to one's capacity (time availability, skills, work experience and health) to complete the work (Cecile and Palmer-Jones, 1998). Work intensity may have many aspects including multitasking, time poverty or time pressure, health implications. Multitasking is the overlap of many activities at a time. Time poverty or time pressure can be defined as the lack of time to carry out the work comfortably (Bardasi and Wodon, 2010). Multitasking and time pressure may impact negatively health outcomes (Cecile and Palmer-Jones, 1998), reversely given the same amount of workload, workers with poorer health may need more time to complete their work, potentially resulting in greater time pressure and higher work intensity (Doan et al., 2021).

Participants were asked their agreement (one being strongly disagree and seven being strongly agree) on a number of self-reported work-related questions including: I have to work fast in my job, I have to work very intensely in my job and I don't have enough time to do everything in my job. These questions are about work pace, time pressure and workload, which affect physical fatigue/exhaustion after the working day, which then affect sleep hours and sleep quality. These three variables were used to construct a unique 'work intensity' variable using the Principal Component Analysis (PCA) method. The Cronbach's alpha statistic for the scale reliability coefficient (internal consistency) is 0.73. This coefficient is greater than the universally used criterion of 0.70 (Lance et al., 2006). The constructed score of work intensity used in our study is highly correlated with all of

Table 1 Descriptive statistics of sample for working individuals aged 25–64 years, pooled data of HILDA 2013 and 2017.

Variable	Mean	Std. Dev.	Min	Max
Sleep quality	1.94	1.29	0.005	6.64
Sleep hours (weekly)	49.01	7.81	6	84
Overall sleep rating	100%			
[1] Very good	17.47	37.97		
[2] Fairly good	57.40	49.45		
[3] Fairly bad	21.70	41.22		
[4] Very bad	3.42	18.16		
Had difficulty falling asleep within 30 min	100%			
[1] Not during the past month	36.49	48.14		
[2] Less than once a week	26.81	44.30		
[3] Once or twice a week	20.26	40.20		
[4] Three or four times a week	9.48	29.30		
[5] Five or more times a week	6.93	25.40		
Had taken medicine to help sleep	100%			
[1] Not during the past month	87.79	32.74		
[2] Less than once a week	5.15	22.11		
[3] Once or twice a week	3.32	17.92		
[4] Three or four times a week	1.32	11.45		
[5] Five or more times a week	2.41	15.32		
Work intensity	4.02	1.41	0.007	6.451
Age	42.34	10.91	25	64
Sex	0.53	0.50	0	1
Highest education level achieved	100%			
[1] Postgraduate - masters or doctorates	9.74	29.65		
[2] Graduate diplomas, graduate certificates	7.76	26.77		
[3] Bachelor or Honours	21.84	41.32		
[4] Advanced diplomas, diplomas	10.97	31.26		
[5] Cert III or IV	23.82	42.60		
[6] Year 12	12.29	32.84		
[7] Year 11 and below	13.54	34.22		
Marital status	100%			
[1] Married or de facto	73.56	44.10		
[2] Separated, divorced or widowed	9.62	29.49		
[3] Never married and not de facto	16.81	37.39		
Ethnic background	100%			
[1] Australian, not of Indigenous origin	66.47	47.21		
[2] Aboriginal or Torres Strait Islander Australian	1.69	12.89		
[3] Other English speaking country	11.24	31.59		
[4] Non-English speaking country	20.58	40.43		
Has a long-term health condition (0 = no, 1=yes)	0.18	0.38	0	1
Has a child under the age of 6 years (0 = no, 1 = yes)	0.17	0.38	0	1
Financial hardship index	0.53	1.41	0.07	13.20
Unpaid time	20.45	20.15	0	80
Works shift work (0 = regular daytime, 1 = shift work)	0.20	0.40	0	1
Work hours (weekly)	38.29	12.75	1	80
Employment contract type	100%			
[1] Employed on fixed-term contract	10.67	30.88		
[2] Employed on a casual basis	14.27	34.98		
[3] Employed on a permanent or ongoing basis	75.04	43.27		
Occupation type	100%			
[1] Managers	14.44	35.15		
[2] Professionals	28.25	45.02		

Table 1 (continued)

Variable	Mean	Std. Dev.	Min	Max
[3] Technicians and trades workers	11.24	31.59		
[4] Community and personal service work	11.37	31.75		
[5] Clerical and administrative workers	14.59	35.30		
[6] Sales workers	5.33	22.47		
[7] Machinery operators and drivers	6.80	25.18		
[8] Labourers	7.94	27.03		
Drinking status	100%			
[1] Never drink	8.52	27.91		
[2] Very rarely/ no longer	28.76	45.26		
[3] Moderate drinker	53.94	49.84		
[4] Heavy drinker	8.77	28.28		
Smoking status	100%			
[1] Never smoke	56.22	49.61		
[2] Past smoker	27.00	44.40		
[3] Current smoker	16.77	37.36		
Physical activity level	100%			
[1] Sedentary	26.14	43.94		
[2] Low	40.19	49.03		
[3] Moderate	22.31	41.63		
[4] High	11.34	31.70		

these three components used to constructed work intensity, ranging from 73 to 88%.

Covariates. As previously discussed, range of variables may have confounding effects on sleep quality. As such, the following variables, divided into four groups, were controlled for as a part of the statistical modelling strategy: individual characteristics (age, sex, ethnicity, marital status, Australian State or Territory, education and existing long-term health conditions), household characteristics (financial hardship, having young children under 6 years of age and time spent engaging in unpaid work), work characteristics (hours per week spent working, work schedule or work shift, employment contract type and occupation) and lifestyle characteristics (alcohol consumption, tobacco use including cigarettes and other tobacco products, and frequency of physical activity participation).

Time-lagged variables. One of our models is time-lagged model. One-year lagged independent variables were created for work intensity, work hours, alcohol consumption status, physical activity level and smoking status to adjust for possible reciprocal relationships between sleep quality and these factors in the regression models.

Analysis models. The Ordinary Least Squares (OLS) regression was used for the derived continuous sleep quality variable (range 0.005 to 6.64; mean of 1.94 (see Table 1)). Our study model is based on evidence from the existing literature on the association between working conditions and sleep (Åkerstedt et al., 2002a; Åkerstedt et al., 2002b; De Lange et al., 2009; Virtanen et al., 2009; Nakashima et al., 2011; Hwang et al., 2019; Deng et al., 2020). Accordingly, the model for predicting sleep quality includes individual and household characteristics, socio-economic characteristics, work attributes (excluding our key variable of interest - work intensity) and lifestyle such as smoking, alcohol drink and physical exercise. We also adjust for location and time effect in the models. Firstly, the OLS regression was run with minimal controls. This included the dependent variable (sleep quality) and the independent variable of interest (work intensity), as well as year dummy variables and Australian States or Territory dummy variables (Table 2, column 1). Potential confounding variables were then included in the second OLS regression (Table 2, column 2). The third regression was similar to the model in column 2 but time-lagged variables (work intensity, work hours, alcohol drinking status, physical activity level and smoking status) likely to be affected by worker's sleep quality, were used to avoid reverse relationship (Table 2, column 3).[1] This approach enabled us to move closer to a causal relationship estimate rather than a simple association typically reported in studies investigating working conditions and sleep.

Results

Table 1 shows the descriptive statistics for the sample used in the current analysis. The mean of the aggregated sleep quality variable was 1.94, where the minimum is 0.005 and the maximum is 6.64, with sleep quality worsening as the score increased. About a quarter of workers in Australia rated their sleep quality as bad or very bad, 37% had trouble falling asleep at least once per week and about 12% needed to take medicine to help sleep. The average hours of sleep per week was 49 h or around 7 h per night. The mean of the derived work intensity variable was 4.026 with a minimum of 0.0075 and a maximum of 6.451, with work intensity increasing with the score.

Sleep quality was found to be significantly associated with work intensity in all three regression models. The basic OLS model estimate (Table 2, column 1) shows that an increase by one unit (range of 0.0075 to 6.4511) for work intensity leads to a statistically significant increase of 0.0837 points (or 8.37%) in score of sleep quality (range of 0.005 to 6.64 with a higher score indicative of worse sleep quality) implying that higher work intensity adversely affects sleep quality (worsening).

When adjusting further for a full set of individual, household, work and lifestyle characteristics in column 2 (Table 2), it produced similar results to the basic model, with the work intensity coefficient increasing slightly to 0.0935. Table 2 also includes the results for a range of possible confounding variables, as expected, these were found to be significantly associated with sleep quality. For example, an individual was more likely to experience poorer sleep quality if they were a woman, divorced or separated, of Aboriginal or Torres Strait Islander descent, have long-term health conditions, have a lower education level, have young children, are experiencing financial hardship, have non-standard work shifts, smoke and are less physically active. The results of the lagged model in Table 2, column 3 also show very consistent results with previous models (the effect is 7.95% for one unit increase in work intensity).

Discussion

This study examined the relationship between work intensity and sleep quality and found poorer sleep quality to be associated with higher work intensity (higher score of work intensity), indicating that if workers face higher workload and/or time pressure at work conditions, their sleep quality decreases (poorer sleep quality). These results were consistent in all regression models, with adjustments for covariates and time-lagged variables not resulting in substantial changes to the findings. In the final time-lagged model, each unit increase in work intensity resulted in a decrease in sleep quality scores of around 8%.

There is a large translation gap between developing knowledge about impacts of work intensity on sleep, staff retention and increased productivity. Workplace policies aiming at improving working conditions such as reducing workload, time pressure, and long hours can help improve sleep quality, health and

Table 2 Work intensity and sleep quality relationship, the OLS estimates.

Variable	Basic OLS (1)	Full OLS (2)	Lagged OLS (3)
Work intensity	0.0837***	0.0935***	
Work intensity (lag)			0.0795***
Sex (male = 1/female=0)		−0.0973***	−0.0571*
Age		0.0283***	0.0242**
Age-squared		−0.0003***	−0.0003**
Education Level (reference: Postgraduate degree)			
[2] Graduate diploma, graduate certificate		0.0732	0.0719
[3] Bachelor or Honours		0.0882*	0.0773
[4] Adv diploma, diploma		0.1908***	0.1628***
[5] Cert III or IV		0.2505***	0.2067***
[6] Year 12		0.1795***	0.1495**
[7] Year 11 and below		0.3590***	0.3312***
Marital status (reference: Married or De facto)			
[2] Separated, divorced or widowed		0.1210***	0.1313***
[3] Never married and not de facto		0.1697***	0.1579***
Ethnicity (reference: non-Indigenous Australian)			
[2] Aboriginal or Torres Strait Islander Australian		0.2890***	0.3473***
[3] Other English speaking country		−0.0531	−0.0308
[4] Non-English speaking country		−0.1238***	−0.1262***
Has a long-term health condition (yes = 1)		0.4529***	0.4141***
Has a child under age of 6 (yes = 1)		0.1114***	0.0967***
Financial hardship		0.0772***	0.0773***
Unpaid work time		0.0038***	0.0040***
Works shift work (non-standard shift = 1)		0.2073***	0.2033***
Work hours		0.0037***	
Work hours (lag)			0.0032***
Employment contract (reference: employed on a fixed-term contract)			
[2] Employed on a casual basis		−0.0250	−0.0234
[3] Employed on a permanent or ongoing		−0.0120	−0.0211
Occupation (reference: managers)			
[2] Professionals		0.0033	0.0064
[3] Technicians and trades workers		−0.0688	−0.0523
[4] Community and personal service work		0.0133	0.0173
[5] Clerical and administrative workers		−0.0168	−0.0105
[6] Sales workers		0.0626	0.0554
[7] Machinery operators and drivers		−0.0264	−0.0747
[8] Labourers		−0.0263	−0.0236
Drinking status (reference: never drink)			
[2] Very rarely/ no longer		0.1033*	
[3] Moderate drinker]		−0.0134	
[4] Heavy drinker		0.1021	
Drinking status (lag) (reference: never drink)			
[2] Very rarely/ no longer			0.1781***
[3] Moderate drinker]			0.0672
[4] Heavy drinker			0.1189*
Smoking (reference never smoke)			
[1] Past smoker		0.0853***	
[2] Current smoker		0.1937***	
Smoking (lag) (reference: never smoke)			
[1] Past smoker			0.1070***
[2] Current smoker			0.2010***
Physical activity levels (reference: sedentary)			
[1] Low		−0.1162***	
[2] Moderate		−0.1939***	
[3] High		−0.2485***	
Physical activity levels (lag) (reference: sedentary)			
[1] Low			−0.1269***
[2] Moderate			−0.2075***
[3] High			−0.2044***
Observations	13,661	12,071	10,407
R-squared statistics	0.0110	0.0888	0.0785
Prob > F statistics	0.0000	0.0000	0.0000

Note: Significant ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Models further controlled for year and state dummy variables. For succinct, we do not report standard errors in this table.

productivity (Doan et al. 2022; Gibson and Shrader, 2018; Swanson et al., 2011). In addition to individual health impacts, poor sleep has been linked to negative workplace outcomes including loss of productivity, wage loss, absenteeism, presenteeism, injuries, and occupational safety issues (Streatfeild et al., 2021; Swanson et al., 2011; Rosekind et al., 2010; Gibson and Shrader, 2018; Park et al., 2018). Economically, poor sleep has consequences for both individuals and employers. At the individual level, sleeping one additional hour per week has been shown to increase an individual's wage income by 1.1% in the short-term and 5% in the long-term (Gibson and Shrader, 2018). For employers, productivity losses from fatigue and workplace injuries due to workers' sleep deficiency were estimated to cost US $1967 per employee per year in the US (Rosekind et al., 2010). In Australia, productivity losses from sleep-related issues were estimated to cost US$7.7 billion in the 2019–20 financial year (Streatfeild et al., 2021).

Our findings align with the current literature (Akerstedt et al., 2002a; Akerstedt et al., 2002b; Linton, 2004; Ribet and Derriennic, 1999; Kalimo et al., 2000; Hwang and Lee, 2019; Deng et al., 2020). Existing studies on the association of high work intensity and sleep quality are limited in their findings as they mostly utilise one or two binary measures of sleep quality, for example, whether the participant had problems sleeping during a set period of time (yes/no) (Linton, 2004; Akerstedt et al., 2002a; Akerstedt et al., 2002b). However, in the analysis by Ribet and Derriennic (1999), five measures of sleep quality were used to identify sleep disorders categorised by two or more affirmative responses out of the five. Another study (Kalimo et al., 2000) utilised principal component analysis to create dichotomous variables from a multitude of self-reported sleep quality measures. Our study used a similar principal component analysis, combining three measures of sleep quality (overall sleep rating, having trouble sleeping in 30 min, taking medicine to help sleep) and one measure of sleep hours per week to create a unique sleep quality variable. Our measure of sleep quality provides a more comprehensive aspect of sleep.

Many potentially confounding variables (individual, household, work and lifestyle characteristics) included in the regression modelling were found to be significantly associated with sleep quality, including working in shift work, having existing health conditions and number of weekly work hours. These associations were expected and in line with the existing research (Virtanen et al., 2009; Nakashima et al., 2011; Kim and Lee, 2015; Akerstedt et al., 2002a; Deng et al., 2020; Lamond et al., 2000). Notably, working hours were associated with sleep quality only to a small degree, with an increase of 10 work hours resulting in sleep quality worsening by only 3.2%. This suggests that the intensity of the work, rather than the duration/hours of the work, has a greater impact on sleep (8–9%, see Table 2). Sleep hours and sleep quality are also affected by many other factors such as domestic work time, travelling to/from workplace, wage rates, work-family conflict, and environment. Shorter commutes and higher incomes can provide support for longer and better sleep as workers can save time from commuting, afford to live in better environments (e.g., better neighbourhood, housing) and can pay for domestic work activities which impact their time use. These factors should be considered in future study. The sheer number of potentially confounding variables found to be significantly associated with sleep quality highlights the complexity of achieving quality sleep and suggest that it may be affected by a multitude of other factors not included in this study.

Future studies could, when longitudinal data is available, investigate whether there is a causal relationship between work intensity and sleep quality. Future research may also benefit from exploring and seeking to identify protective factors. Our study supports existing research that has found an association between sleep quality and work intensity. Notably, it highlights that there are more avenues for improving sleep quality aside from simply reducing work intensity, workload and time pressure.

Conclusion

Sleep is an important contributor to an individual's health and wellbeing, and experiencing poor quality sleep has widespread impacts for the Australian population. The findings from this study show that working under intense conditions is strongly associated with experiencing poor sleep quality, this effect is even stronger than the effect of working long hours. The development and implementation of workplace policies that seek to reduce work intensity could help address challenges surrounding sleep in Australia and promote better work and health outcomes for individuals, workplaces and broader society.

Data availability

The dataset used in the current study is not publicly available, but it would be accessible from the Melbourne Institute if an access approval is granted by the institute. Codes used in the current study can be available upon request.

Received: 30 August 2022; Accepted: 10 October 2022;
Published online: 20 October 2022

Note

1 Codes would be available upon request.

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Acknowledgements

This study utilised data collected as part of the Household, Income and Labour Dynamics in Australia (HILDA) survey. The HILDA survey is designed and managed by the University of Melbourne Melbourne Institute and funded by the Australian Government Department of Social Services.

Author contributions

SL carried out literature review, data work, and drafted up the paper. Lyndall advised on ideas, paper structure and editing. TD helped with developing ideas, data work, modelling, and interpreting regression estimates, editing and revising.

Competing interests

The authors declare no competing interests.

Ethical approval

The research ethic protocol was approved by the Australian National University Human Research Ethics Committee.

Informed consent

This study used the secondary data from the HILDA survey which was conducted and managed by the Melbourne Institute. The authors were granted an access to the dataset, and the Informed Consent was deemed not necessary for the current study.

Additional information

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