BMJ Open

Poor psychosocial job conditions increase sickness absence: evidence from the PATH Through Life Mid-Aged Cohort

Liana Leach ,[1] Allison Milner,[2] Lay San Too,[2,3] Peter Butterworth[1]

To cite: Leach L, Milner A, Too LS, *et al*. Poor psychosocial job conditions increase sickness absence: evidence from the PATH Through Life Mid-Aged Cohort. *BMJ Open* 2022;**12**:e059572. doi:10.1136/bmjopen-2021-059572

► Prepublication history and additional supplemental material for this paper are available online. To view these files, please visit the journal online (http://dx.doi.org/10.1136/bmjopen-2021-059572).

LL and AM are joint first authors.

Received 07 December 2021
Accepted 08 September 2022

[1]National Centre for Epidemiology and Population Health, Australian National University, Canberra, Australian Capital Territory, Australia
[2]Melbourne School of Population and Global Health, The University of Melbourne, Melbourne, Victoria, Australia
[3]School of Population Health and Global Health, The University of Melbourne, Melbourne, Victoria, Australia

Correspondence to
Dr Liana Leach;
liana.leach@anu.edu.au

ABSTRACT

Objectives Evidence is mounting that poor psychosocial job conditions increase sickness absence, but there is a need for further rigorous prospective research to isolate the influence of psychosocial job quality from other measured and unmeasured confounders. This study used four waves of prospective longitudinal data (spanning 12 years) to investigate the extent to which increases in poor psychosocial job quality are associated with greater relative risk of day of sickness absence.

Design Prospective cohort study.

Setting Data were from the Australian PATH Through Life cohort study. The analyses adopted hybrid-regression estimations that isolated the effect of within-person change in psychosocial job quality on sickness absence over time.

Participants Participants were from a midlife cohort aged 40–44 at baseline (7644 observations from 2221 participants).

Primary outcome measure Days sickness absence in the past 4 weeks.

Results The results show that after adjusting for a wide range of factors as well as unmeasured between-person differences in job quality, each additional psychosocial job adversity was associated with a 12% increase in the number of days of sickness absence (relative risk ratio: 1.12, 95% CI 1.03 to 1.21). Increases in psychosocial job adversity were also related to greater functional impairment (relative risk ratio: 1.17 (1.05 to 1.30)).

Conclusion The results of this study strengthen existing research highlighting the importance of addressing poor psychosocial job quality as a risk factor for sickness absence.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ Findings are based on robust longitudinal cohort data (spanning 12 years) with the original sample randomly selected from the population.
⇒ Adjustments are made for a wide variety of personal, health and demographic predictors of sickness absence, including variables rarely controlled for in prior research (ie, early life adversities and personality characteristics).
⇒ The main weakness of this study is potential lack of generalisability due to the restricted geographical area from which the sample was recruited (in a city with a preponderance of more highly educated professionals and public servants) and the narrow midlife cohort (aged 40–44 at baseline).
⇒ It is also important to note that both exposures and outcomes are self-reported and, thus, may be subjected to residual reporting bias.

INTRODUCTION

Absence from work due to sickness is an important issue in public health. Previous studies have noted that sickness absence is predictive of chronic health conditions[1 2] and mortality[1 2] as well as exit from the workforce.[3] The broader economic and social costs associated with sickness absence are substantial, running into the tens of billions of dollars for many countries.[4 5] From a population health perspective, identifying the causes of sickness absence that are amenable to intervention is critical—to reduce both sickness absence and the subsequent adverse health-related consequences.

We know that the causes of sickness absence are complex and inter-related, including factors connected to the nature of the illness, the industry a person is employed in, gender[6] and income.[7] Given a broad range of factors contribute, there is still debate about the extent to which work-related environmental influences, and, in particular, *psychosocial job stressors* (such as low levels of job control, high job demands, and job insecurity), contribute to sickness absence.[4 8–11] A 2012 longitudinal study based on the British Birth Cohort[9] recommended a 'life course' perspective, arguing the importance of taking childhood disadvantage, education, coping styles and personality into consideration. The study concludes by stating that 'a greater understanding of the ways in which occupational risk factors interact with individual vulnerabilities across the life-course is required' (p.1).

Building upon this 2012 cohort study, several other longitudinal studies have sought to investigate the contribution of psychosocial job quality to sickness absence while

controlling for a broad range of possible influences. For example, Wang *et al* analysed data from the Norwegian Hordaland Health Study and found that job strain was associated with long-term sickness absence (>16 days per year) 1 year later after adjusting for education, income, Body Mass Index (BMI), physical and mental health and health-related behaviours[12]; however, this research did not adjust for early life adversities or personality characteristics. In addition, no information was included about how psychosocial job quality might influence number of days of sickness absence (only a binary indicator of long sickness absence was included). This information is important as individual and organisational costs vary based on the length of sickness absence.[3 13 14] Other longitudinal research conducted in Australia by Milner *et al* included a measure of days of sickness absence in the past 12 months and found that exposure to three or more psychosocial job adversities was associated with an 11% increase in days of sick leave.[11] However, this research made no adjustment for early life adversities or personality characteristics.

The current study also examines psychosocial job conditions and sick leave in the Australian context—adopting an outcome measure of days of sickness absence over a brief 4-week period. Australia has a different system from most European countries (where much of the research on psychosocial job conditions and health originates). In Australia, paid sick leave is provided by employers rather than being government funded/supported and sick leave is accrued over time with an employer (in general, 10 days accrue per year for full-time workers and prorata for part-time workers).[15] While the pool of available sick leave days accumulates with time with the same employer, if an employee changes employer, they lose all their pre-existing sick leave entitlement. If employees do exhaust all of their accrued sick leave days, they can use other leave or may be able to take unpaid leave. In addition, employers can ask employees to provide evidence (eg, medical certificate from a health professional) for as little as 1 day or less off work. For further context, around 20% of Australian workers are employed on a casual basis and usually have no paid leave entitlements.[16]

This system affects the amount of paid sick leave Australian workers have and how sickness absences are taken (as also explained in Lallukka *et al*).[17] The average frequency and duration of sick leave in Australia are likely lower than in many European countries, although exact figures are unknown as there are no national administrative records on sickness absences in Australia. The current study adopts an outcome measure of days of sickness absence over a brief 4-week period. While this is a short reference period compared with others used in the existing literature, it reflects the lower levels of leave taken in the context of the Australian system.

The current study uses four waves of Australian cohort data (spanning 12 years) to examine increases in psychosocial job adversity in association with increased days of sickness absence. The analyses uniquely control for influences across the life course, from childhood adversities to proximal adverse life events, as well as personality and health-related conditions. In addition, hybrid analyses isolate and adjust for unmeasured differences in psychosocial job quality between individuals. By controlling for a wide range of confounders, and removing the influence of unmeasured differences between individuals (ie, accounting for person-related predisposition for reporting psychosocial job stressors), we increase confidence in testing for a causal association between psychosocial job quality and sickness absence. To complement days of sickness absence as an outcome, we also examine the effect on functional impairment—defined as impairment at work due to physical/mental health problems. Supplementary analyses were also conducted using the outcomes—(a) any sickness absence (no days vs 1 or more days) and (b) longer sickness absence (up to and including 4 days vs 5 days or more (representing at least 1 working week)).

METHODS

Sample

Participants were from the PATH Through Life Project, a prospective community survey that commenced at the Australian National University (ANU) in 1999 and has been jointly hosted by the ANU and the University of New South Wales since 2019. The survey focuses on individual health and well-being trajectories across the life course and the sample includes three cohorts (young, midlife and older adults) randomly selected from the Australian Electoral Rolls of Australian Capital Territory and neighbouring Queanbeyan.[18] The current study was restricted to the midlife cohort who were assessed every 4 years from wave 1 in 2000/2001 to wave 4 in 2012/2013. The participation rate of this cohort at baseline was 65% (2530 participants). Of those who participated at baseline, 93% completed the survey at wave 2, 86% at wave 3 and 71% at wave 4 (figure 1). For the first three waves, participants were usually assessed in their own home or at the ANU. They were invited to complete a questionnaire using a laptop computer under the supervision of a trained interviewer. For the fourth wave, participants were invited to complete an online version of the questionnaire. All participants provided informed consent to participate at each wave of the study.

We excluded observations from participants when they were: (1) not employed, (2) not in the labour force, (3) employed but on long-term leave or (4) had missing data on employment status in each wave (figure 1). We also excluded participants with less than two waves of data.

Patient and public involvement

The PATH study is a general population study and was formed based on pilot testing in Canberra community. There has been a regular feedback process for participants to engage with the study development and findings. PATH has long-standing ties to the Canberra community,

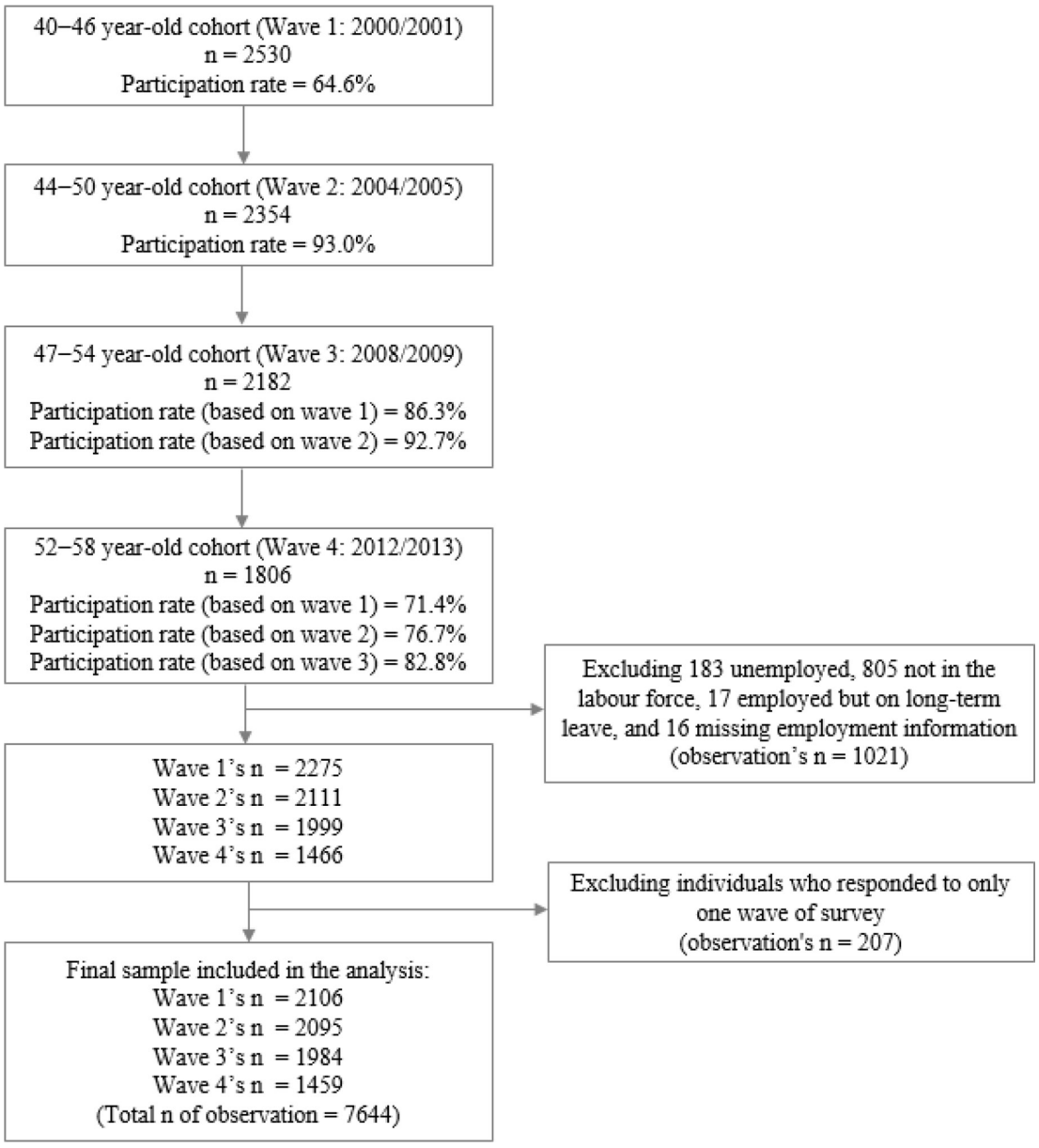

Figure 1 Study profile.

with the data forming the basis of several local government reports as well as regular engagement with both local and national stakeholders.

Measures

Outcome variables—days sickness absence and functional impairment

'Days of sickness absence' was generated based on two items: 'In the last 4 weeks, have you stayed away from your work (or school or place of study) for more than half a day because of any illness or injury that you had?' and 'How many days in the last 4 weeks have you stayed away from your work (or school, or place of study)?' The first item offered two response categories ('yes' and 'no'). Those who responded 'no' to the first item were classified as having zero day of sickness absence. These two questions were combined to generate the number of days of sickness absence in a 4-week period. Two binary measures were also included in supplementary analyses—(a) any sickness absence ('0'=no days vs '1'=1 or more days) and (b) longer sickness absence ('0'=≤4 days vs '1'=≥5 days (representing at least 1 working week)).

'Functional impairment' (secondary outcome) was generated based on four questions from the Short-Form Health Survey[19] that asked whether participants had problems with work or regular daily activities over the past 4 weeks due to their physical or mental health. Respondents were asked whether they: (a) accomplished less than you would like as a result of your physical health? (b) were limited in the kind of work or other activities undertook as a result of your physical health? (c) accomplished less than you would like as a result of any emotional problems? (d) did not do work or other activities as carefully as usual as a result of any emotional problems? Participants who reported 'yes' to any of these items were classified

as having functional impairment due to physical/mental health problems while those who indicated 'no' to all items were classified as not having functional impairment.

Exposure variable—psychosocial job quality

Three aspects of job quality were used to calculate a composite measure of exposure to poor job quality—job control, job demands and job insecurity. Job control and job demands were assessed using 19 items taken from the Whitehall II study.[20] Fifteen items assessed job control and four assessed job demands. These items offered four response categories: '3-often', '2-sometimes', '1-rarely' and '0-never'. Following the methodology used in previous studies,[21 22] average total scores for job control and job demands were calculated and these scores were then dichotomised to identify the top 30% of respondents with the greatest job adversity (ie, low job control, high job demands). One item: 'How secure do you feel about your job or career future in your current workplace?' (responses: 'not at all secure', 'moderately secure', 'secure', 'extremely secure') was used to assess job insecurity. Individuals who selected either of the first two responses were classified as having '1' high job insecurity while all else were classified as '0' low job insecurity.

As in our previous research,[23 24] we used a composite indicator approach to generate an estimate of overall psychosocial job adversity based on the sum of the three individual indicators (ie, low control, high demands and high job insecurity), providing a count of adversities between 0 and 3. In the analyses, this job quality score was separated into two variables to represent both the within-person variability over time and between-person averaged differences. To do this, a variable representing within-person variability was calculated by subtracting the composite job quality score at each wave from the mean score across all waves (ie, a change or deviation score was calculated at each wave). The (time-invariant) mean score for overall job quality across all waves was used to estimate between-person differences. This process of separating within and between-person components is known as 'demeaning'. Further details are provided in the Statistical Analysis section below.

Potential confounders

We adjusted for a range of variables that potentially confound the association of days of sickness absence from work with psychosocial job quality.[12 25] These variables included time-invariant stable influences from baseline (ie, gender, education, childhood adversity, neuroticism) and time-varying measures from each wave that might covary with changes in psychosocial job quality and sickness absence in the short term (ie, partner status, occupational skill level, parental responsibilities, non-work life events, financial hardship, smoking status, alcohol consumption, physical exercise, chronic physical health conditions and common mental disorders).

Educational attainment was grouped as' incompleted high school', 'completed high school' and 'completed tertiary study'. Partner status included two categories: 'no partner' and 'partnered' (ie, currently married or living with a partner). Occupational skill level consisted of three categories: 'high' (managers/administrators/professionals); 'medium' (associate professionals/tradespersons/advanced clerical and service workers) and 'low' (intermediate production and transport workers/elementary clerical, sales and service workers/labourers). Parental responsibilities were coded based on having a youngest child aged under 15 years. Financial hardship was derived from the item: 'Have you or your family had to go without things you really needed in the last year because you were short of money?'. Respondents were considered to have financial hardship if they responded 'yes, often' or 'yes, sometimes'.

For childhood adversity, participants were asked about childhood experiences up to the age of 16 years and were categorised as having childhood adversity if they responded 'yes' to any of eight items (taken from the Parental Bonding Instrument,[26] the British National Survey of Health and Development,[27] the US National Comorbidity Survey[28] or an open-ended question).[29] These items covered neglect, authoritarian upbringing, witnessing physical/sexual abuse as well as verbal abuse, psychological abuse, physical abuse, physical punishment, and sexual abuse by a parent.

Adverse life events were measured using an extended version of the List of Threatening Experiences Questionnaire.[30] Analyses included nine items about non-work adverse events in the past 6 months: serious illness/injury/assault, death of a close family member or friend, relationship separation, serious problems within close relationships, financial crisis, legal problems and loss of something valuable. The number of life events were summed and divided into three categories: none, one, or two or more events.

Smoking status was grouped into never/past smoker and current smoker. Hazardous/harmful alcohol consumption[31] was derived from the Alcohol Use Disorders Identification Test[32] and classified into 'yes' and 'no'. The hours respondents engaged in moderate or vigorous physical exercise per week were assessed by items from the Whitehall II study[33] and categorised into five groups (0, <1.5, 1.5–3, 3.1– 5.5, > 5.5 hours). A variety of chronic physical health conditions such as heart problems, hypertension, cancer, arthritis, thyroid problems, epilepsy, asthma, diabetes, and stroke were coded as a summary variable representing the experience of none, one or two or more of these conditions.

Depression and anxiety were assessed using the Goldberg Anxiety and Depression scales.[34] Each scale comprises nine binary items ('yes' or 'no'); total scale score 0–9. Binary scores representing likely depression and generalised anxiety disorder diagnosis were calculated based on validated cut-points assessed against diagnosis from a structured diagnostic interview (ie ≥5 on the depression scale and ≥7 on the anxiety scale).[35] A binary measure of common mental disorder at wave 4 was then

Table 1 Sample characteristics at baseline (n=2106)

Sample characteristic	n	%
Sex		
Male	1052	49.9
Female	1054	50.1
Partner status		
No partner	414	19.7
Having a partner	1692	80.3
Education completion		
Incomplete high school	561	26.6
Completion of high school	695	33.0
Completion of tertiary study	850	40.4
Occupational skill level		
High	1122	53.3
Medium	564	26.8
Low	420	19.9
Parental responsibilities		
No	720	34.2
Yes	1386	65.8
Childhood adversities		
No	1476	70.1
Yes	622	29.5
Unknown	8	0.4
Financial hardship		
No	1620	76.9
Yes	482	22.9
Unknown	4	0.2
Smoking status		
Never/past smoker	1729	82.1
Current smoker	377	17.9
Hazardous/harmful alcohol consumption		
No	1978	93.9
Yes	128	6.1
Moderate/vigorous physical exercise (hours spent in the last week)		
0	406	19.3
<1.5	444	21.1
1.5–3.0	357	17.0
3.1–5.5	514	24.4
>5.5	385	18.3
Average hours spent in the last week (mean, SD)	3.58	5.95
Number of chronic physical health conditions		
0	1195	56.7
1	704	33.4
≥ 2	207	9.8
Number of adverse non-work life events		
0	1072	50.9
1	617	29.3
≥ 2	417	19.8
Depression/anxiety		
No	1563	74.2
Yes	532	25.3
Unknown	11	0.5
Neuroticism (mean, SD)	3.91	3.17

generated based on the presence of a likely depressive and/or anxiety disorder.

Neuroticism (the tendency to experience negative emotion) was included as a covariate as this personality trait may influence self-reported job quality and sickness absence/functional impairment and thus inflate the observed association. The measure of neuroticism was from the Eysenck Personality Questionnaire,[36] and the scale total was categorised into quintiles.

Statistical analysis

The association between job quality and days of sickness absence was assessed using a longitudinal random-intercept negative binomial regression model with two levels, where occasion clustered within individuals. There was overdispersion in the sickness absence variable and hence a negative binomial distribution was chosen. This model fitted a fixed (average) regression slope for the number of sickness absence days over time while permitting the intercept to vary (to reflect the different initial number of sickness absence days for individuals). Coefficients were transformed into relative risks (RRs). To assess the association between job quality and functional impairment (a binary variable), we used a longitudinal random-intercept logistic regression model. Coefficients were transformed into ORs. A final series of supplementary analyses also used longitudinal regression models to test the associations between: (a) job quality and any sickness absence (0 days vs 1 or more days) and (b) job quality and a longer period of sickness absence (≤4 days vs ≥5 days). Further supplementary analyses also included psychosocial job quality as a categorical variable to confirm a dose–response relationship with days of sickness absence (whereby each additional job adversity is associated with an increase in the number of sickness absence days taken).

In all models (sickness absence and functional impairment), associations with job quality were examined with hybrid-regression estimations that differentiated between-individual and within-individual associations. The hybrid model is an extension of a random effects model with demeaning,[37] in which both the person mean values of the exposure (capturing the between-individual effect) and the person deviation scores from their mean (capturing the

within-individual effect) are included as regressors.[38] The between-person association compared the risk of sickness absence between different individuals based on their average level of job quality over time. The within-person association compared the risk of sickness absence across individuals' own changing levels of psychosocial job quality by controlling for all time-invariant factors, both observable and unobservable.[37]

In all models, an initial simple model included the original/raw measure of job quality (range 0–3). The following model then separated the within-person (ie, deviation score) and between-person (ie, average score) components of the job quality measure. Relevant covariates across the lifecourse were then entered into subsequent models. Model 3 included sociodemographic covariates (some assessed at baseline and other more proximal factors assessed at wave 3), childhood adversity and recent non-work adverse life events, followed by health-related covariates (smoking status, alcohol consumption, exercise and chronic health conditions) (model 4), depression/anxiety (model 5) and neuroticism (model 6).

The proportion of observations with missing data on all variables was low, ranging from 0% to 1.5%. Our analyses were based on observations with no missing data (complete analyses). All analyses were conducted using StataSE V.14.[39]

RESULTS

Descriptive characteristics at baseline (aged 40–44) are shown in table 1. There was an equal split of men and women. The majority of the sample had completed a tertiary degree (40.4%), were working in high-skilled occupations (53.3%) and had parental responsibilities (65.8%). Data on the key exposure and outcome are seen in table 2. Across all waves, 41.7% of participants reported exposure to one job stressor, and close to 80% reported exposure to one job stressor across any wave. The overall mean of job quality was 0.87 (SD=0.81). Across all waves, 8.4% of people reported taking 1 day and 13.8% reported taking 2 or more days of sickness absence in a 4-week period. In any wave, 24.6% reported 1 day of sickness absence in a 4-week period, and 35.4% reported an average of 2 or more days in a 4-week period. The mean of sickness absence days was 0.77 (SD=2.61). Functional impairment was reported in 31.7% of people across all waves (up to 89.5% across any wave of data). Univariate tests of association showed that the physical and mental health variables (ie, number of chronic health conditions, anxiety and/or depression, functional impairment) were all significantly associated with days of sickness absence ($p<0.001$).

Table 3 shows the findings for the association between job quality and sickness absence over time for the original/raw measure of job quality as well as the separated within-person (ie, deviation score) and between-person (ie, average score) components. Model 1 shows that each additional job adversity is associated with a 23% increase in the number of days of sickness absence (RR 1.23, 95% CI 1.16 to 1.31). Model 2 shows that this represents both within-person change in the number of job adversities experienced (RR 1.17, 95% CI 1.08 to 1.27) and averaged differences in job quality between people (RR 1.31, 95% CI 1.20 to 1.43). When adjusting

Table 2 Descriptive statistics on exposures and outcome at each wave

	All waves (n=7644)	Wave 1 (n=2106)	Wave 2 (n=2095)	Wave 3 (n=1984)	Wave 4 (n=1459)	Any wave* (persons=2221)
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Job quality (number of job adversities)						
0	2834 (37.1)	683 (32.4)	825 (39.4)	785 (39.6)	541 (37.1)	1464 (65.9)
1	3190 (41.7)	892 (42.4)	863 (41.2)	833 (42.0)	602 (41.3)	1717 (77.3)
2	1357 (17.8)	436 (20.7)	351 (16.8)	313 (15.8)	257 (17.6)	931 (41.9)
3	242 (3.2)	95 (4.5)	52 (2.5)	51 (2.6)	44 (3.0)	205 (9.2)
Unknown	21 (0.3)	0	4 (0.2)	2 (0.1)	15 (1.0)	21 (1.0)
Number of days of sickness absence						
0	5916 (77.4)	1616 (76.7)	1647 (78.6)	1502 (75.7)	1151 (78.9)	2133 (96.0)
1	643 (8.4)	185 (8.8)	171 (8.2)	183 (9.2)	104 (7.1)	546 (24.6)
2+	1052 (13.8)	305 (14.5)	267 (12.7)	294 (14.8)	186 (12.8)	787 (35.4)
Unknown	33 (0.4)	0	10 (0.5)	5 (0.3)	18 (1.2)	33 (1.5)
Functional impairment						
No	5211 (68.2)	1421 (67.5)	1435 (68.5)	1343 (67.7)	1012 (69.4)	1325 (59.7)
Yes	2424 (31.7)	685 (32.5)	655 (31.3)	641 (32.3)	443 (30.4)	1988 (89.5)
Unknown	9 (0.1)	0	5 (0.2)	0	4 (0.3)	9 (0.4)

*% sum for each variable is more than 100% because individuals can be included in multiple categories.

Table 3 Relative risk and 95% CIs from longitudinal random-intercept negative binomial regression models assessing the relationship between psychosocial job quality and the number of days of sickness absence

	Model 1 (adjusted for time only)	Model 2 (within-person and between-person terms)	Model 3 (adding socio-demographic covariates, childhood adversity and non-work events)	Model 4 (adding health covariates)	Model 5 (adding depression/ anxiety)	Model 6 (adding neuroticism)
Original job quality score (0–3)[a]	1.23 (1.16 to 1.31)***					
Job quality deviation score		1.17 (1.08 to 1.27)***	1.15 (1.06 to 1.25)**	1.15 (1.06 to 1.25)**	1.12 (1.03 to 1.21)**	1.12 (1.03 to 1.21)**
Average job quality across waves		1.31 (1.20 to 1.43)***	1.21 (1.10 to 1.32)***	1.19 (1.09 to 1.30)***	1.06 (0.97 to 1.17)	1.04 (0.95 to 1.14)
Sex						
Male (ref.)			1.00	1.00	1.00	1.00
Female			1.28 (1.14 to 1.42)***	1.24 (1.11 to 1.39)***	1.22 (1.09 to 1.36)***	1.21 (1.08 to 1.35)**
Partner						
Having a partner (ref.)			1.00	1.00	1.00	1.00
No partner			1.30 (1.15 to 1.46)***	1.29 (1.14 to 1.46)***	1.27 (1.13 to 1.44)***	1.26 (1.12 to 1.42)***
Education completion						
Incomplete high school (ref.)			1.00	1.00	1.00	1.00
Completion of high school			0.99 (0.86 to 1.14)	1.00 (0.87 to 1.15)	1.01 (0.88 to 1.16)	1.01 (0.88 to 1.16)
Completion of tertiary study			0.98 (0.84 to 1.14)	1.00 (0.86 to 1.17)	1.04 (0.89 to 1.21)	1.04 (0.89 to 1.21)
Occupational skill level						
High (ref.)			1.00	1.00	1.00	1.00
Medium			1.03 (0.91 to 1.17)	1.03 (0.91 to 1.17)	1.02 (0.89 to 1.16)	1.01 (0.89 to 1.15)
Low			0.89 (0.76 to 1.04)	0.89 (0.76 to 1.04)	0.91 (0.78 to 1.07)	0.91 (0.78 to 1.06)
Parental responsibilities						
No (ref.)			1.00	1.00	1.00	1.00
Yes			1.02 (0.91 to 1.15)	1.03 (0.91 to 1.15)	1.02 (0.91 to 1.15)	1.02 (0.91 to 1.15)
Financial hardship						
No (ref.)			1.00	1.00	1.00	1.00
Yes			1.13 (1.00 to 1.29)	1.12 (0.99 to 1.28)	1.04 (0.92 to 1.19)	1.04 (0.92 to 1.19)*
Childhood adversity (wave 1)						
No (ref)			1.00	1.00	1.00	1.00
Yes			1.32 (1.18 to 1.47)***	1.31 (1.17 to 1.46)***	1.25 (1.12 to 1.40)***	1.24 (1.11 to 1.38)***
Adverse non-work life events						
0 (ref.)			1.00	1.00	1.00	1.00
1			1.10 (0.98 to 1.24)	1.09 (0.97 to 1.23)	1.07 (0.95 to 1.20)	1.06 (0.95 to 1.19)
≥2			1.47 (1.29 to 1.67)***	1.45 (1.27 to 1.65)***	1.34 (1.18 to 1.52)***	1.33 (1.17 to 1.52)***
Smoking status						
Never/past smoker (ref.)				1.00	1.00	1.00

Continued

Table 3 Continued

	Model 1 (adjusted for time only)	Model 2 (within-person and between-person terms)	Model 3 (adding socio-demographic covariates, childhood adversity and non-work events)	Model 4 (adding health covariates)	Model 5 (adding depression/ anxiety)	Model 6 (adding neuroticism)
Current smoker				1.02 (0.88 to 1.18)	1.00 (0.86 to 1.15)	1.00 (0.86 to 1.16)
Alcohol consumption						
No (ref.)				1.00	1.00	1.00
Yes				0.96 (0.79 to 1.17)	0.95 (0.78 to 1.15)	0.94 (0.78 to 1.14)
Moderate/vigorous physical exercise						
0 (ref.)				1.00	1.00	1.00
<1.5				1.03 (0.88 to 1.20)	1.04 (0.89 to 1.22)	1.06 (0.90 to 1.23)
1.5–3.0				1.10 (0.94 to 1.30)	1.10 (0.94 to 1.30)	1.12 (0.95 to 1.31)
3.1–5.5				0.93 (0.80 to 1.09)	0.96 (0.82 to 1.12)	0.97 (0.83 to 1.13)
>5.5				0.83 (0.70 to 0.98)*	0.87 (0.74 to 1.03)	0.88 (0.74 to 1.04)
Number of chronic physical health conditions						
0 (ref.)				1.00	1.00	1.00
1				1.02 (0.91 to 1.14)	1.00 (0.89 to 1.12)	1.00 (0.89 to 1.12)
≥ 2				1.35 (1.17 to 1.55)***	1.29 (1.13 to 1.48)***	1.29 (1.12 to 1.48)***
Depression/anxiety						
No (ref.)					1.00	1.00
Yes					1.92 (1.71 to 2.15)***	1.83 (1.62 to 2.06)***
Neuroticism						
0 (Low) (ref.)						1.00
1						1.08 (0.89 to 1.31)
2						1.08 (0.86 to 1.36)
3						1.09 (0.89 to 1.32)
4 (High)						1.26 (1.03 to 1.55)*
Survey wave						
1 (ref)	1.00	1.00	1.00	1.00	1.00	1.00
2	0.91 (0.80 to 1.03)	0.90 (0.79 to 1.03)	0.91 (0.80 to 1.04)	0.90 (0.79 to 1.03)	0.92 (0.81 to 1.05)	0.92 (0.81 to 1.05)
3	1.08 (0.96 to 1.23)	1.07 (0.95 to 1.22)	1.08 (0.94 to 1.23)	1.04 (0.91 to 1.19)	1.06 (0.92 to 1.21)	1.06 (0.92 to 1.21)
4	0.89 (0.77 to 1.02)	0.88 (0.76 to 1.02)	0.92 (0.78 to 1.08)	0.87 (0.74 to 1.02)	0.89 (0.76 to 1.05)	0.89 (0.75 to 1.05)

*p<0.05; **p<0.01; ***p<0.001. [a]Number of psychosocial job adversities.

for sociodemographic factors, adverse life events, health behaviours and other unmeasured between-person differences in model 4, the results show that each additional experience of job adversity is associated with a 15% increase in the number of days of sickness absence. In the final model also adjusting for depression, anxiety and neuroticism, there continues to be a 12% increase in days of sickness absence attributable to each additional exposure to poor-quality work.

Results for functional outcomes are seen in table 4. These results reflect a similar pattern of results to those displayed in table 3. Model 1 shows that each additional job adversity (combining variation both within and between people) is associated with a 60% increase in the odds of functional impairment (OR 1.60, 95% CI 1.47 to 1.74). Model 2 shows that this represents both within-person change in the number of adversities experienced (OR 1.30, 95% CI 1.17 to 1.43) and averaged differences in job quality between people (OR 2.50, 95% CI 2.15 to 2.90). In the final model (6) adjusting for all covariates, each additional job adversity continues to be associated with a 17% increase in the odds of functional impairment.

Supplementary analyses (see online supplemental tables S1–S3) adopted different operationalisations of the key sickness absence and job quality variables to explore the robustness of the findings.

Online supplemental tables S1,S2 show that after adjusting for all covariates, each additional exposure to poor quality work was associated with a 14% increase in the odds of taking any sickness absence within the last 4-week period and a 33% increase in the odds of taking sickness absence of at least 5 days. The final supplementary analyses (online supplemental table S3) included the psychosocial job quality measure as a categorical variable. The increase in the coefficients with each additional job adversity provides support for a dose–response relationship, whereby each additional job adversity is associated with an increase in the number of sickness absence days taken.

DISCUSSION

This study found that when the number of psychosocial job adversities people experienced increased this change was accompanied by significantly greater sickness absence. This was found to be the case after controlling for childhood adversity, a range of individual health and personality variables, sociodemographic factors and job characteristics. This suggests the importance of not only person-related factors in the frequency of sickness absence but also job-related factors. Results for functional outcomes are similar, indicating that there are comparable mechanisms explaining both sickness absence and functional health problems. Given that sickness absence generally indicates poor health, and that our findings were replicated with functional impairment and in supplementary analyses, our findings can be interpreted as an indication that poor psychosocial job conditions impact adversely on health. However, we also note that there continues to be a within-person association after we control for mental health and chronic health conditions, suggesting there are also other motivations for taking time off from work in the context of psychosocial adversities at work—such as potentially using sick leave as a coping mechanism or preventative health behaviour.[40]

The current results align with other studies finding that job strain[41] and low decision latitude[9] are predictors of sickness absence, including previous longitudinal research that has specifically examined changes in working conditions in association with changes in sickness absence.[11 42] For example, research from the British Whitehall II study (2006) compared groups who did and did not change their psychosocial job conditions (across two follow-up periods) and controlled for sex, age, occupational status, baseline health, alcohol, smoking and BMI.[43] The results showed that decreased decision latitude, increased job demands and decreased social support all predicted a greater risk of sickness absence (both short spells ≤7 days and long spells >7 days). More recently, Milner *et al* used longitudinal fixed effects models to show that increases in psychosocial adversities were associated with increases in days of sickness absence over 12 months[11]. This latter study controlled for time-varying factors including age, household structure and income, job permanency, occupational skill level, educational attainment and presence of a long-term health condition or disability.

Expanding on prior research, the hybrid model in the current study allowed us to control for a broader range of both time-varying and time-invariant predictors across the lifecourse and to examine the influence of both time-varying and time-invariant components of psychosocial job quality. The results predicting days of sickness absence within a 4-week period showed that while between-person comparisons of average levels of job quality were associated with sickness absence in the initial models, it was *within-person* change in job quality that remained uniquely associated in the final fully adjusted model. These within-person specific results add strength to the argument that job quality is an independent causal predictor of sickness absence.[10 43]

Limitations and strengths

The limitations of this paper include the restricted geographical area from which the sample was recruited—the cities of Canberra and Queanbeyan, in Australia. As Canberra is a city that includes many professionals and public servants, (baseline sample comprised of 53% professionals),[18] the findings may not be generalisable to samples taken from more disadvantaged communities. Second, as the study only included data from the path midlife cohort (aged 40–44 at baseline), the results may differ in other age groups. We reduced the likelihood of dependent misclassification by controlling for person-specific factors that could influence both sickness absence and reporting of psychosocial job stressors. In saying this, it is important to note that both exposures and outcomes

Table 4 ORs and 95% CIs from longitudinal random-intercept logistic regression models assessing the relationship between psychosocial job quality and functional impairment

	Model 1 (adjusted for time only)	Model 2 (within-person and between-person terms)	Model 3 (adding socio-demographic covariates, childhood adversity and non-work events)	Model 4 (adding health covariates)	Model 5 (adding depression/ anxiety)	Model 6 (adding neuroticism)
Original job quality score (0–3)[a]	1.60 (1.47 to 1.74)***					
Job quality deviation score		1.30 (1.17 to 1.43)***	1.27 (1.15 to 1.41)***	1.28 (1.15 to 1.42)***	1.16 (1.05 to 1.30)**	1.17 (1.05 to 1.30)**
Average job quality across waves		2.50 (2.15 to 2.90)***	2.16 (1.87 to 2.49)***	2.14 (1.86 to 2.47)***	1.49 (1.30 to 1.71)***	1.34 (1.17 to 1.54)***
Sex						
Male (ref.)			1.00	1.00	1.00	1.00
Female			1.21 (1.02 to 1.43)*	1.17 (0.99 to 1.39)	1.11 (0.95 to 1.30)	1.05 (0.90 to 1.24)
Partner						
Having a partner			1.00	1.00	1.00	1.00
No partner			1.26 (1.05 to 1.51)*	1.26 (1.05 to 1.51)*	1.26 (1.05 to 1.50)*	1.23 (1.03 to 1.47)*
Education completion						
Incomplete high school (ref.)			1.00	1.00	1.00	1.00
Completion of high school			0.97 (0.78 to 1.21)	0.98 (0.79 to 1.22)	1.01 (0.82 to 1.24)	1.00 (0.81 to 1.23)
Completion of tertiary study			1.21 (0.96 to 1.53)	1.27 (1.01 to 1.61)*	1.39 (1.12 to 1.74)**	1.38 (1.10 to 1.72)**
Occupational skill level						
High (ref.)			1.00	1.00	1.00	1.00
Medium			1.06 (0.89 to 1.27)	1.06 (0.89 to 1.26)	1.03 (0.87 to 1.23)	1.02 (0.86 to 1.21)
Low			0.75 (0.60 to 0.94)*	0.73 (0.59 to 0.91)**	0.78 (0.63 to 0.97)*	0.78 (0.62 to 0.97)*
Parental responsibilities						
No (ref.)			1.00	1.00	1.00	1.00
Yes			0.80 (0.68 to 0.94)**	0.82 (0.70 to 0.96)*	0.82 (0.70 to 0.96)*	0.81 (0.69 to 0.95)***
Financial hardship						
No (ref.)			1.00	1.00	1.00	1.00
Yes			1.92 (1.61 to 2.29)***	1.91 (1.60 to 2.28)***	1.59 (1.33 to 1.90)***	1.60 (1.34 to 1.91)***
Childhood adversity (wave 1)						
No (ref)			1.00	1.00	1.00	1.00
Yes			1.81 (1.51 to 2.17)***	1.78 (1.49 to 2.13)***	1.54 (1.30 to 1.82)***	1.47 (1.24 to 1.74)***
Adverse non-work life events						
0 (ref.)			1.00	1.00	1.00	1.00
1			1.35 (1.17 to 1.57)***	1.33 (1.15 to 1.54)***	1.25 (1.08 to 1.45)**	1.24 (1.07 to 1.44)**
≥2			2.11 (1.77 to 2.51)***	2.07 (1.74 to 2.47)***	1.78 (1.49 to 2.12)***	1.76 (1.48 to 2.11)***
Smoking status						
Never/past smoker (ref.)				1.00	1.00	1.00
Current smoker				0.99 (0.79 to 1.22)	0.89 (0.72 to 1.09)	0.87 (0.71 to 1.08)

Continued

Table 4 Continued

	Model 1 (adjusted for time only)	Model 2 (within-person and between-person terms)	Model 3 (adding socio-demographic covariates, childhood adversity and non-work events)	Model 4 (adding health covariates)	Model 5 (adding depression/ anxiety)	Model 6 (adding neuroticism)
Alcohol consumption						
No (ref.)				1.00	1.00	1.00
Yes				1.19 (0.91 to 1.55)	1.17 (0.90 to 1.52)	1.13 (0.87 to 1.47)
Moderate/vigorous physical exercise						
0 (ref.)				1.00	1.00	1.00
<1.5				0.97 (0.79 to 1.20)	1.01 (0.81 to 1.25)	1.03 (0.83 to 1.27)
1.5–3.0				1.15 (0.92 to 1.43)	1.16 (0.92 to 1.45)	1.21 (0.97 to 1.51)
3.1–5.5				0.80 (0.65 to 0.99)*	0.87 (0.71 to 1.07)	0.90 (0.73 to 1.11)
>5.5				0.75 (0.59 to 0.93)*	0.83 (0.66 to 1.04)	0.86 (0.69 to 1.08)
Number of chronic physical health conditions						
0 (ref.)				1.00	1.00	1.00
1				1.27 (1.09 to 1.48)**	1.21 (1.04 to 1.41)*	1.22 (1.04 to 1.42)*
≥ 2				1.63 (1.33 to 1.99)***	1.53 (1.25 to 1.87)***	1.53 (1.25 to 1.87)***
Depression/anxiety						
No (ref.)					1.00	1.00
Yes					7.75 (6.57 to 9.14)***	6.68 (5.63 to 7.92)***
Neuroticism						
0 (low) (ref.)						1.00
1						1.24 (0.94 to 1.63)
2						1.54 (1.11 to 2.12)**
3						1.82 (1.38 to 2.40)***
4 (high)						2.32 (1.72 to 3.11)***
Survey wave						
1 (ref.·)	1.00	1.00	1.00	1.00	1.00	1.00
2	0.99 (0.85 to 1.16)	0.96 (0.82 to 1.12)	0.95 (0.81 to 1.11)	0.94 (0.80 to 1.10)	1.01 (0.85 to 1.19)	1.00 (0.85 to 1.18)
3	1.08 (0.92 to 1.26)	1.04 (0.88 to 1.21)	0.98 (0.82 to 1.16)	0.92 (0.77 to 1.09)	0.97 (0.81 to 1.16)	0.97 (0.81 to 1.16)
4	0.96 (0.80 to 1.15)	0.94 (0.79 to 1.12)	0.88 (0.72 to 1.08)	0.79 (0.64 to 0.98)*	0.85 (0.69 to 1.05)	0.83 (0.67 to 1.03)

*p<0.05; **p<0.01; ***p<0.001. [a]Number of psychosocial job adversities.

are self-reported and may still be subject to residual reporting bias. Finally, while the 4-week reference period for days of sickness absence is a briefer outcome than is commonly used in this area of research, it is appropriate for the Australian context (and the results were replicated using a binary measure of ≥5 day's sickness absence in supplementary analyses).

Important study strengths include the longitudinal design (which facilitated the hybrid modelling), and the adjustment for a wide variety of personal, health and demographic predictors of sickness absence, including variables rarely controlled for in prior research (ie, early life adversities and personality characteristics). In terms of outcomes, our study adds information on number of days of sickness absence (rather than a binary outcome only) and replicates the results with functional impairment. A final strength is that PATH has a relatively large sample size that has been randomly selected from the population.

CONCLUSION

The results of this study suggest that increases in psychosocial job adversity (ie, high job demands, low job control and job insecurity) are accompanied by increases in sickness absence, and that this effect is not explained by differences or changes in other sociodemographic factors, physical or mental health status, childhood or recent adverse life events or personality. The findings highlight the importance of addressing poor job quality as a risk factor for sickness absence.

Acknowledgements The authors thank the study participants and the PATH project team. We would also like to acknowledge the contribution of Anthony Jorm, Helen Christensen, Bryan Rodgers, Simon Easteal, Kaarin Anstey, Andrew Mackinnon and Nic Cherbuin as Chief Investigators on funding supporting Waves 1–4 of the 40s cohort of PATH. We would also like to acknowledge the substantial contribution our colleague and co-author Allison Milner made to the field of occupational epidemiology.

Contributors PB oversaw the study and contributed the key job quality measures to the PATH study. LL and AM wrote the first draft of the manuscript and LL wrote revised versions. LST performed the statistical analyses and all authors (LST, PB, AM and LL) interpreted the findings. All authors revised the draft and LL, LST and PB contributed to the final version of manuscript. We would like to note that AM passed away in 2019. Although she has not approved the final submitted version of the paper, the paper closely aligns with the original drafts AM contributed to. LL is the guarantor for this article and accepts full responsibility for the finished work.

Funding The PATH Through Life Study was funded by the National Health and Medical Research Council (973302, 179805, 418139, 1156849), and the Australian Government Agency—Safe Work Australia (Grant# N/A). It is currently managed by both the ANU and the University of New South Wales. LST was supported by a National Health and Medical Research Council Early Career Fellowship (GNT1156849). PB was supported by ARC Future Fellowship (FT130101444) and a University of Melbourne Faculty of Medicine, Dentistry and Health Sciences Research Fellowship.

Competing interests None declared.

Patient and public involvement Patients and/or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research. Refer to the Methods section for further details.

Patient consent for publication Not applicable.

Ethics approval The PATH Through Life Project was approved by the Australian National University Human Research Ethics Committee: #M9807; #2002/190; #2006/314 and #2010/542. Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data may be obtained from a third party and are not publicly available. The PATH dataset may be obtained from a third party and are not publicly available. It is not possible to gain access to the de-identified data without developing a genuine, scientifically-based collaboration with a PATH investigator. The PATH investigators welcome research that complements the aims of the PATH study and optimises the use of the data, please contact us (info@pathstudy.org.au) to discuss your research proposal. For further information about the study see http://www.pathstudy.org.au/

ORCID iD

Liana Leach http://orcid.org/0000-0003-3686-2553

REFERENCES

1 Kivimäki M, Head J, Ferrie JE, *et al*. Sickness absence as a prognostic marker for common chronic conditions: analysis of mortality in the GAZEL study. *Occup Environ Med* 2008;65:820–6.
2 Kivimäki M, Head J, Ferrie JE, *et al*. Sickness absence as a global measure of health: evidence from mortality in the Whitehall II prospective cohort study. *BMJ* 2003;327:364.
3 Kivimäki M, Forma P, Wikström J, *et al*. Sickness absence as a risk marker of future disability pension: the 10-town study. *J Epidemiol Community Health* 2004;58:710–1.
4 Pekkala J, Blomgren J, Pietiläinen O, *et al*. Occupational class differences in long sickness absence: a register-based study of 2.1 million Finnish women and men in 1996–2013. *Br Med J Open* 2017;7.
5 Whitaker SC. The management of sickness absence. *Occup Environ Med* 2001;58:420–4.
6 Leinonen T, Viikari-Juntura E, Husgafvel-Pursiainen K, *et al*. Cause-specific sickness absence trends by occupational class and industrial sector in the context of recent labour market changes: a Finnish panel data study. *BMJ Open* 2018;8:e019822.
7 Meng L, Robinson KT, Smith ML. Factors associated with sickness absence among employees with chronic conditions. *Occup Med* 2017;67:296–300.
8 Christensen KB, Labriola M, Lund T, *et al*. Explaining the social gradient in long-term sickness absence: a prospective study of Danish employees. *J Epidemiol Community Health* 2008;62:181–3.
9 Henderson M, Clark C, Stansfeld S, *et al*. A lifecourse approach to long-term sickness absence--a cohort study. *PLoS One* 2012;7:e36645.
10 Melchior M, Krieger N, Kawachi I, *et al*. Work factors and occupational class disparities in sickness absence: findings from the GAZEL cohort study. *Am J Public Health* 2005;95:1206–12.
11 Milner A, Butterworth P, Bentley R, *et al*. Sickness absence and psychosocial job quality: an analysis from a longitudinal survey of working Australians, 2005–2012. *Am J Epidemiol* 2015;181:781–8.
12 Wang M-J, Mykletun A, Møyner EI, *et al*. Job strain, health and sickness absence: results from the Hordaland health study. *PLoS One* 2014;9:e96025.
13 Henderson M, Glozier N, Holland EK. Long term sickness absence: is caused by common conditions and needs managing. *Br Med J* 2005;330:802–3.
14 Vahtera J, Pentti J, Kivimäki M. Sickness absence as a predictor of mortality among male and female employees. *J Epidemiol Community Health* 2004;58:321–6.

15 Fair Work Ombudsman. Paid sick & carer's leave. Available: https://www.fairwork.gov.au/leave/sick-and-carers-leave/paid-sick-and-carers-leave?msclkid=cc10a18ccffc11ec9c31d4a8c0443c44 [Accessed 15 May 2022].
16 Laß I, Wooden M. Trends in the prevalence of non-standard employment in Australia. *J Ind Relat* 2020;62:3–32.
17 Lallukka T, Hiilamo A, Wooden M, *et al*. Recurring pain, mental health problems and sick leave in Australia. *SSM - Mental Health* 2021;1:100025.
18 Anstey KJ, Christensen H, Butterworth P, *et al*. Cohort profile: the path through life project. *Int J Epidemiol* 2012;41:951–60.
19 Roelen CAM, Heymans MW, Thun E, *et al*. Predictive value of the SF-12 for sickness absence because of mental, musculoskeletal, and other somatic disorders. *J Occup Environ Med* 2015;57:1113–8.
20 Bosma H, Marmot MG, Hemingway H, *et al*. Low job control and risk of coronary heart disease in Whitehall II (prospective cohort) study. *BMJ* 1997;314:558.
21 Butterworth P, Leach LS, McManus S, *et al*. Common mental disorders, unemployment and psychosocial job quality: is a poor job better than no job at all? *Psychol Med* 2013;43:1763–72.
22 Butterworth P, Leach LS, Rodgers B, *et al*. Psychosocial job adversity and health in Australia: analysis of data from the HILDA survey. *Aust N Z J Public Health* 2011;35:564–71.
23 Butterworth P, Leach LS, Strazdins L, *et al*. The psychosocial quality of work determines whether employment has benefits for mental health: results from a longitudinal national household panel survey. *Occup Environ Med* 2011;68:806–12.
24 Broom DH, D'Souza RM, Strazdins L, *et al*. The lesser evil: bad jobs or unemployment? A survey of mid-aged Australians. *Soc Sci Med* 2006;63:575–86.
25 Milner A, Butterworth P, Bentley R, *et al*. Sickness absence and psychosocial job quality: an analysis from a longitudinal survey of working Australians, 2005-2012. *Am J Epidemiol* 2015;181:781–8.
26 Parker G. Parental characteristics in relation to depressive disorders. *Br J Psychiatry* 1979;134:138–47.
27 Rodgers B. Reported parental behaviour and adult affective symptoms. 1. associations and moderating factors. *Psychol Med* 1996;26:51–61.
28 Kessler RC, Magee WJ. Childhood adversities and adult depression: basic patterns of association in a US national survey. *Psychol Med* 1993;23:679–90.
29 Henderson AS, Jorm AF, Korten AE, *et al*. Symptoms of depression and anxiety during adult life: evidence for a decline in prevalence with age. *Psychol Med* 1998;28:1321–8.
30 Brugha TS, Cragg D. The list of threatening experiences: the reliability and validity of a brief life events questionnaire. *Acta Psychiatr Scand* 1990;82:77–81.
31 National Health and Medical Research Council. *Australian alcohol guidelines: health risks and benefits*. Canberra: Department of Health and Ageing, 2001.
32 Saunders JB, Aasland OG, Babor TF, *et al*. Development of the alcohol use disorders identification test (AUDIT): WHO collaborative project on early detection of persons with harmful alcohol consumption--II. *Addiction* 1993;88:791–804.
33 Marmot MG, Smith GD, Stansfeld S, *et al*. Health inequalities among British civil servants: the Whitehall II study. *Lancet* 1991;337:1387–93.
34 Goldberg D, Bridges K, Duncan-Jones P, *et al*. Detecting anxiety and depression in general medical settings. *BMJ* 1988;297:897–9.
35 Kiely KM, Butterworth P. Validation of four measures of mental health against depression and generalized anxiety in a community based sample. *Psychiatry Res* 2015;225:291–8.
36 Eysenck SBG, Eysenck HJ, Barrett P. A revised version of the psychoticism scale. *Pers Individ Dif* 1985;6:21–9.
37 Allison PD. *Fixed effects regression models*. SAGE publications, 2009.
38 Schunck R, Perales F. Within- and between-cluster effects in generalized linear mixed models: a discussion of approaches and the Xthybrid command. *Stata J* 2017;17:89–115.
39 StataCorp. *Stata statistical software: release 14*. College Station, TX: StataCorp LP, 2015.
40 Allebeck P, Mastekaasa A. Chapter 3. causes of sickness absence: research approaches and explanatory models. *Scand J Public Health* 2004;32:36–43.
41 Wang M-J, Mykletun A, Møyner EI, *et al*. Job strain, health and sickness absence: results from the Hordaland health study. *PLoS One* 2014;9:e96025.
42 Head J, Kivimäki M, Martikainen P, *et al*. Influence of change in psychosocial work characteristics on sickness absence: the Whitehall II study. *J Epidemiol Community Health* 2006;60:55–61.
43 North FM, Syme SL, Feeney A, *et al*. Psychosocial work environment and sickness absence among British civil servants: the Whitehall II study. *Am J Public Health* 1996;86:332–40.