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Impact of fly-in fly-out work on health behaviours and affective states: A daily diary study

Bernard Kwadwo Yeboah Asiamah-Asare[1,2] | **Suzanne Robinson**[1,3] | **Daniel Powell**[2] | **Dominika Kwasnicka**[4,5]

[1]Curtin School of Population Health, Curtin University, Bentley, Western Australia, Australia

[2]Health Psychology, Institute of Applied Health Sciences, University of Aberdeen, Aberdeen, Scotland, UK

[3]Deakin Health Economics, Institute for Health Transformation, Deakin University, Burwood, Victoria, Australia

[4]Faculty of Psychology, SWPS University of Social Sciences and Humanities, Wroclaw, Poland

[5]NHMRC CRE in Digital Technology to Transform Chronic Disease Outcomes, Melbourne School of Population and Global Health, University of Melbourne, Melbourne, Victoria, Australia

Correspondence
Bernard Kwadwo Yeboah Asiamah-Asare, Curtin School of Population Health, Curtin University, Kent Street, Bentley, Western Australia 6102, Australia.
Email: bernard.yeboah-asiamah@postgrad.curtin.edu.au

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Abstract

Our knowledge about the role of fly-in fly-out (FIFO) work-related factors on the well-being of workers across the FIFO work cycle is limited. This study examined the within-person effects of job demand and control on psychological states and health behaviours. The study employed a daily diary design, with 23 FIFO workers in the Australian mining industry completing a daily diary survey for 28 consecutive days across on-shift and off-shift periods. Multilevel analyses showed FIFO workers experienced higher positive affect and enjoyed better sleep quality, but consumed more alcohol, during off-shift days as compared to on-shift days. Within-person variability in daily demand (workload) was associated with higher anxious affect, whereas job control predicted lower anxious and depressed affects, higher positive affect, more alcohol consumption, and more physical activity. The within-person effect of demand on anxious affect was moderated by job control such that those who generally had more control over their jobs had a smaller effect of demand on anxiety than those with less control. Results suggest potentially modifiable aspects of FIFO work—particularly job control—may help alleviate the impact of workload on poorer health behaviours and mood.

KEYWORDS
affect, daily diary, FIFO, health behaviours, job control, job demand

1 | INTRODUCTION

Fly-in fly-out (FIFO), which entails travelling a long distance to work in remote areas and rotating between a continuous specified number of days working at the site and a specified leave period at home, is commonly practised in the natural resources industry, particularly onshore mining and offshore oil and gas (Storey, 2010) in several countries around the world. Workers typically work 12-h day and/or night shifts and could work, for example, 8 or 14 days with a corresponding 6 or 7 days leave period (Parker et al., 2018).

Previous research has explored the impact of FIFO work on the health and well-being of workers (Asare et al., 2021; Parker et al., 2018), with evidence of a higher prevalence of psychological distress and alcohol consumption among FIFO workers than the general Australian population (Parker et al., 2018). Work and leave periods of the FIFO lifestyle are distinct, with diverse conditions and schedules for the FIFO workers as compared to other occupations (Gardner et al., 2018). Such contextual differences warrant consideration in assessing the health of FIFO workers.

Whilst current research tends to compare differences between FIFO workers and other professions/general population, there is little available evidence relating to within-person variations over time (Asare et al., 2021; Asare, Robinson, Kwasnicka, et al., 2022). A small number of within-person design studies have provided some insights into how FIFO workers experience health outcomes over time and by context (Ferguson et al., 2010; Muller et al., 2008; Paech et al., 2014; Rebar et al., 2018). For instance, a study by Rebar et al. (2018) used a daily diary study to establish day-to-day variation in behaviours, including less physical activity, poorer nutrition, poorer sleep quality, and more cigarette smoking on on-shift days, and more alcohol drinking during off-shift days among FIFO workers in Australia (Rebar et al., 2018).

Furthermore, studies examining within-person effects have found FIFO work-related predictors of health that are mainly concentrated on the influence of roster and/or shift patterns of rotation on health issues (e.g., Ferguson et al., 2010; Muller et al., 2008). Studies providing insight into the impact of job demands and resources (JD-R) of FIFO work on the health and well-being of workers are uncommon and used mainly cross-sectional designs (Asare et al., 2021). A recent daily diary study established that on days with higher workloads and emotional demands, there was higher emotional exhaustion (Albrecht & Anglim, 2018). However, the study was limited to on-shift work periods of construction FIFO workers in Australia, and it is known that psychosocial work characteristics may differ between different occupations (Stansfeld et al., 2013). The present research focused on examining the job demand and control determinants of FIFO mining workers' psychological health and behaviours across on-and off-shift periods.

1.1 | The JD-R model and FIFO work

The JD-R model suggests that job-related strains are caused by factors broadly classified as job demands and job resources (Bakker & Demerouti, 2007; Demerouti & Bakker, 2011). Job demands are described as the aspects of work that 'require sustained physical and/or psychological effort or skills and are therefore associated with certain physiological and/or psychological costs' (Bakker & Demerouti, 2007, p. 312). Such aspects of work, including workload, work pressures and emotional demands, are deemed to initiate health impairment processes (Demerouti & Bakker, 2011). On the other hand, job resources are described as the 'aspects of the job that are either functional in achieving work goals, reduced job demands and the associated physiological and psychological costs, or stimulate personal growth, learning, and development' (Bakker & Demerouti, 2007, p. 312).

Examples of job resources include autonomy, job clarity and social support, and are indicated to initiate motivational processes (Demerouti & Bakker, 2011). These two underlying psychological processes directly and interactively influence the health and well-being of workers (Bakker & Demerouti, 2007; Demerouti & Bakker, 2011). According to the JD-R model, excessive job demands will need more effort in attaining job-related goals which lead to exhaustion (or burnout) and health issues (Bakker & Demerouti, 2007). The presence of high job resources nurtures the 'growth, learning and development' of workers or contributes to accomplishing job-related goals and assists workers to cope with the negative impact of job demands (Bakker & Demerouti, 2007). Also, the motivational roles of high job resources are said to help buffer the negative health consequences of high job demands, whereas the availability of low job resources exposes individuals to the negative consequences of high job demands (Bakker & Demerouti, 2007).

Very few studies have employed the JD-R model to explain the impact of FIFO work-related characteristics on the health of FIFO workers (Asare et al., 2021). Studies have highlighted some favourable and unfavourable FIFO work characteristics that are pertinent to the JD-R model. For instance, the emotional demands of dealing with living away from families, loneliness and social isolation, concerns about keeping family and social relationships, and absence from significant family occasions during extended work periods (Gardner et al., 2018; Torkington et al., 2011). The workload inherent within FIFO roles with high demands of compressed rosters, and long shift hours, are indicated as important stressors among FIFO workers (Asare et al., 2021). On the other hand, FIFO workers often earn higher wages relative to similar occupations (Storey, 2001) and, during work periods, are not involved in domestic commitments (Gardner et al., 2018).

1.2 | Affects, health behaviours and JD-R

Work activities and experiences potentially have significant ramifications for people's mental well-being, such as their emotional states, and health-related behaviours on- and off-shift (Ilies et al., 2007). The existing literature demonstrates that workers' experiences of high perceived job stressors (e.g., workload) were related to negative emotions (e.g., Ilies et al., 2007, 2010; Schusterschitz et al., 2018).

Within-persons study designs have also well documented that affects show substantial within-and day-to-day variations (e.g., Röcke et al., 2009) and which can be influenced by job stressors over time (e.g., Ilies et al., 2007, 2010). For instance, daily diary studies have reported that perceived high workload is positively associated with daily variability in negative affect (Ilies et al., 2007). On the other hand, job resources (e.g., job control) are noted to be connected to positive mental well-being (e.g., Nahrgang et al., 2011). Studies have also documented the effect of job demands and job resources on health-related behaviours (e.g., Jones et al., 2007; Nielsen et al., 2018; Radi et al., 2007), including those associated with problematic alcohol use (Nielsen et al., 2018).

1.3 | The present study

We conducted a daily diary study using ecological momentary assessment (EMA) method aimed at examining the within-person variability in short-term health outcomes of FIFO workers over the course of a roster cycle, focusing primarily on within-person fluctuations in job demand and control as determinants. Our first aim was to examine within-person differences in affects and health behaviours between on-shift and off-shift periods. We hypothesized that, during on-shift periods: negative affect would be higher, positive affect would be lower, sleep quality would be poorer, leisure-time physical activity would be lower, fruit and vegetable consumption would be lower, smoking would be higher, and alcohol consumption would be lower. The second aim was to test the JD-R model, and it was hypothesized that, within individuals, higher-than-usual daily demand (workload) would be associated with a higher daily negative affect, and higher-than-usual daily job control would be associated with a higher daily positive affect. It was also hypothesized that higher-than-usual levels of daily demand would be associated with poorer daily health behaviours, whereas high-than-usual levels of daily job control will be associated with better health behaviours. Lastly, it was hypothesized that a moderation effect based on the JD-R model that job control (both typical level and within-person variability) would moderate (attenuate) any relationship between daily demand and affect and behaviour.

2 | METHODS

2.1 | Study design and participants

This was a daily diary study conducted among FIFO workers in the mining industry in Australia. All participants that took part in a larger cross-sectional study of FIFO workers, reported elsewhere (Asare, Robinson, Powell, et al., 2022), were invited to take part in the present study between July and December 2021. All were FIFO mining workers, aged 18 years and above, and work on more than 3 days of on-and off-shift rosters during the study period. Figure 1 outlines the flow of participants into the present study. Of the 216 workers that completed the cross-sectional study (Asare, Robinson, Powell, et al., 2022), 52 (24.1%) agreed to take part in the present study. Of the 52 participants included in the study, 8 (15.4%) could not be reached to schedule the daily surveys, and 21 (%) did not respond to at least three daily diaries in both the on-shift and off-shift phases, which was set as a minimum threshold for data provision for statistical modelling (Figure 1).

A pragmatically-derived final sample of 23 was included in the analysis. Comparable study sample sizes have been demonstrated in previous similar studies (Ferguson et al., 2010; Waage et al., 2012) (for a review see Asare, Robinson, Kwasnicka, et al., 2022). Participants were aged 43.04 (SD = 9.97) years, mostly males (69.6%), worked in maintenance/technician roles (34.8%), for 10.52 (SD = 6.53) years in FIFO roles, and on rotation shift (mix of day and night shift) (56.5%) and regular shift (fixed day) (43.5%) and mostly for 12 h long (78.3%). Participant demographics are reported in Table 1.

2.2 | Procedure

Workers who agreed to take part in the study were directed to online participant information and provided written informed consent and mobile contact numbers in order to schedule daily diary assessments via text message. Participants were contacted by the lead author to introduce the research and schedule the daily diary assessments and discuss instructions on how to complete the assessments. All the daily diary assessments started within 2 days of participants consenting to take part in the study.

Daily web-based surveys, hosted on *Qualtrics*, were administered using an online SMS programme *(MessageMedia)* with the embedded survey link, once per day for 28 consecutive days over on-and off-shift days. The use of daily diary assessments in FIFO work is an emerging approach to understanding within-person variability over time, used in this population (for a review, see Asare, Robinson, Kwasnicka, et al., 2022). The assessments were sent to participants' mobile phones at 16:00 Australian Western Standard Time every evening and were available until 06:00 the following day, for the participants to report their daily experiences and behaviours over the last 24 h. Daily assessment/survey took up to 5 min to complete. Reminder texts were additionally sent: workers received one text message the day before the 28-day protocol with instructions on how to complete the daily assessments, and another text every 3 days to encourage participants to complete their assessment within the allowed time. The completion of daily diaries was monitored remotely by the lead author.

All participants completing multiple days (at least 6 days) of daily assessments were offered an individualized report including infographics summarizing their data provided over the period of data collection, similar to that provided elsewhere (Kwasnicka et al., 2017). The study was approved by the Curtin University Human Research Ethics Committee (reference number: HRE2020-0693).

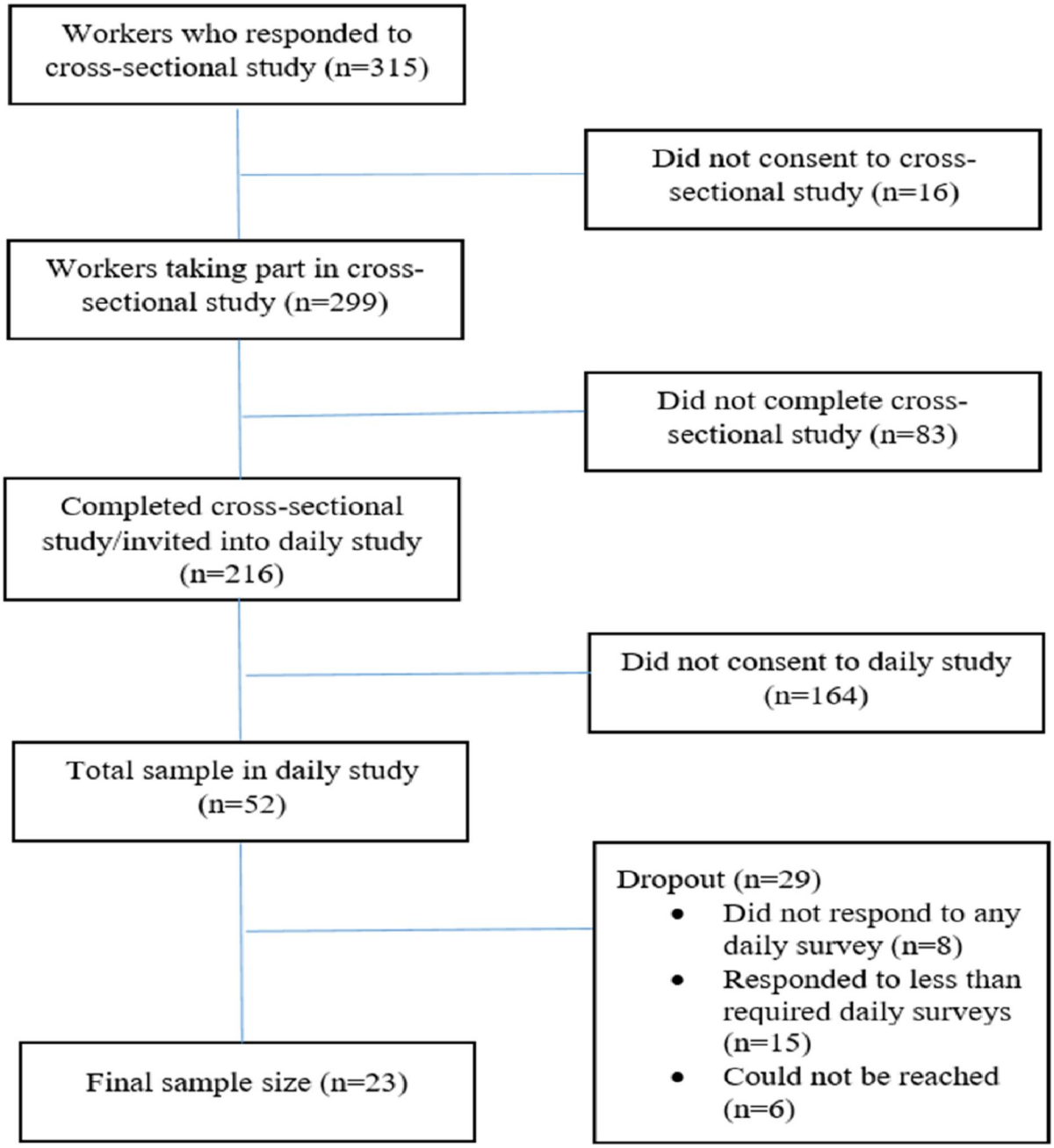

FIGURE 1 Flow of participants into the present study.

2.3 | Measures

Demographic characteristics and baseline health and health-related behaviours were assessed as described elsewhere (Asare, Robinson, Powell, et al., 2022).

2.3.1 | Daily sleep quality

Sleep quality was assessed using an item adapted from the Pittsburgh Sleep Quality Index (Buysse et al., 1989) and reframed to cover a single day: '*Last night, how would you rate your sleep quality overall?*' on the responses 1 = very good to 4 = very poor. The use of a single item as a measure of daily sleep quality is demonstrated to be reliable, readily conceived, and was chosen to limit the burden on participants (Sullivan Bisson et al., 2019).

2.3.2 | Alcohol intake

Daily alcohol intake was assessed using an item adapted from the Alcohol Use Disorders Identification Test-Concise and reframed to cover a single-day timeframe. Each day, participants were asked to report the number of drinks taken over the last 24 h using the item:

TABLE 1 Background characteristics of study participants.

Characteristics	*n* (%)
Age (years)	*M* = 43.04 (SD = 9.97)
Sex	
Male	16 (69.6)
Female	7 (30.4)
Ethnicity	
Caucasian/White	18 (78.3)
Other	5 (21.7)
Marital status	
Married	13 (56.5)
De-facto/co-habiting	6 (26.1)
Single/divorce	4 (17.4)
Have children	
Yes	18 (78.3)
No	5 (21.7)
Educational level	
Secondary education	7 (30.4)
Trade/apprentice	6 (26.1)
TAFE/college/diploma	6 (26.1)
Bachelor/postgraduate degree	4 (17.4)
Years worked in FIFO role	*M* = 10.52 (SD = 6.53)
FIFO role	
Management	3 (13.0)
Professional	3 (13.0)
Maintenance/technician	8 (34.8)
Production/drilling/construction/labourer	5 (21.7)
Machinery operator and driver	4 (17.4)
Shift pattern	
Rotation shift (mix of day and night shift)	13 (56.5)
Regular shift (fixed day)	10 (43.5)
Shift length	
12 h	18 (78.3)
>12 h	5 (21.7)
Consecutive days spent at work	
<8 days	3 (13.0)
8 days	6 (26.1)
14 days	14 (60.9)
Consecutive days spent at home	
<8 days	12 (52.2)
8 days	8 (34.8)
14 days	3 (13.0)
Smoking	
Yes	4 (17.4)
No	19 (82.6)
Alcohol intake	
Never	4 (17.4)
Yes	19 (82.6)
Body mass index	
Normal weight	6 (26.1)
Overweight	11 (47.8)
Obese	6 (26.1)
Physical health status	
Poor	3 (13.0)
Good	20 (87.0)
Psychological distress	
Low/moderate risk	15 (65.2)
High/very high risk	8 (34.8)

'*How many standard alcohol drinks did you consume today?*' and on a count scale: 0 *to* 7 *or more*, consistent with previous studies (Hequembourg et al., 2020).

2.3.3 | Smoking

Participants were asked to report the number of cigarettes smoked over the last 24 h since the last survey using the item: '*How many cigarettes did you smoke today?*', consistent with previous daily study (Hequembourg et al., 2020).

2.3.4 | Fruits and vegetables

Participants were asked to report on the daily number of servings of fruits and vegetables consumed, using the reframed items: '*How many servings of fruits did you consume today?*' and *How many serves of vegetables did you consume today?* adapted from the Australian National Health Survey and scored on a scale 0 = *none to* 6 = 6 *serves or more*. A serving of fruits was indicated to be equivalent to one-half cup of fruit and one serving of vegetables was equivalent to one cup of leafy green or raw salad vegetables (Australian Nutrition Foundation, 2021). As is common with the scale, the number of fruit and vegetable servings was summed to create the fruit and vegetable intake score (Anderson & Fowers, 2020).

2.3.5 | Physical activity

Daily leisure time physical activity was assessed using an item from the *International Physical Activity Questionnaire-short form* (Craig et al., 2017). Participants were asked: '*How many minutes did you do moderate (e.g., bicycling, brisk walking) to vigorous (e.g., aerobic, running, sports) physical activities outside of work for at least 10 min at a time today?*', consistent with the approach demonstrated in previous EMA study (e.g., Fredrickson et al., 2020). Leisure-time physical activity is indicated to be beneficial for all workers (Prince et al., 2021).

2.3.6 | Affect

Daily positive and negative affect were assessed using items from the PANAS-X (Watson & Clark, 1994). Participants responded to six items framed as: '*How [e.g., excited] did you feel today?*' scored on a 5-point Likert scale: 0 = *not at all to* 4 = *extremely*. Using the subscales of the PANAS, three affect indices were generated; positive affect (happy, excited; Spearman-Brown = 0.87), anxious affect (nervous, worried; Spearman-Brown = 0.83), and depressed affect (sad, lonely; Spearman-Brown = 0.79). All subscale scores ranged from 0 to 8. Higher scores were indicative of higher levels of affects and consistent with the approach demonstrated in previous EMA studies (e.g., Stevenson et al., 2019).

2.3.7 | Job demand

Workload is indicated as part of the regular job demand faced by workers (Dijkhuizen & Veldhoven, 2014) and was used as a measure of job demand in this study. *Daily job demand* was measured with two items adopted from the Job Content Questionnaire: designed to assess the psychosocial characteristics of jobs including *decision latitude, psychological demands and social support* (Karasek et al., 1998) and as used in a previous study (Albrecht & Anglim, 2018). The items were '*Today, my workload was too heavy*' and '*Today, I did not have enough time to do my work to the best of my ability*' scored on a 7-point rating scale: 0 = *strongly disagree to* 6 = *strongly agree*. The items were summed (ranging from 0 to 12; Spearman-Brown = 0.78) and the average was taken to give a daily workload variable with a high score indicating high job demand.

2.3.8 | Job control

Job autonomy is indicated as an important job resource (Hätinen et al., 2007) and was measured as job control in this study. *Daily job control* was measured using items adapted from the Work Design Questionnaire, which measures work design characteristics including task, knowledge, social and work content characteristics (Morgeson & Humphrey, 2006). Two items from the task characteristics of work design were measured on a 7-point rating scale: 0 = *strongly disagree to* 6 = *strongly* agree and were '*Today, I had autonomy to decide on the order in which things are done on my job*' and '*Today, I had autonomy in making decisions on my job*'. The items were summed (ranging from 0 to 12; Spearman-Brown = 0.89) and the average was taken to give a daily job control variable with a high score indicating high levels of job control. The reliability of items/scales used was fairly stable across the study periods (days 1–28) except for days where there were fewer responses (see Supporting Information S1).

2.4 | Data analysis plan

An initial examination of sample descriptive statistics was performed, followed by a Spearman's Rank correlation matrix of the various person-mean scores for our daily diary and baseline assessments. With the daily diary data, intraclass correlation coefficients (ICC) were computed to examine the partitioning of variance to within-person or between-person. A higher ICC (potential range 0–1) indicates less variability across time. Cigarette smoking was intended to be assessed as a dependent variable, but was excluded as only a few of the participants (n = 4) indicated smoking (average 0.82 ± 2.49 cigarettes per day), with high ICC (0.93) showing almost no within-person variance.

All hypotheses were tested using multilevel models, with linear mixed models for continuous outcomes (positive affect, anxious affect, depressed affect and sleep quality) and generalized linear mixed modelling for counts and binary outcomes (fruits and vegetable intake, alcohol and physical activity). A negative binomial distribution with a log link function was used for the model predicting counts of fruits and vegetables. Alcohol and physical activity data showed highly zero-inflated distributions and were transformed into dichotomous variables: alcohol intake categorized into days with no alcohol intake (0) and days with at least one standard drink intake (1); and moderate-to-vigorous physical activity (MVPA) categorized into <30 min of MVPA (0) and at least 30 min of MVPA (1). Alcohol intake and physical activity were modelled using binomial distributions with a logit link function.

Data were structured such that daily assessments (Level 1) were nested within individuals (Level 2). To test the first hypothesis, separate models tested the effect of work period (on-shift [1] vs. off-shift [0]) on affective states (anxious, depressed and positive affects) and behavioural (sleep quality, alcohol intake, fruits and vegetable intake and physical activity) outcomes. To test the second hypothesis, separate models assessed the direct effects of job demand-resource factors (job demand, job control) on daily affective states and behavioural outcomes. To assess the influence of work-related factors on the next day's sleep quality, the sleep quality variable was transformed into a lag sleep quality outcome variable by removing the first day's sleep quality reports for each participant. Job demand and control were entered as both level-1 (within-person) and level-2 (between-person) predictors: raw scores were person-mean centred and entered at level-1, and person-mean scores were then grand-mean centred and entered at level-2. Demographic and FIFO work

characteristics age (mean centred at 0), sex (male = 0, female = 1), marital status (married = 0, single = 1), have children (yes = 0, no = 1), FIFO role (manual = 0, office = 1), shift pattern (rotation/swing day and night shift = 0, regular fixed day shift = 1), and shift hours (≤12 = 0, >12 = 1), were entered as level-2 predictors as covariates to adjust for potential confounders based on existing literature. A time variable, being days into the study, was also entered.

To test the moderation hypotheses, the interaction of job control with workload was tested in two models: first, we tested whether the within-person effect of demand on outcomes was moderated by the within-person effect of control (i.e., that the effect of a particularly demanding day is attenuated on days with more control than usual) and, secondly, a cross-level interaction of between-person job control (i.e., that the effect of a particularly demanding day is attenuated for those who generally enjoy more job control).

All models allowed for fixed and random effects of shift periods (on-shift vs. off-shift) and random intercepts, and full information maximum likelihood estimation. Models did not converge with random slopes, so these were omitted. All models employed robust standard error estimation and estimated random effects using an unstructured covariance matrix and autocorrelation of residuals using a first-order autoregressive covariance matrix. All data analyses were completed in SPSS (Version 26) and statistical significance was set at $\alpha = 0.05$. For parsimony, we do not present full tables for all models in the paper, but all are reported in full in Supporting Information S2.

3 | RESULTS

3.1 | Descriptive statistics

The 23 participants completed 434 of a possible 644 days (67.4% overall compliance with the protocol). On average, participants completed 18.87 (SD = 5.77) days of data, with 11.26 (SD = 4.11) on-shift and 7.61 (SD = 4.30) off-shift days. On average, respondents reported experiencing modest levels of positive affect (M = 1.75, SD = 1.06, range 0–4) and low levels of anxious affect (M = 0.73, SD = 0.87, range 0–4) and depressed affect (M = 0.83, SD = 0.96, range 0–4) per day. On average, participants reported fairly good sleep quality (M = 1.81, SD = 0.81, range 0–3). The respondents typically reported consuming 1.00 (SD = 1.82) standard alcoholic drink and 3.48 (SD = 1.98) serves of fruits and vegetables per day. Typically, the study respondents also reported engaging in MVPA for 19.39 (SD = 26.49) minutes per day. The intraclass correlations showed that between 39% and 90% of the variance in the study variables could be attributed to within-person variation. Variance in sleep quality and MVPA predominantly belonged to within-person variation, with only 10% and 21% respectively of the variability accounted for by between-person differences (see Table 2).

3.2 | Main effects of shift period on affects and health behaviours

Positive affect was significantly lower whilst on-shift compared to off-shift (γ = −0.50, SE = 0.14, 95% CI = −0.78, −0.21, p = 0.001). Similarly, study respondents tended to have poor sleep quality (γ = −0.36, SE = 0.11, 95% CI = −0.57, −0.14, p = 0.002) and consume less alcohol (γ = −1.35, SE = 0.48, Exp(γ) = 0.26, 95% CI = 0.10, 0.67, p = 0.005) during on-shift compared to off-shift periods. However, there were no significant differences in anxious affect, depressed affect, fruit and vegetable intake, and physical activity during on-shift and off-shift periods (see Tables 3 and 4). Boxplots of the average health outcomes over on-and off-shift periods are shown in Figures 2 and 3.

TABLE 2 Between-person correlations of daily variables.

Parameter	*M* (SD)	ICC	1	2	3	4	5	6	7	8	9
1. Positive affect (0–4)	1.75 (1.06)	0.42	1								
2. Anxious affect (0–4)	0.73 (0.87)	0.58	−0.18***	1							
3. Depressed affect (0–4)	0.83 (0.96)	0.48	−0.42***	0.65***	1						
4. Job demand (0–6)	2.20 (1.42)	0.39	−0.17***	0.11*	0.16***	1					
5. Job control (0–6)	4.12 (1.49)	0.36	0.44***	−0.28***	−0.33***	−0.30***	1				
6. Standard alcohol drinks/day	1.00 (1.82)	0.52	−0.05	0.11*	0.07	−0.06	0.05	1			
7. Minutes of MVPA/day	19.39 (26.49)	0.21	0.18***	−0.05	−0.21***	−0.02	0.21***	0.06	−0.11*	1	
8. Sleep quality (0–3)	1.81 (0.81)	0.10	0.28***	−0.25***	−0.30***	−0.13*	0.32***	0.06	−0.11*	0.15**	1
9. Fruits and vegetables/day	3.48 (1.98)	0.61	0.02	−0.31***	−0.10***	−0.09	−0.01	−0.04	−0.05	0.20***	0.27***

Note: Numbers in parentheses alongside parameter labels represent the range of possible scores on that measure.

Abbreviations: ICC, intra-class correlation: higher ICC values (potential range 0–1) show less variability across time; *M*, mean; MVPA, moderate to vigorous physical activity; SD, standard deviation.

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

TABLE 3 Multilevel models of the effect of shift period on affects and sleep quality.

	Anxious affect			Depressed affect			Positive affect			Sleep quality		
Parameter	**γ (SE)**	**95% CI**	***p*-value**	**γ (SE)**	**95% CI**	***p*-value**	**γ (SE)**	**95% CI**	***p*-value**	**γ (SE)**	**95% CI**	***p*-value**
Fixed effects												
Intercept	1.50 (0.43)	0.61, 2.39	0.002	1.56 (0.50)	0.54, 2.58	0.004	2.33 (0.44)	1.45, 3.22	<0.001	1.69 (0.25)	1.18, 2.20	<0.001
Shift period	0.04 (0.13)	−0.23, 0.31	0.750	0.22 (0.17)	−0.13, 0.57	0.204	−0.50 (0.14)	−0.78, −0.21	0.001	−0.36 (0.11)	−0.57, −0.14	0.002
Random effects[a]	σ^2 (SE)			σ^2 (SE)			σ^2 (SE)			σ^2 (SE)		
Intercept	0.25 (0.09)	0.12, 0.50	0.005	0.31 (0.11)	0.16, 0.63	0.005	0.20 (0.08)	0.09, 0.45	0.018	0.02 (0.02)	0.002, 0.21	0.426
Shift period	0.29 (0.12)	0.13, 0.64	0.012	0.51 (0.19)	0.24, 1.07	0.009	0.27 (0.12)	0.11, 0.65	0.030	0.11 (0.07)	0.03, 0.40	0.141
Residual[b]												
AR1 diagonal	0.30 (0.02)	0.26, 0.36	<0.001	0.40 (0.03)	0.34, 0.48	<0.001	0.55 (0.05)	0.45, 0.65	<0.001	0.51 (0.04)	0.44, 0.61	<0.001
AR1 rho	0.16 (0.08)	0.01, 0.31	0.010	0.29 (0.07)	0.16, 0.41	<0.001	0.29 (0.06)	0.16, 0.40	<0.001	0.19 (0.07)	0.06, 0.32	0.003

Note: Shift period: on-shift days (1) versus off shift day (0) of FIFO roster cycle. Models adjusted for covariates: day of assessment (centred at day 14), age (mean centred at 0), sex (male = 0, female = 1), marital status (married = 0, single = 1), have children (yes = 0, no = 1), FIFO role (manual = 0, office = 1), shift pattern (rotation/swing day and night shift = 0, regular fixed day shift = 1), and shift hours (≤12 = 0, >12 = 1).

Abbreviations: AR1, first-order autoregressive; CI, confidence interval; FIFO, fly-in fly-out; SE, standard error.

[a]Random effect covariance structure: unstructured.

[b]Residual covariance structure: AR1.

TABLE 4 Generalized linear mixed models of effects of shift periods on behaviours.

	Alcohol intake[a]			Fruits and vegetable[b]			Physical activity[a]		
Parameter	**Exp(γ)[c]**	**95% CI**	***p*-value**	**Exp(γ)**	**95% CI**	***p*-value**	**Exp(γ)[c]**	**95% CI**	***p*-value**
Fixed effects									
Intercept	0.03	0.00, 0.33	0.004	2.22	1.46, 3.38	<0.001	0.59	0.08, 2.25	0.605
Shift period (off-shift vs. on-shift)	0.26	0.10, 0.67	0.005	0.91	0.78, 1.08	0.284	0.39	0.15, 1.07	0.066
Random effects[d]	σ^2 (SE)			σ^2 (SE)			σ^2 (SE)		
Intercept	4.50 (2.24)	1.69, 11.95	0.045	0.20 (0.08)	0.09, 0.45	0.017	2.83 (1.57)	0.95, 8.40	0.072
Shift period	2.99 (1.55)	1.08, 8.25	0.054	0.12 (0.05)	0.05, 0.28	0.025	3.67 (1.76)	1.43, 9.40	0.037
Residual[e]									
AR1 diagonal	0.67 (0.05)	0.57, 0.78	<0.001	0.34 (0.04)	0.28, 0.42	<0.001	0.69 (0.07)	0.57, 0.83	<0.001
AR1 rho	0.17 (0.06)	0.04, 0.29	0.009	0.31 (0.09)	0.14, 0.47	<0.001	0.44 (0.06)	0.32, 0.55	<0.001

Note: Alcohol intake: yes = 1, no = 0; fruits and vegetable intake: serves taken; physical activity (MVPA): <30 min = 0, at least 30 min = 1. Models adjusted for covariates: days into assessment (centred at day 14), age (mean centred at 0), sex (male = 0, female = 1), marital status (married = 0, single = 1), have children (yes = 0, no = 1), FIFO role (manual = 0, office = 1), shift pattern (rotation/swing day and night shift = 0, regular fixed day shift = 1), and shift hours (≤12 = 0, >12 = 1).

Abbreviations: AR1, first-order autoregressive; CI, confidence interval; FIFO, fly-in fly-out; MVPA, moderate to vigorous physical activity; SE, standard error.

[a]Logistic models.

[b]Negative binomial log model; Shift period: on-shift days (1) versus off shift day (0) of FIFO roster cycle.

[c]Exp(γ) is interpreted as an increase (values >1) or decrease (values <1) odd in alcohol intake and MVPA for a 1-unit increase in the predictor.

[d]Random effect covariance structure: unstructured.

[e]Residual covariance structure: AR1.

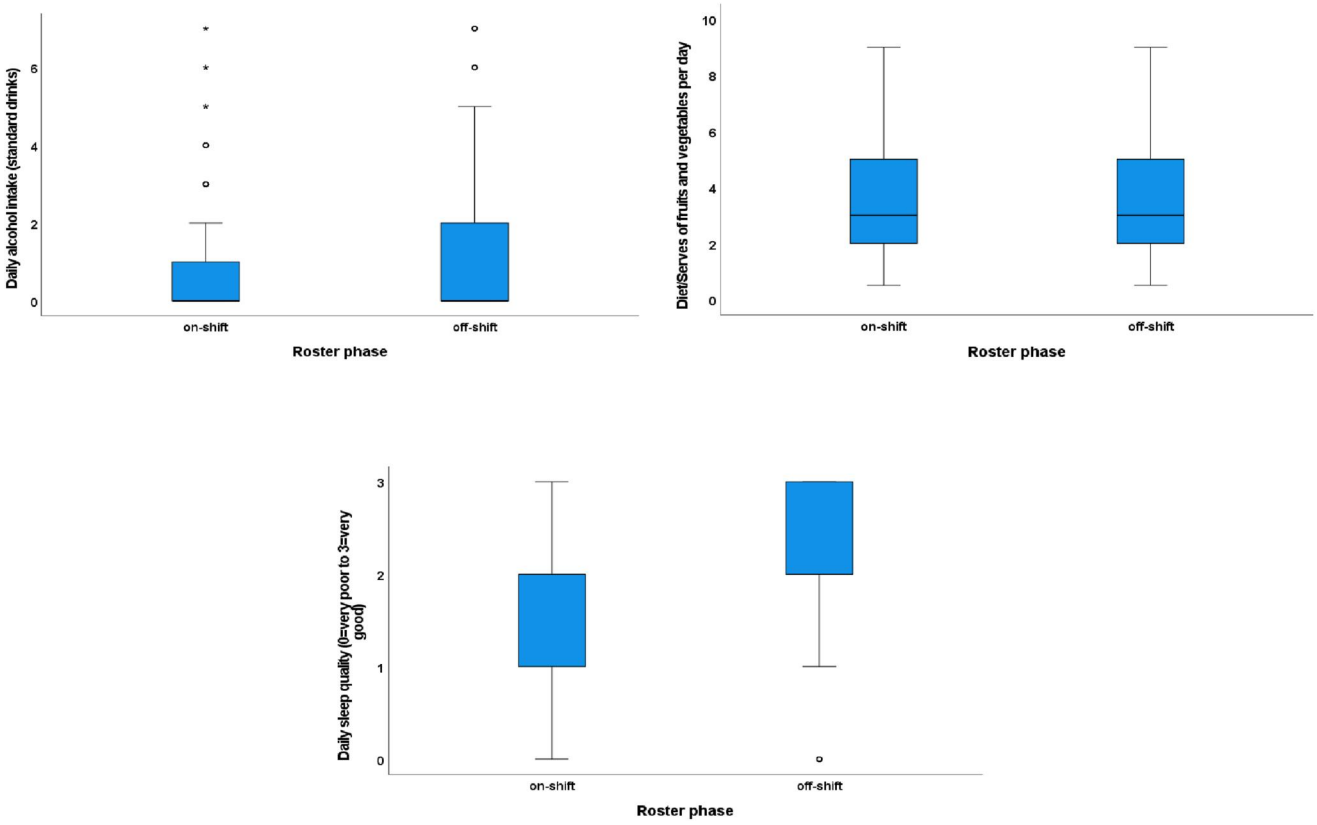

FIGURE 2 Boxplots of the average daily alcohol intake, fruits and vegetable intake, and sleep quality of fly-in fly-out workers during on-shift days and off-shift days.

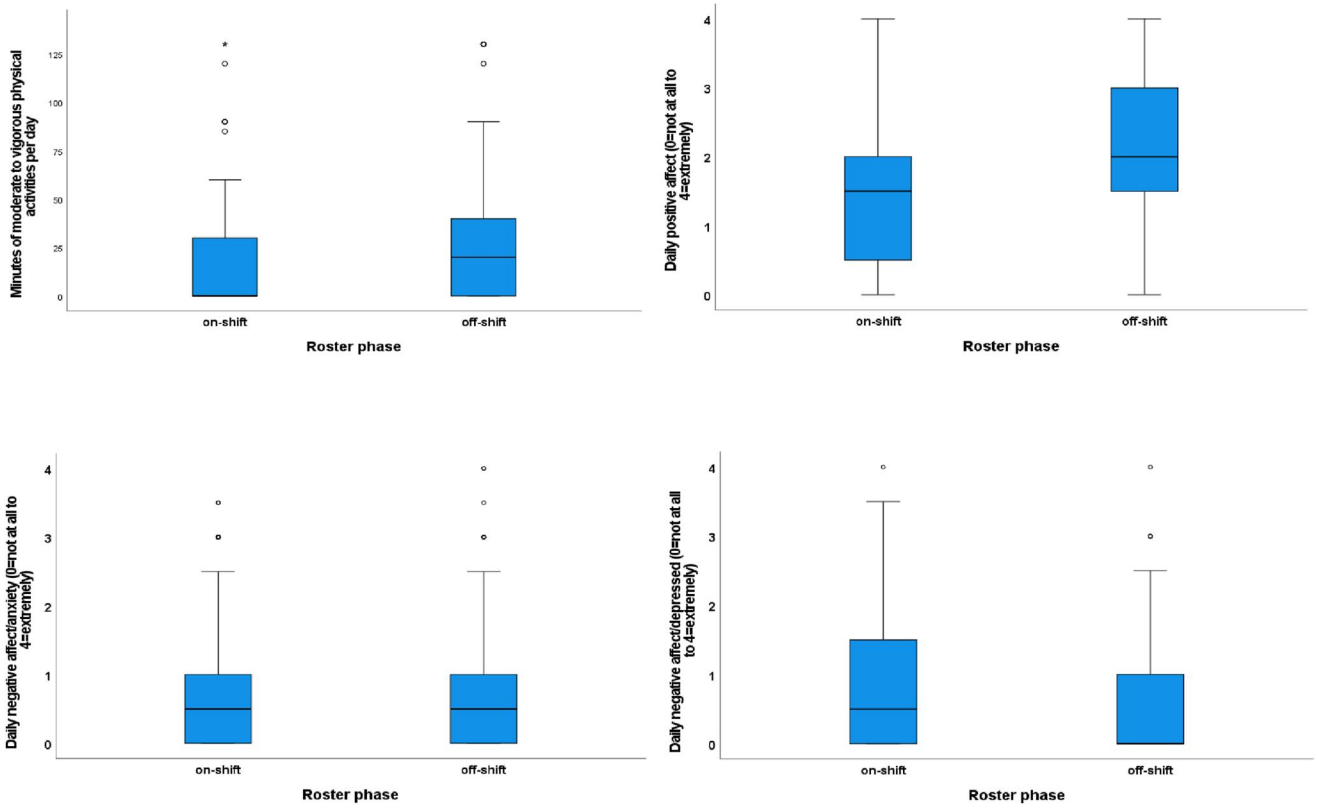

FIGURE 3 Boxplots of the average daily physical activity time, positive affect, anxious affect and depressed affect of fly-in fly-out workers during on-shift days and off-shift days.

3.3 | Main effects of within-person and between-person job demand and control on health outcomes

3.3.1 | Affective states

The results show that anxious affect was significantly positively associated with within-person job demand ($\gamma = 0.05$, SE = 0.03, 95% CI = 0.004, 0.10, $p = 0.035$) while negatively associated with within-person job control ($\gamma = -0.14$, SE = 0.03, 95% CI = −0.19, −0.09, $p < 0.001$). Between-person job control was also positively associated with anxious affect ($\gamma = -0.50$, SE = 0.17, 95% CI = −0.85, −0.16, $p = 0.005$). In the model predicting depressed affect, only within-person job control was a significant predictor ($\gamma = -0.12$, SE = 0.03, 95% CI = −0.17, −0.06, $p < 0.001$). The model predicting positive affect indicated both within-person job control ($\gamma = 0.24$, SE = 0.03, 95% CI = 0.17, 0.30, $p < 0.001$) and between-person job control ($\gamma = 0.40$, SE = 0.16, 95% CI = 0.07, 0.74, $p = 0.021$) to be positively associated with positive affect (see Table 5).

3.3.2 | Health behaviours

Within-person and between-person job demands and control were not associated with sleep quality ($p > 0.05$) (Table 5). Intake of alcohol was associated with between-person job demand ($\gamma = -1.82$, SE = 0.74, Exp(γ) = 0.16, 95% CI = 0.04, 0.70, $p = 0.015$), such that on average there was a decrease in the odds of alcohol consumption with a 1-unit increase above the mean in demand. Within-person job control was also associated with alcohol consumption ($\gamma = 0.65$, SE = 0.17, Exp(γ) = 1.91, 95% CI = 1.37, 2.67, $p < 0.001$), such that with a 1-unit increase in job control there was an increase in the odds of alcohol intake.

Fruits and vegetable intake was associated with between-person demand ($\gamma = -0.16$, SE = 0.07, Exp(γ) = 0.86, 95% CI = 0.75, 0.98, $p = 0.022$) and job control ($\gamma = -0.20$, SE = 0.08, Exp(γ) = 0.82, 95% CI = 0.70, 0.96, $p = 0.016$). There was a 14% decrease in fruit and vegetable intake in those with 1-unit higher demand and an 18% decrease in fruit and vegetable intake in those with 1-unit higher job control. The within-person variables were found not to be associated with fruits and vegetable intake. The model predicting physical activity showed within-person job control to be associated with physical activity ($\gamma = 0.41$, SE = 0.17, Exp(γ) = 1.51, 95% CI = 1.08, 2.11, $p = 0.016$). The odds of physical activity were higher with a 1-unit increase in job control. The between-person variables were found not to be associated with physical activity (see Table 6).

3.4 | Interaction between job demand and job control in predicting health outcomes

3.4.1 | Affective states

The results showed a significant interaction between within-person demand and job control in predicting anxious affect. The effect of

TABLE 5 Multilevel linear models of within- and between-person fixed effects.

	Anxious affect			Depressed affect			Positive affect			Sleep quality		
Parameters	**γ (SE)**	**95% CI**	***p*-value**	**γ (SE)**	**95% CI**	***p*-value**	**γ (SE)**	**95% CI**	***p*-value**	**γ (SE)**	**95% CI**	***p*-value**
Fixed effects												
Intercept	1.80 (0.38)	1.01, 2.58	<0.001	1.64 (0.47)	0.68, 2.61	0.002	2.00 (0.38)	1.23, 2.78	<0.001	2.64 (0.32)	2.00, 3.26	<0.001
Shift period	−0.11 (0.13)	−0.37, 0.15	0.385	0.10 (0.15)	−0.21, 0.42	0.504	−0.27 (0.10)	−0.48, −0.07	0.012	−0.20 (0.14)	−0.48, 0.07	0.148
Aggregate job demand (between person)	−0.09 (0.16)	−0.42, 0.24	0.593	0.15 (0.20)	−0.26, 0.56	0.452	−0.06 (0.16)	−0.38, 0.26	0.708	−0.11 (0.12)	−0.36, 0.13	0.356
Daily job demand (within person)	0.05 (0.03)	0.004, 0.10	0.035	0.02 (0.03)	−0.04, 0.08	0.530	−0.01 (0.03)	−0.07, 0.05	0.725	−0.01 (0.04)	−0.09, 0.07	0.752
Aggregate job control (between person)	−0.50 (0.17)	−0.85, −0.16	0.005	−0.28 (0.21)	−0.70, 0.15	0.190	0.40 (0.16)	0.07, 0.74	0.021	−0.02 (0.13)	−0.27, 0.24	0.903
Daily job control (within person)	−0.14 (0.03)	−0.19, −0.09	<0.001	−0.12 (0.03)	−0.17, 0.06	<0.001	0.24 (0.03)	0.17, 0.30	<0.001	0.01 (0.04)	−0.07, 0.09	0.838
Random effects[a]	σ^2 (SE)			σ^2 (SE)			σ^2 (SE)			σ^2 (SE)		
Intercept[b]	0.17 (0.06)	0.08, 0.35	0.006	0.26 (0.10)	0.13, 0.53	0.007	0.15 (0.06)	0.07, 0.33	0.013	-	-	-
Shift period	0.27 (0.11)	0.12, 0.58	0.012	0.40 (0.16)	0.18, 0.89	0.014	0.069419	0.01, 0.44	0.327	0.14 (0.09)	0.04, 0.50	0.126
Residual[c]												
AR1 diagonal	0.28 (0.02)	0.24, 0.32	<0.001	0.39 (0.03)	0.33, 0.46	<0.001	0.50 (0.04)	0.43, 0.59	<0.001	0.54 (0.05)	0.45, 0.64	<0.001
AR1 rho	0.17 (0.07)	0.0.02, 0.58	0.026	0.28 (0.07)	0.15, 0.40	<0.001	0.28 (0.06)	0.16, 0.40	<0.001	0.26 (0.07)	0.12, 0.38	<0.001

Note: Anxious affect (0 = not at all to 4 = extremely), depressed affect (0 = not at all to 4 = extremely), positive affect (0 = not at all to 4 = extremely), sleep quality (0 = very poor to 3 = very good). Shift period: on-shift days (1) versus off shift day (0) of FIFO roster cycle. Models adjusted for covariates: day of assessment (centred at day 14), age (mean centred at 0), sex (male = 0, female = 1), marital status (married = 0, single = 1), have children (yes = 0, no = 1), FIFO role (manual = 0, office = 1), shift pattern (rotation/swing day and night shift = 0, regular fixed day shift = 1), and shift hours (≤12 = 0, >12 = 1).

Abbreviations: AR1, first-order autoregressive ; CI, confidence interval; FIFO, fly-in fly-out; SE, standard error.

[a]Random effect covariance structure: unstructured.

[b]Random intercept in model predicting sleep quality was omitted due to non-convergence of the model.

[c]Residual covariance structure: AR1.

TABLE 6 Generalized linear mixed models of within- and between-person fixed effects.

	Alcohol intake[a]			Fruits and vegetable[b]			Physical activity[a]		
Parameters	**Exp(γ)[c]**	**95% CI**	***p*-value**	**Exp(γ)**	**95% CI**	***p*-value**	**Exp(γ)[c]**	**95% CI**	***p*-value**
Fixed effects									
Intercept	0.04	0.002, 0.96	0.047	2.54	1.70, 3.79	<0.001	0.66	0.06, 7.20	0.736
Shift period (on-shift vs. off-shift)	0.34	0.12, 0.92	0.034	0.90	0.76, 1.07	0.223	0.48	0.19, 1.22	0.122
Aggregate job demand (between person)	0.16	0.04, 0.70	0.015	0.86	0.75, 0.98	0.022	0.76	0.24, 2.38	0.636
Daily job demand (within person)	1.27	0.95, 1.70	0.110	0.99	0.97, 1.02	0.619	1.12	0.93, 1.34	0.225
Aggregate job control (between person)	0.28	0.04, 1.86	0.186	0.82	0.70, 0.96	0.016	0.38	0.12, 1.22	0.103
Daily job control (within person)	1.91	1.37, 2.27	<0.001	0.98	0.94, 1.02	0.228	1.51	1.08, 2.11	0.016
Random effects[d]	σ^2 (SE)			σ^2 (SE)			σ^2 (SE)		
Intercept	5.83 (3.20)	1.99, 17.12	0.069	0.20 (0.09)	0.08, 0.49	0.027	3.45 (1.75)	1.13, 10.56	0.080
Shift period	3.85 (2.01)	1.39, 10.68	0.055	0.12 (0.05)	0.05, 0.29	0.024	3.33 (1.75)	1.19, 9.33	0.057
Residual[e]									
AR1 diagonal	0.67 (0.05)	0.57, 0.78	<0.001	0.34 (0.03)	0.28, 0.41	<0.001	0.72 (0.07)	0.60, 0.87	<0.001
AR1 rho	0.18 (0.07)	0.05, 0.31	0.006	0.31 (0.07)	0.13, 0.46	<0.001	0.44 (0.06)	0.31, 0.55	<0.001

Note: Alcohol intake: yes = 1, no = 0; fruits and vegetable intake: serves taken; physical activity (MVPA): <30 min = 0, at least 30 min = 1. Shift period: on-shift days (1) versus off shift day (0) of FIFO roster cycle. Models adjusted for covariates: day of assessment (centred at day 14), age (mean centred at 0), sex (male = 0, female = 1), marital status (married = 0, single = 1), have children (yes = 0, no = 1), FIFO role (manual = 0, office = 1), shift pattern (rotation/swing day and night shift = 0, regular fixed day shift = 1), and shift hours (≤12 = 0, >12 = 1).

Abbreviations: AR1, first-order autoregressive; CI, confidence interval; FIFO, fly-in fly-out; MVPA, moderate to vigorous physical activity; SE, standard error.

[a]Logistic models.

[b]Negative binomial log model.

[c]Exp(γ) is interpreted as an increase (values >1) or decrease (values <1) odds in alcohol intake and MVPA for a 1-unit increase in the predictor.

[d]Random effect covariance structure: unstructured.

[e]Residual covariance structure: AR1.

daily demand on anxiety was lower on days that were accompanied by high control (γ = −0.04, SE = 0.02, 95% CI = −0.07, −0.01, p = 0.013). There were no significant interactions between within-person demand and job control in predicting depressed and positive affects. For the cross-level interaction, the interaction between within-person demand and between-person job control was significant in predicting depressed affect: the effect of daily demand on depressed affect was attenuated in individuals with typically more control over their jobs (γ = −0.09, SE = 0.04, 95% CI = −0.17, −0.01, p = 0.023). The same interaction was not quite statistically significant with anxiety as outcome (γ = −0.07, SE = 0.03, 95% CI = −0.13, 0.00, p = 0.051), but was not significant in predicting positive affect (see Tables 7–8, Supporting Information S3).

3.4.2 | Health behaviours

There were no significant interactions between within-person demand and job control in predicting sleep quality, alcohol intake, fruit and vegetable intake and physical activity. For cross-level interaction, the interaction between within-person demand and between-person job control was significant in predicting sleep quality and alcohol intake, but not in predicting fruit and vegetable intake and physical activity. Respondents at the typical level of job control across days showed better sleep quality on days with high demand (γ = 0.14, SE = 0.06, 95% CI = 0.02, 0.26, p = 0.028). Similarly, respondents at the typical level of job control across days showed increased odds of alcohol intake on days with high demand. The within-person main effects of workload and job control remained statistically not significant in the models predicting sleep quality, and fruits and vegetable intake. Furthermore, the within-person main effects of job control remained significant but demand remained statistically not significant in the models predicting alcohol intake and physical activity (see Tables 8–9, Supporting Information S3).

4 | DISCUSSION

This study examined the impact of FIFO work on psychological well-being and health-related behaviours, examining the role of job-related factors including job demand and control.

4.1 | Variability of daily variables over and across FIFO work periods (on and off-shifts)

We found significant within and between-persons variations in daily affects, health behaviours and work conditions across on-and off-shift days. This is consistent with the findings of previous FIFO studies, which found daily differences in alcohol intake, exercise, sleep quality, nutrition quality (Rebar et al., 2018), emotional exhaustion and work conditions (including workload, emotional demands, co-worker support) (Albrecht & Anglim, 2018). Daily variations in affects, health behaviours and work conditions have been widely documented among the general population (e.g., Anderson & Fowers, 2020; Ilies et al., 2010). The extent of fluctuations in individuals' experiences over time is indicated to impact negatively on their well-being (Kuppens et al., 2007), suggesting that FIFO workers could be experiencing diminished well-being (Albrecht & Anglim, 2018).

Our study indicated partial support for hypothesis 1 on positive affect, sleep quality and alcohol intake. The study found that workers' positive affect was significantly lower during on-shift compared to off-shift days. This is the first study to examine affects during on-and off-shift periods. Several cross-sectional studies have indicated high levels of psychological distress among FIFO workers (e.g., Asare et al., 2021; Asare, Robinson, Powell, et al., 2022). FIFO workers, during work periods, are separated from their families and faced with the emotional strain of dealing with being away from families, loneliness and social isolation, anxiety about maintaining family and social relationships and missing important family events (Gardner et al., 2018; Torkington et al., 2011). However, we found no differences in anxious affect and depressed affect during on-and off-shift periods. It is worth noting the small sample included in this study.

Our results demonstrated that sleep quality was poorer during on-shift compared to off-shift days. This corroborates the findings made in previous daily studies among FIFO workers in Australia (Maisey et al., 2022; Rebar et al., 2018) and earlier cross-sectional studies (Asare, Robinson, Powell, et al., 2022; Tuck et al., 2013). Though FIFO workers may be free from social and domestic commitments during work periods (Gardner et al., 2018), they typically work long hours and day and night shifts, which are indicated to limit sleep (Paech et al., 2010; Rhéaume & Mullen, 2018). Studies have indicated that during off-shift days, workers show signs of recovery from the sleep loss accumulated during work periods (Maisey et al., 2022; Paech et al., 2010).

Workers reported consuming less alcohol during on-shift periods compared to off-shift periods, aligning with the findings from earlier daily studies (Muller et al., 2008; Rebar et al., 2018) and earlier cross-sectional study (Asare, Robinson, Powell, et al., 2022). Typically, FIFO campsites have a 'wet mess': a place where alcohol is sold (Sibbel et al., 2016). However, workplace practices including daily alcohol testing prior to the commencement of work (Australian Mines and Metals Association, 2016), and restrictions on alcohol consumption (Tuck et al., 2013) may have impacted the consumption of alcohol during on-shift days. On the other hand, the availability of more alcohol and a sense of liberty from limitations on alcohol consumption (Asare et al., 2021) are highlighted to contribute to a high level of alcohol consumption during off-shift days. However, daily alcohol consumption levels reported during on-shift and off-shift among FIFO workers in our study were lower than reported in the general Australian adult (aged 15 and above) population (Australian Institute of Health and Welfare, 2021) and non-FIFO shift workers in the nursing, postal and printing industry (Dorrian et al., 2017).

In contrast to a previous daily diary study, which found FIFO workers to exercise less and report poorer nutrition quality during on-shift compared with off-shift periods (Rebar et al., 2018), our study found no differences in physical activity and fruit and vegetable intake during on-and off-shift days. The observed disparities could be explained by the differences in sample sizes between the studies, as a small sample was included in the current study, and differences in the items used in measuring the outcome variables. However, the levels of fruit and vegetable intake reported among FIFO workers in our study during on- and off-shift periods were comparable to that reported among non-FIFO night shift workers in Australia (Shaw et al., 2019). Again, whereas physical activity during on-shift was lower, that during off-shift periods was higher among FIFO workers in our study than reported in shift-working nurses and midwives in Australia (Henwood et al., 2012), and comparable to the national average (Australian Bureau of Statistics, 2013). It should be noted that typical FIFO campsites have recreational facilities including gyms and serve workers with a wide range of healthy food options (Perring et al., 2014; Sibbel et al., 2016), which could encourage physical activities and healthy eating habits during on-shift periods (Bandoni et al., 2005). However, lengthy shifts and the distance between workplaces and campsites have been cited as factors that limit the amount of time an employee can spend engaged in physical activities (Perring et al., 2014). Further studies with large sample sizes and consistent measuring items are required to explore physical activity and fruit and vegetable intake during on-and off-shift days.

4.2 | Job demand, job control and affects

The study showed that within-person job demand was a significant predictor of anxious affect; supporting our proposed hypothesis 2. This is consistent with the findings of previous daily studies, where high daily job demand positively predicted day-level negative affect in other working populations (Ilies et al., 2007, 2010; Schusterschitz et al., 2018). A daily study among FIFO workers in Australia also indicated that within-person workload was positively associated with within-person emotional exhaustion (Albrecht & Anglim, 2018). The finding in our current study aligns with the health impairment process of the job demand resource model (Demerouti & Bakker, 2011), which suggests that a high workload drains the psychological and physical resources of workers and may result in energy exhaustion and subsequently health problems. Our results stress the significant role day-specific workload plays in daily emotional experiences in FIFO workers, besides the association attributed to between-person

differences (Ilies et al., 2007). However, our study found no significant association between between-person job demands and anxious affect, which could be attributed to the small sample included in the study.

The study found that within-person job control was a significant predictor of low anxious and depressed affects and high positive affect (in-line with hypothesis 2). Similar associations were also observed between-person job control and anxious affect and positive affect. These findings are consistent with that of earlier daily studies (Daniels et al., 2013; Reis et al., 2000; Xanthopoulou et al., 2012). In the FIFO context, a daily study has also demonstrated job autonomy to be a significant predictor of worker engagement (Albrecht & Anglim, 2018). Our finding is consistent with and extends to the FIFO context of the motivational mechanism of the JD-R (Demerouti & Bakker, 2011). Job control impact on the psychological well-being of workers is indicated as instrumental in enhancing the mental health of workers and job satisfaction and also decreases workers' burnout by lessening the adverse effect of role strain on burnout (Zhou, 2020).

4.3 | Job demand, job control and health behaviours

Our results demonstrated no associations between within-person job demand and health behaviours (alcohol intake, fruit and vegetable intake, physical activity and sleep quality) in contrast to our proposed hypothesis that high daily job demand would be associated with poor health behaviours. Again, these findings are in contrast with previous similar daily studies (Gillet et al., 2020; Jones et al., 2007; Nielsen et al., 2018). This is the first known study to examine the effect of day-specific demand on health behaviours in FIFO workers and further studies may therefore be needed. However, the study found some evidence of between-person demand as a predictor of less alcohol consumption and fruit and vegetable intake. Whereas the finding on fruit and vegetable intake mirrors the extant literature, which indicates high between-person job-related stressors are linked to lower consumption of fruits and vegetables, for example, (Devine et al., 2007), again it is worth noting the small sample included in the study.

We found that within-person job control was a significant predictor of alcohol consumption and physical activity. The finding on physical activity indicates that an increase in daily job control was associated with an increase in daily physical activity and supports the motivational mechanism of the JD-R (Demerouti & Bakker, 2011). Job control is indicated to increase the sense of self-determination and support needs satisfaction, which sequentially improves physical activity (Abdel Hadi et al., 2021). Our finding suggests allowing for some autonomy in work processes on a daily basis could promote daily physical activity among FIFO workers, which is indicated may be engaged in as an activity for recovery after work (van Hooff et al., 2018). However, in contrast to our prediction of better health behaviours on days of high job control, this study indicated that an increase in daily job control was associated with an increase in daily alcohol intake. A previous study has also indicated high job control to be associated with the consumption of caffeine (Jones et al., 2007). This finding could possibly be expounded by the increased chances for alcohol consumption that high-control positions are expected to provide (Jones et al., 2007).

4.4 | Interactions between demand and job control on affect and health behaviours

In the third hypothesis, first, we proposed that there would be interactions between the daily demand and job control, in particular, the negative impact of daily workload on affects and health behaviours would be low when daily job control is high. In that, the buffering effect suggests high job control may lessen the distress produced by high demand, control the reactions or lessen the negative effects of the reactions to the stress on health (Demerouti & Bakker, 2011). There was no evidence to support our prediction of interaction between within-person workload and job control in predicting depressed and positive affects, sleep quality, alcohol intake, fruit and vegetable intake, and physical activity.

However, there was evidence for interaction between within-person demand and job control on anxious affect to support our prediction in part, suggesting that the association between demand and anxious affect is weaker in the midst of high job control. Similar findings of the buffering effect of job control on the effect of workload in predicting affective distress have been documented (Ilies et al., 2010). This finding indicates that in conditions of high demand, high control on the job may be essential in reducing FIFO workers' anxious experiences. Secondly, we proposed there would be cross-level interactions between the daily demand and between-person job control. There was evidence to support this prediction on depressed affect, sleep quality, and alcohol intake. On days with high demand, FIFO workers with greater job control were less likely to experience depressed affect and more likely to have better night sleep quality and consume more alcohol than those with low job control. The evidence from this study largely aligns with the fact that having job control is positive for health, but again shows that high job conditions could also provide the chance for some negative behaviours, for example, alcohol intake, to thrive.

4.5 | Implications for practice and research

The study reveals substantial within-person variations in affective states, health behaviours and job demand and control over the course of FIFO work periods and confirms the significance of these daily variations in work conditions for the health and well-being of FIFO workers. This gives indications to FIFO organizations to acknowledge these within-person processes and actively screen and manage the daily variabilities that may exist in the work conditions and well-being of workers. The findings from our study also suggest that workplace interventions aimed at addressing the affective states and behaviours

of workers should also consider off-shift periods of the FIFO work cycle, particularly for health behaviours (e.g., alcohol intake).

In relation to the direct effect of daily demands on anxious affect, organizational interventions could address high demands through (1) *worker selection*, where there is conscious effort to recruit and assign workers who have the required knowledge and skills to perform a particular job, (2) *effective training programs*, where workers and managers are offered training to assist develop the knowledge and skills needed to perform their jobs effectively, and (3) *job redesign* involving reassigning of job tasks (Bowling & Kirkendall, 2012).

With regards to daily job control effect on affective states, alcohol intake and physical activity, FIFO organization could implement strategies that enhance job controls, including *work redesign interventions* such as *empowerment and self-managing work teams* to efficiently deal with strenuous job demands (Parker & Sprigg, 1999). The findings of our study demonstrate that interventions that emphasize lessening job demands and enhancing job control may not be successful at all times, particularly when it comes to encouraging healthy behaviours. They might be harmful in some situations; for instance, high job controls might cause people to consume more alcohol. With the limitations associated with between-person study designs, which have been highlighted in this study, more future studies may employ within-person daily designs to significantly advance the progress in understanding how FIFO work conditions affect workers' affective states and behaviours (Jones et al., 2007).

4.6 | Strengths and limitations of the study

This study tested the health impairment, motivational and moderation/buffer process of the job demands-resources model using a within-person multilevel design, which allows for the assessment of the variability in FIFO workers' affective states and health behaviours over time and across context. Specifically, this study is to the best of our knowledge the first to examine the variability in affective states over and across FIFO work periods and examine their associations with demand and job control. Again, this study is also the first to test the buffer process (moderation effects) of the job demands-resources model using within-person design in the FIFO mining context. This study also measured variables covering one complete FIFO work cycle, which may have accounted for the role of recovery during off-shift days, a time spent outside of FIFO voted work times with no work commitments and indicated to impact on recovery and well-being (Albrecht & Anglim, 2018).

However, this study is not without limitations. Firstly, the study relied on self-reported measures of affects and health behaviours, which could be associated with under-and/or over-estimation of study parameters and may not truly reflect participants' experiences/feelings and acceptable health behavioural levels. Secondly, to limit the burden on study participants due to the repeated measurements over time, brief or single items were used in assessing affects and health behaviours, however, such items are indicated to show variability across time (Jones et al., 2007).

Furthermore, the study assessed affects and health behaviours using the end-of-day approach, where participants report their feelings and behaviours for the entire day at bedtime. Given that variables such as affects are indicated to show rapid variations within days (e.g., Röcke et al., 2009), more intensive assessment designs could be useful in future studies taking into consideration the FIFO work context. Additionally, the study is limited in establishing causal relationships between daily variables, despite the advantages dairy surveys have over a snapshot cross-sectional survey. Item used to measure sleep quality tend to measure sleep during the night, however, participants who worked night shifts sleep during the day, which may impact the interpretation and the responses given on sleep quality. It is known that years of participants' experience in the mining industry, in FIFO roles/settings and in specific operations could be significant in understanding the influence of job demand and control on health outcomes (Abbe et al., 2011). However, the covariate effects of years of experience in FIFO settings could not be estimated in our model and the effect of years of participants' experience in the mining industry and in specific operations could not be explored due to the unavailability of data. The study was also limited in assessing the availability of facilities such as recreational facilities (including a gym), and wet mess-where alcohol is available and the quality of food provided at FIFO campsites, which could influence workers' choices and their health behaviours. Such contextual factors could be important in understanding daily differences in behaviours, particularly between on and off-shift days.

5 | CONCLUSIONS

The study has demonstrated significant variations in the daily affective states and health behaviours across the FIFO work cycle: FIFO workers experienced high positive affect and consumed more alcohol during off-shift days compared to on-shift days but had poorer night sleep quality during on-shift days compared to off-shift days. The study has also provided empirical evidence for the significant direct and interaction effects between demand and job control on affective states and health behaviours of FIFO workers, which deepens our understanding of the mechanisms that support and impair daily job-related well-being. Further studies employing within-person daily designs are needed to provide an in-depth understanding of how FIFO work conditions affect workers' affective states and behaviours.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are not publicly available due to ethical and privacy restrictions.

ORCID

Bernard Kwadwo Yeboah Asiamah-Asare https://orcid.org/0000-0002-1381-4981
Suzanne Robinson https://orcid.org/0000-0001-5703-6475
Daniel Powell https://orcid.org/0000-0003-4995-6057
Dominika Kwasnicka https://orcid.org/0000-0002-5961-837X

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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