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## Health and related behaviours of partners of fly-in fly-out workers in Australia: a cross-sectional study

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### ABSTRACT

The recurrent absence of workers from home associated with fly-in fly-out (FIFO) work practice has the potential to affect the partners of the workers. This study aimed to examine the mental and physical health of partners of FIFO workers and compare their health-related behaviours during on-and off-shift periods. Partners of FIFO workers in Australia (N=248) completed an online survey. Partners reported higher sleep duration ( $7.3 \pm 1.4$  vs  $6.4 \pm 1.3$  hours,  $p < .001$ ) and better sleep quality during off-shift nights compared to on-shift nights. Among the current smokers (16.9%), partners smoked more cigarettes per day during on-shift periods than off-shift ( $13.1 \pm 8.2$  vs  $11.6 \pm 7.6$ ,  $p = .034$ ), but there was no difference in alcohol consumption at risky levels. Partners also consumed similar portions of fruits and vegetables and engaged in similar minutes of moderate to vigorous physical exercise per day during on-and off-shift days. Majority of partners had good physical health status (85.1%), but risk of psychological distress was high (50.4%). Interventions could target assisting multiple health behaviour changes and reducing psychological distress by supporting partners to adapt to and cope with the demands/stressors of FIFO lifestyles, particularly in the absence of workers.

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## Introduction

In the last couple of decades, the mineral resources industry, particularly the mining sector, has contributed significantly to the Australian economy; bringing substantial revenue to both the government and private enterprises (Mckenzie et al., 2014). The recent 'resource boom' in Australia has been driven by demands from Asia, notably China (McKenzie & Hoath, 2014), and as a result of the upsurge in demand, the adoption

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of rotational work arrangements, also noted as fly-in fly-out (FIFO), has increased (McKenzie & Hoath, 2014; Meredith et al., 2014). FIFO work arrangements are also common in resources industry in other parts of world including Scotland, Norway and Canada (Asare et al., 2021).

FIFO is a long-distance commuting arrangement (Mckenzie et al., 2014), where workers travel to remote work areas to stay in company-provided accommodation. They work compressed shifts of extended hours (typically 12 hours) for a designated continuous number of days, before travelling back home for designated leave periods (Storey, 2010; Storey, 2016). Simply put, workers rotate between the worksites in remote/isolated locations and their homes (Mayes, 2020; Storey, 2016). For example, a worker may be required to spend 14 days at a worksite followed by 14 days at home or 14 days at worksites followed by 7 days at home (or 8 days on /6 days off) (McKenzie & Hoath, 2014; Parkes, 2012).

The upsurge in the use of FIFO work schedules in the mineral resource industry has been attributed to efficiency gains and cost savings for companies. It is also seen to be an effective way to recruit staff during initial mine site construction and maintenance phases, during peak demands and for short-medium term operations in remote areas. Other reasons include the preference of workers and their families for urban residence and the inadequate social amenities in remote resource-based communities (Mckenzie et al., 2014; Storey, 2016).

Besides the considerable high financial benefits associated with FIFO work (Storey, 2016), workers preference for FIFO work could also be attributed to the opportunity given to expend significant period with family and friends during days off and to separate work from domestic obligations (Gallegos, 2006; Meredith et al., 2014). The efficiency and operational advantages of FIFO arrangement as a mode of employment for several companies in Australia, suggest the use of FIFO work arrangements will continue to increase in the near future (Cooke et al., 2019; Mckenzie et al., 2014). This escalating use and preference for FIFO work arrangements have raised concerns, with governmental calls for more investigations into the effect of such work arrangements on workers and their families and the design of measures to promote the health and well-being of such populations (Education and Health Standing Committee, 2015).

FIFO work lifestyle involves frequent separations of workers from their families over a period. Such recurrent absence of workers from home may suggest constant interruptions to the routine family life such as the domestic roles and obligations, and everyday interactions between family members (Dittman et al., 2016; Parkes et al., 2005). In the absence of workers, partners may have to take up extra domestic and parental obligations increasing the demands on them, and according to the *Work-Family Conflict Theory* (Greenhaus & Beutell, 1985), *inter-role conflict*: the demands of work and family roles interfering with the discharge of one another, can arise leading to stress-associated problems (Allen et al., 2000; Greenhaus & Beutell, 1985), such as psychological strains and substance abuse (Allen et al., 2000). A FIFO work lifestyle of recurrent presence and absence of workers is indicated to be synonymous to 'living two lives' (Gardner et al., 2018; Parkes et al., 2005) with schedules that require partners to take up diverse social responsibilities and forms of behaviours (Gardner et al., 2018).

Furthermore, spending long periods apart from the family home could impact partner relationships. In line with the Attachment Theory, partner relationships require the continuing presence, accessibility and awareness of one another to build trust and security (Bowlby, 1980; Holden, 2010). As such, in the absence or separation of one, the emotional bonds become vulnerable causing one or both to experience distress (Bowlby, 1980).

Several studies have examined the effects of FIFO employment on workers' health and well-being (Asare et al., 2021), and have demonstrated some negative consequences on workers. These included: a higher prevalence of psychological distress (Bowers et al., 2018; James et al., 2018; Sellenger & Oosthuizen, 2017) and a higher risk of suicide (Miller et al., 2019) among onshore FIFO workers than reported in the general populations. FIFO work can also be associated with risky lifestyle behaviours such as excessive alcohol intake, smoking and being overweight/obese (Joyce et al., 2013). However, studies examining the influence of FIFO employment arrangements on the health and related lifestyle behaviours of families and FIFO partners are limited (Asare et al., n.d.; Meredith et al., 2014).

Available quantitative studies have reported that partners of FIFO workers have a higher prevalence of psychological distress than the overall population (Lester et al., 2015; Parker et al., 2018), higher levels of depression, anxiety and stress as compared to partners of non-FIFO workers (Dittman et al., 2016), and higher levels of loneliness in the absence of workers as compared to the general population (Wilson et al., 2020). In contrast, other studies found no significant differences in levels of depression, anxiety and stress between partners of FIFO workers and partners of non-FIFO workers (Cooke et al., 2019) and reported healthy psychological wellbeing among partners, which was not influenced by FIFO workers' presence or absence (Sibbel, 2010).

Some studies have reported higher levels of alcohol drinking and smoking in partners of FIFO workers than in the normal population in Australia (Clifford, 2009; Parker et al., 2018). However, other studies suggest there is no statistical difference in alcohol intake between partners of rotation workers and partners of other types of employment and normal population (Cooke et al., 2019; Dittman et al., 2016).

A systematic review of the health and wellbeing of partners of FIFO workers (Asare et al., n. d.) indicated that available quantitative studies present inconsistent findings to understand the effects of FIFO work schedules on the health and well-being of partners of workers. Thus, more research is needed to examine the effects of FIFO work schedules on the health and well-being of partners of workers. Furthermore, there are limited studies (Cooke et al., 2019; Dittman et al., 2016) that have examined factors that predict the health and well-being of partners of FIFO workers. Assessing the factors that contribute to the health and well-being of families of FIFO workers could help to identify concerns for targeted interventions to support FIFO families and inform interventions aimed at improving the health and well-being of FIFO workers and their families. The present study is a cross-sectional study that was aimed at examining the mental and physical health and lifestyle behaviours of partners of FIFO workers and identifying the sociodemographic characters and FIFO work-related characteristics that are associated with their mental and physical health outcomes.

## Methods

### *Participants and recruitment*

Partners of FIFO workers aged 18 years and above in Australia were recruited to take part in the study. A sample size of 199 was estimated to detect, in paired samples *t*-tests, a small difference ( $d = 0.2$ ) between on-and off-shift days with 80% power. Also, we determine the sample likely to detect the prevalence of health outcomes based on the estimates of psychological distress. The estimate for psychological distress in the Australian population is 13% (Australian Bureau of Statistics, 2018b), but we assumed a slightly higher prevalence as we expected there may be higher distress levels in this population (Dittman et al., 2016); therefore, we used an estimate of at least 21%. Cochran's sample size formula, estimating a 21% rate with 95% confidence intervals ( $z = 1.96$ ) and 5% precision, generated a required sample of 255. Assuming 10% dropout, we aimed to recruit 280 participants. Three hundred and fifteen (315) partners of FIFO workers consented to take part in the survey; 67 were excluded due to incomplete data and 248 completed the full questionnaire and their data formed part of the analysis in this study.

Recruitment into the study was done by posting the study's advertising materials in FIFO work and/or partners' support groups on the social media platform Facebook periodically from July to December 2021. Advertising materials directed interested individuals to an online participants' information sheet and consent form. Participants were asked to complete a 10–15 minute online questionnaire developed and hosted on Qualtrics XM online survey platform (<https://www.qualtrics.com/au/>).

### *Data collection instrument and measures*

The online questionnaire consisted of adopted measures from validated instruments and replicated previous studies. Data were collected on the socio-demographic characteristics of participants (*age, sex, ethnicity, relationship status and duration, number of children, age of the youngest child, educational status, and employment status and job type*), and their partner's FIFO work characteristics (*FIFO occupational role, usual FIFO shift pattern, normal shift hours per day, number of consecutive days at work and at home, and the duration as a FIFO worker*).

The psychological distress of participants was assessed using the validated *Kessler Psychological Distress Scale-K10* (Kessler et al., 2002). K10 assesses the current level of psychological distress in the last 30 days using 10 items scored on a 5-point Likert scale of 1 (*none of the time*) to 5 (*all of the time*), with high internal consistency ( $\alpha = 0.93$ ) (Kessler et al., 2002). The total scores (range 0–50) were computed and the level of psychological distress was classified as *low* (10–15), *moderate* (16–21), *high* (22–29) and *very high* (30–50) (Kessler et al., 2002).

The physical component (PCS) scale of the validated Short-Form-8 (SF-8) Health Questionnaire (Ware et al., 2001) was used to measure the physical health status of participants in the last 4 weeks. The subscale of four items rated on a 5 and/or 6-point Likert scales, with retest reliability high (Cronbach's  $\alpha = 0.73$ ), was analysed in line with the recommendations by the authors to compute a total score (0–100): with a score of 50 and above suggesting better physical quality of life (Ware et al., 2001).

Sleep duration and sleep quality were assessed using an item each adopted from the *Pittsburgh Sleep Quality Index (PSQI)* (Buysse et al., 1989) and replicated previous study (Wilson et al., 2020). Participants self-reported the hours of actual sleep they usually get at night (sleep duration) during on-and off-shift days separately using the item: *'How many hours of actual sleep do you usually get at night during your partner's on-shift days (off-shift days)?'* Sleep duration was categorised into short sleep (<7 hours of sleep) and long sleep ( $\geq 7$  hours of sleep) (Hirshkowitz et al., 2015). Participants also self-rated their overall sleep quality typical of on-and off-shift periods separately using the item: *'How would you rate your overall sleep quality during your partner's on-shift days (off-shift days)?'* on a 4 Likert scale of 0 = *very good* to 3 = *very bad* (Buysse et al., 1989).

The risky use of alcohol during on-and off-shift days was assessed by completing the 3-item *Alcohol Use Disorders Identification Test-Concise (AUDIT-C)* (Bradley et al., 2007). The AUDIT-C, a short validated tool, enquires about the frequency of drinking, usual quantity per day, and frequency of heavy drinking on an occasion in the past 12 months and scored on a 5-point scale (0–4). Participants were asked separate AUDIT-C questions for on-and off-shift days (e.g. *'During your partner's on-shift days (off-shift days), how many standard drinks containing alcohol do you have on a typical day when drinking?'*) and a total scores (range 0–12) was generated separately for each period. Risky alcohol use was defined as a score of  $\geq 4$  among males (*sensitivity 0.86, specificity 0.89*) and  $\geq 3$  among females (*sensitivity 0.73, specificity 0.91*) (Bradley et al., 2007).

On smoking status, participants responded to whether they smoke and/or had ever smoked and were grouped into *never smoked, ex-smokers and current smokers*. Participants who were current smokers then reported the number of cigarettes usually smoked each day, separately for on-and off-shift periods using the item: *'How many cigarettes do you usually smoke per day during your partner's on-shift days (off-shift days)?'*

Physical activity during on-and off-shift days was assessed separately using the item: *'How many minutes per day do you usually do vigorous or moderate physical activities outside of work for at least 10 minutes at a time during your partner's on-shift days (off-shift days)?'* adopted from the International Physical Activity Questionnaire-short form (International Physical Activity Questionnaire, 1998). Engaging in at least 30 minutes of moderate-intensity or 20 minutes of vigorous-intensity physical activity per day is deemed adequate physical activity for health benefits (Haskell et al., 2007). Thus, in this study, participants reporting at least 30 minutes of moderate to vigorous physical activity were classified as engaging in adequate physical activity for health benefits.

Participants reported on the typical servings of vegetable and fruit intake each day, separately for on-and off-shift days using the item: *'How many servings of vegetables (fruits) do you usually eat each day during your partner's on-shift days (off-shift days)?'* on an 8 point response scale (1, 2 serves, 3, 4, 5, 6 serves or more, 7 less than one serve, 8 Don't eat fruit/vegetable) (Australian Bureau of Statistics, 2011). Participants daily intake of fruits and vegetable was classified as: adequate (two or more servings of fruits and five or more servings of vegetable) and inadequate (less than two servings of fruits and five servings of vegetable) (Australian Bureau of Statistics, 2018a).

Participants' Body Mass Index (BMI) were calculated using their self-reported weight (kg) and height(m) and categorised into: *underweight (BMI < 18.5), normal weight (18.5–24.9), overweight (25–29.9) and obese (BMI  $\geq 30$ )* (Australian Institute of Health and Welfare, 2020).

## Data analysis

Descriptive statistics including means, frequencies and proportions were done to explore the sociodemographic, FIFO-related characteristics, psychological distress, physical health and lifestyle behaviours (*sleep, alcohol consumption, smoking, physical activity, BMI, and fruit and vegetable intake*). Appropriately, paired *t*-tests and McNemar's test of proportions were done to examine the differences in lifestyle behaviours during on-and off-shift days. Using multiple logistic regressions, the sociodemographic and FIFO-related characteristics factors associated with the mental and physical health status of partners were examined. Reference group for categorical variable in the model were chosen based on the largest category for age, ethnicity, marital status, education, job, shift pattern, days spent at work and at home, and FIFO duration; and normative category for age of youngest child, employment status, alcohol, smoking, physical activity, BMI and shift hours (Grace-Martin, 2022).  $p < .05$  was set as the level of significance. The tolerance test was done to test the assumption of multi-collinearity and the Variance Inflation Factor (VIF) suggested no multi-collinearity (VIF ranging from 1.07 to 2.10). Data were analysed using STATA version 13 (StataCorp LP, College Station, Texas, USA).

## Results

### *Socio-demographic and partner's FIFO work characteristics*

A total of 248 participants were included in this study. The participants were on average  $36.8 \pm 8.7$  years (range 19–59), with approximately 57% aged 35 years or more. Most of the participants were females (98.8%), with a Caucasian/White ethnic background (87.9%). Most of them were married (70.6%), in a relationship with FIFO workers for 5 years and more (85.4%) and had children (83.1%). The youngest child was on average  $6.6 \pm 6.6$  years. More of the participants had attained a bachelor or postgraduate degree (38.3%) and had a part-time job (28.2%) or solely undertook house duties (27.8%) (Table 1).

Most of the participants indicated their partners had worked in FIFO work for 5 years and more (55.7%), worked in the maintenance/technician roles (31.9%), on rotation-mixture of day and night shifts (56.5%) or regular fixed day shifts (41.9%), and for 12 hours on average (70.1%). Additionally, most of the participants indicated workers usually spend 8–14 consecutive days at work (62.9%) and less than eight consecutive days at home (70.2%). Table 1 presents the socio-demographic characteristics of participants and their partners' FIFO work characteristics.

### *Health-related behaviours of partners during on-and off-shift FIFO work periods*

Table 2 presents the health-related behaviours of partners during on and off-shift FIFO work periods.

#### *Sleep duration and quality*

The participants reported an average sleep duration significantly higher during off-shift days compared to on-shift days ( $7.3 \pm 1.4$  hours vs  $6.4 \pm 1.3$  hours,  $p < .001$ ). A significantly



**Table 1.** Multiple logistic regression of personal and FIFO work-related characteristics associated with psychological distress and physical health status ( $N = 248$ ).

Parameters	Total <i>n</i> (%)	Very high/high psychological distress OR (95% CI)	Poor physical health OR (95% CI)
<i>Personal characteristics</i>			
<i>Age in years</i>			
<35	180 (43.6)	1	1
35–44	97 (39.1)	0.61 (0.27–1.36)	1.14 (0.34–3.80)
45+	43 (17.3)	0.88 (0.27–2.85)	0.93 (0.14–6.03)
<i>Ethnicity</i>			
Caucasian/White	218 (87.9)	1	1
Other	30 (12.1)	0.77 (0.30–1.94)	3.57 (0.96–13.22)
<i>Relationship status</i>			
Married	175 (70.6)	1	1
Civil partnership	6 (2.4)	0.80 (0.13–5.12)	0.42 (0.01–12.02)
De-facto/co-habiting	67 (27.0)	0.95 (0.42–2.17)	1.80 (0.56–5.73)
<i>Relationship duration (in years)</i>			
10+	146 (58.9)	1	1
5–9	66 (26.6)	0.58 (0.24–1.41)	2.33 (0.56–9.73)
1–4	36 (14.5)	1.30 (0.40–4.19)	1.16 (0.19–7.16)
<i>Age of youngest child (years)</i>			
None	42 (16.9)	1	1
<1	37 (14.9)	0.20 (0.06–0.68)*	2.01 (0.36–11.23)
1–5	76 (30.7)	0.63 (0.22–1.86)	0.29 (0.05–1.64)
6–11	46 (18.6)	0.48 (0.15–1.54)	1.72 (0.33–9.05)
12–17	35 (14.1)	1.05 (0.32–3.51)	0.40 (0.06–2.61)
18+	12 (4.8)	0.45 (0.08–2.39)	0.45 (0.03–6.65)
<i>Educational status</i>			
TAFE/College	86 (34.7)	1	1
Secondary education	51 (20.6)	1.04 (0.45–2.42)	1.37 (0.44–4.28)
Bachelor degree	68 (27.4)	0.48 (0.21–1.10)	0.36 (0.09–1.47)
Postgraduate degree	27 (10.9)	0.83 (0.28–2.42)	0.44 (0.06–2.98)
Trade/Apprentice/Other	16 (6.4)	0.76 (0.28–2.52)	0.23 (0.03–1.88)
<i>Employment status</i>			
Undertaking house duties	69 (27.8)	1	1
Working full-time	59 (23.8)	0.60 (0.23–1.54)	0.26 (0.06–1.07)
Working part-time	70 (28.2)	0.66 (0.28–1.55)	0.32 (0.08–1.47)
Self-employed	15 (6.1)	1.23 (0.31–4.82)	1.40 (0.20–9.81)
Student	15 (6.1)	0.12 (0.03–0.53)**	0.54 (0.05–5.28)
Other	20 (8.1)	0.34 (0.10–1.22)	0.87 (0.15–4.84)
<i>Smoking status</i>			
Non-smokers	124 (50.0)	1	1
Ex-smoker	82 (33.1)	1.19 (0.60–2.38)	0.99 (0.33–2.96)
Current smoker	42 (16.9)	1.60 (0.65–3.90)	2.98 (0.82–10.88)
<i>Alcohol intake</i>			
No	40 (16.1)	1	1
Yes	208 (83.9)	1.12 (0.50–2.53)	0.61 (0.19–1.98)
<i>Body mass index</i>			
Normal weight	85 (34.3)	1	1
Overweight	78 (31.4)	1.69 (0.78–3.64)	2.55 (0.76–8.53)
Obese	85 (34.3)	1.16 (0.56–2.39)	2.57 (0.79–8.32)
<i>Physical activity</i>			
Adequate	138 (55.7)	1	1
Inadequate	110 (44.3)	1.82 (0.97–3.39)	0.77 (0.29–2.04)
<i>FIFO worker's work characteristics</i>			
<i>Partner's FIFO role</i>			
Maintenance/Technician	79 (31.9)	1	1
Management/Administration/services	17 (6.9)	0.70 (0.19–2.63)	0.25 (0.02–3.21)
Professional	36 (14.5)	1.02 (0.41–2.54)	0.52 (0.13–2.14)
Production	15 (6.1)	1.46 (0.39–5.51)	0.65 (0.08–5.39)
Machinery operator and driver	46 (18.6)	1.25 (0.51–3.10)	0.86 (0.25–2.96)
Drilling/Construction/Labourer	34 (13.7)	2.26 (0.81–6.32)	0.17 (0.03–0.85)*

(Continued)



**Table 1.** Continued.

Parameters	Total n (%)	Very high/high psychological distress OR (95% CI)	Poor physical health OR (95% CI)
Other	21 (8.5)	2.46 (0.76–7.97)	0.14 (0.02–1.12)
Shift pattern			
Rotation shift (mixture of day/night shift)/ other	142 (57.3)	1	1
Regular shift (fixed day/fixed night)	106 (42.7)	0.75 (0.39–1.45)	0.82 (0.29–2.32)
Shift hours			
<12 hours	18 (7.3)	1	1
12+ hours	230 (92.7)	0.68 (0.20–2.30)	0.60 (0.09–4.11)
Consecutive days spent at work			
<8 days	25 (10.1)	0.71 (0.26–1.91)	0.47 (0.08–2.88)
8–14 days	156 (62.9)	1	1
15+ days	67 (27.0)	1.39 (0.59–3.25)	2.92 (0.86–9.85)
Consecutive days spent at home			
<8 days	174 (70.2)	1	1
8–14 days	54 (21.8)	1.08 (0.49–2.37)	0.74 (0.22–2.50)
15+ days	20 (8.0)	1.30 (0.33–5.19)	0.25 (0.02–3.34)
FIFO lifetime duration			
<3 years	84 (33.9)	1	1
3–4 years	54 (21.8)	0.85 (0.35–2.09)	0.13 (0.03–0.60)**
5–9 years	56 (22.5)	1.09 (0.41–2.93)	0.20 (0.04–0.99)*
10+ years	54 (21.8)	1.24 (0.42–3.66)	0.20 (0.03–1.25)

Note: Reference category: used largest category for age, ethnicity, marital status, education, job, shift pattern, days spent at work and at home, and FIFO duration; and normative category for age of youngest child, employment status, alcohol, smoking, physical activity, BMI and shift hours.

\* $p < .05$ ; \*\* $p < .01$ .

higher proportion of the participants reported 7 or more hours of sleep duration during off-shift than on-shift days (69.3% vs 45.6%,  $p < .001$ ). Likewise, a significantly higher proportion of partners indicated their sleep quality as fairly good or very good during off-shift as compared to on-shift days (73.0% vs 54.8%,  $p < .001$ ).

### **Smoking and alcohol intake**

Approximately seventeen per cent of the participants indicated to be current smokers; smoking on average more cigarettes per day during on-shift days than on off-shift days ( $13.1 \pm 8.2$  vs  $11.6 \pm 7.6$ ,  $p = .034$ ). A high proportion of participants (83.9%) reported to consume alcohol. Similar proportions of participants were found to consume alcohol at risky levels during on- and off-shift days (69.8% vs 70.6%,  $p = .500$ ).

### **Fruits and vegetable intake**

With regards to fruits and vegetable intake, partners indicated to consume  $2.5 \pm 1.4$  serves of vegetables per day during on-shift periods and  $2.4 \pm 1.3$  serves during off-shift days ( $p = 0.123$ ). Similar proportions of them reported consuming the recommended five or more serves per day during on-and off-shift days (7.3% vs 4.4%,  $p = .167$ ). Likewise, partners reported consuming similar portions of fruits during the workers' on-and off-shift days ( $1.6 \pm 1.1$  serves per day); with similar proportions consuming two or more serves per day during the on-and off-shift days (46.4% vs 42.7%,  $p = .272$ ).

**Table 2.** Health status and related behaviours of partners of FIFO workers ( $N = 248$ ).

Health indicators	On-shift days	Off-shift days	Test statistics	$p$ -value
Sleep duration	6.4 ± 1.3 hours	7.3 ± 1.4 hours	-7.8614	<b>&lt;.001*</b>
<7 hours	135 (54.4)	76 (30.7)	33.80	<b>&lt;.001<sup>‡</sup></b>
7+ hours	113 (45.6)	172 (69.3)		
Sleep quality				<b>&lt;.001<sup>‡</sup></b>
Fairly good/very good	136 (54.8)	181 (73.0)	21.32	
Fairly bad/very bad	112 (45.2)	67 (27.0)		
Alcohol intake				
Non-risky	75 (30.2)	73 (29.4)	2.00	.500 <sup>‡</sup>
Risky	173 (69.8)	175 (70.6)		
Smoking	$n$ (%)			
Non-smokers	124 (50.0)			
Current smokers	42 (16.9)			
Ex-smokers	82 (33.1)			
Number of cigarettes smoked per day	13.1 ± 8.2	11.6 ± 7.6	2.2000	<b>.034*</b>
Vegetables intake (serves per day)	2.5 ± 1.4	2.4 ± 1.3	1.5463	.123*
<5 serves	230 (92.7)	237 (95.6)	2.58	.167 <sup>‡</sup>
5 + serves	18 (7.3)	11 (4.4)		
Fruits intake (serves per day)	1.6 ± 1.1	1.6 ± 1.1	0.8111	.418*
<2 serves	133 (53.6)	142 (57.3)	1.53	.272 <sup>‡</sup>
2+ serves	115 (46.4)	106 (42.7)		
Moderate/vigorous physical activities	32.6 ± 33.9 mins	32.2 ± 31.6 mins		.869*
Inadequate	110 (44.3)	110 (44.3)	0.00	1.000 <sup>‡</sup>
Adequate	138 (55.7)	138 (55.7)		
Body mass index	$n$ (%)			
Underweight	2 (0.8)			
Normal/health weight	83 (33.5)			
Overweight	78 (31.4)			
Obese	85 (34.3)			
Physical health status				
Poor	37 (14.9)			
Good	211 (85.1)			
Psychological distress				
Low risk	71 (28.6)			
Moderate risk	52 (21.0)			
High risk	76 (30.6)			
Very high risk	49 (19.8)			

\* $p$  value from paired  $t$ -test; <sup>‡</sup>Exact McNemar significance probability; Bold significant at  $p < .05$ .

### **Physical activity and body mass index**

The same proportion of partners undertook moderate-to-vigorous physical activity of at least 30 minutes (55.7%) or less (44.3%) per day during the on-and off-shift days. The overall average BMI reported by partners was  $28.8 \pm 6.5 \text{ Kg/m}^2$  and 31.4% classified as overweight and 34.3% as obese.

### **Physical health and psychological distress**

The physical health and psychological distress of partners are outlined in Table 2. The majority of the partners were classified as having good physical health (85.1%). A combined 50.4% of partners reported a high (30.6%) or very high (19.8%) risk of psychological distress.

### **Personal and FIFO work-related characteristics associated with physical health and psychological distress**

The results of multiple logistic regression are outlined in Table 1. The results showed participants whose partners worked in drilling/construction/labourer roles compared to

working in maintenance/technician roles (OR = 0.17, 95% CI = 0.03–0.85) and had worked in FIFO arrangements for 3–5 years (OR = 0.13, 95% CI = 0.03–0.60) and 5–9 years (OR = 0.20, 95% CI = 0.04–0.99) compared to less than 3 years had reduced odds of experiencing poor physical health.

The odds of experiencing high to very high psychological distress were lower among partners who had children aged less than 1 year compared to those without children (OR = 0.20; 95% CI = 0.06–0.68) and those who were students compared to partners who solely undertake housework (OR = 0.12; 95% CI = 0.03–0.53). There were no significant associations between FIFO work-related characteristics and psychological distress (Table 1).

## Discussion

### *Main findings*

This study aimed to examine the mental and physical health and health-related behaviours of partners of FIFO workers in Australia. Partners of FIFO workers reported shorter sleep duration, poorer sleep quality and smoking more cigarettes during workers' on-shift days. Partners of FIFO workers consumed fewer fruits and vegetables, engaged in inadequate moderate-to-vigorous physical activities and drank alcohol at risky levels across on-and off-shift periods. A high proportion of partners reported good physical health status, but the risk of psychological distress was high among partners.

### *Sleep and health-related behaviours*

The study found sleep duration during off-shift days to be higher than on on-shift days. Furthermore, study results found that sleep duration during on-shift days ( $6.4 \pm 1.3$  hours) was shorter than the suggested seven or more hours a night (Hirshkowitz et al., 2015). These findings are partly in contrast to an earlier study, which reported no differences in partners' sleep durations during on-and off-shift days but reported an average sleep duration of  $6.9 \pm 1.6$  hours among partners when workers are away at work, comparably low as reported in our study (Wilson et al., 2020).

Our study found more partners during on-shift days experienced poorer sleep quality than during off-shift days. This finding is consistent with the findings of prior research, which found that sleep quality was poorer during workers' on-shift periods (Rebar et al., 2018; Wilson et al., 2020). In the absence of workers, partners take up additional and multiple household roles (Gardner et al., 2018; Parkes et al., 2005) increasing the demands on them, leading to inter-role conflicts (Greenhaus & Beutell, 1985), which is indicated to be associated with short sleep duration and poorer sleep quality (Buxton et al., 2016; Crain et al., 2014). Additionally, the absence of workers from home may impact the partners' sense of security, comfort and shared assurances that could be provided by sleeping together with the partner (Hislop, 2007).

The study found about 17% of partners were current smokers, this is similar to another study (Clifford, 2009). This rate is higher than the 10.4% reported among females and 11.2% reported among adults in the Australian overall populace (Australian Institute of

Health and Welfare, 2021c). Again, partners smoked more cigarettes per day during FIFO workers' on-shift days than on off-shift days, which is in line with the findings of a daily study in Australia (Rebar et al., 2018). High stress is indicated to be an important factor contributing to smoking (Lawless et al., 2015; Stubbs et al., 2017), particularly in females (Lawless et al., 2015). The partners of FIFO workers, most of whom were female in our study, are indicated to experience increased stress (profound in the absence of workers), for instance, from the recurrent adjustment to the presence and absence of workers which comes with changes to roles and disruption to lifestyles (Gardner et al., 2018; Mayes, 2020; Parkes et al., 2005). These stressors could potentially increase the urge to smoke cigarettes among partners (Rebar et al., 2018), and may explain why smoking prevalence is higher in partners of FIFO workers than in the overall populace and partners smoke more during on-shift days. The daily cigarettes smoked during on- and off-shift days were on average compared to the rates reported for adult females and the general smoking population in Australia (12.9 cigarettes per day) (Australian Institute of Health and Welfare, 2021c).

Our study also found high proportions of partners (83.9%) consume alcohol, and that is comparable to the 85.9% previously documented among partners of FIFO workers (Clifford, 2009). The use of alcohol is reportedly high in the general Australian population, where about 77% of the population aged 14 and above report drinking at least a serve of alcohol in the last 1 year (Australian Institute of Health and Welfare, 2021a). Furthermore, a high proportion of partners consumed alcohol at risky levels during on-shift days (69.8%) and off-shift days (70.6%), higher than rates reported for drinking at long-term risk (16.8%) and short-term risk (25%) in the overall Australian populace (Australian Institute of Health and Welfare, 2021a). A previous study has documented similar findings of higher proportions of partners of FIFO workers consuming alcohol at long-term (37.8% vs 10.3%) and short-term (32.9% vs 17.5%) risk levels compared to population norm (Parker et al., 2018). FIFO workers also consume alcohol at higher levels than the general population (Dittman et al., 2016; Parker et al., 2018) and other workgroups (Joyce et al., 2013). With alcohol drinking often indicated as a social experience (Morris et al., 2020), and the level of alcohol consumption in partners documented to be associated with that of their spouses (Polenick et al., 2018), may account for the high levels of alcohol consumption observed among partners in our study.

Furthermore, the levels of consumption of alcohol during on- and off-shift days were similar. This contradicts the findings of a daily study, which found that partners consume more alcohol when workers are at home (Rebar et al., 2018). The observed differences could be attributed to the difference in measurements and study designs where the previous study employed longitudinal daily assessments as compared to the snap shoot assessment employed in our study. The findings of high levels of smoking and alcohol consumption in our study suggest the need for interventions aimed at addressing smoking and alcohol consumption in workers to be extended to their families who are also affected by the stressors of FIFO lifestyles.

Our study found the average serves of fruits and vegetable intake among partners were below the recommended daily requirements of two or more serves of fruits and five or more serves of vegetable intake per day (Australian Bureau of Statistics, 2018a). The proportions of partners found to meet the daily requirement of fruits intake during on-shift (46.4%) and off-shift (42.7%) days were lesser than the 51.3% found in the

overall adult Australian population (Australian Bureau of Statistics, 2018a). Concerning vegetable intake, a lower proportion of partners during off-shift days (4.4%) met daily requirements than the reported 7.5% in the overall Australian populace (Australian Bureau of Statistics, 2018a). A previous daily study has found FIFO families (workers and partners) to consume food of limited nutritional quality (Rebar et al., 2018). It has been suggested that increased stress from the demands of FIFO lifestyle may limit the choices and prioritisation of healthy food among FIFO families (Rebar et al., 2018), as an increase in stress promote the intake of unhealthy foods while reducing the intake of healthy foods (Hill et al., 2021).

The study also found partners to engage in physical activity for on average more than 30 minutes per day, but four in nine partners engaged in moderate-to-vigorous physical activity lasting for less than 30 minutes per day during the on-and off-shift days. A previous daily study has also found FIFO families engage in an average of more than 30 minutes of exercise per day with very much day-to-day variation (Rebar et al., 2018). The increase in demands of FIFO lifestyles on partners (Gardner et al., 2018) has been suggested to limit the time needed for leisure-time physical activities particularly when workers are away at work (Rebar et al., 2018). However, we found no difference in the average minutes spent or the proportion of partners who participate in moderate-to-vigorous physical activity for not less than 30 minutes per day during the on-and off-shift days. Likewise, the intake of fruits and vegetables were similar during on-and off-shift days. These findings contradict the findings of a previous daily study where partners reported less exercise time and poorer nutrition quality during on-shift days than off-shift days (Rebar et al., 2018). The differences seen may well be ascribed to the variances in measurements and designs between the previous longitudinal daily assessments and our snap cross-sectional study.

Our study found about two-thirds of participating partners (65.7%) were overweight or obese. Comparable findings have been reported among the general adult Australian population where 67% of the population were overweight or obese (Australian Institute of Health and Welfare, 2020). The rates of overweight and obesity are generally increasingly high in the adult population in Australia (Huse et al., 2018; Keramat et al., 2021). In Australia, high BMI is indicated as the second prominent contributing factor of disease burden (Australian Institute of Health and Welfare, 2021b), and is associated with increased risk of non-infectious diseases, such as cardiovascular diseases (World Health Organization, 2021) and productivity losses (Keramat et al., 2020). Our study findings, therefore, emphasise the need for continuous efforts in addressing the high overweight and obesity rates in FIFO workers' partners and the overall Australian populace. Particularly in FIFO partners, efforts could be geared toward assisting them to adapt to and cope well with the demands/stressors of FIFO lifestyles to reduce stress and encourage increased consumption of fruits and vegetables and uptake of regular physical activity (World Health Organization, 2021).

### ***Physical health and psychological distress***

The study found a high proportion of partners (85.1%) were classified as having good physical health status. Similarly, a previous daily study has found the daily intake of medication for physical health impairments among partners' as rare (Rebar et al., 2018).

Another study has also found partners of rotation off-shore workers to report similar physical health status as partners of non-rotation on-shore workers (Taylor et al., 1985). Most FIFO families are suggested to be self-selected people who choose and remain in FIFO work, and as such tend to develop resilience and strive to deal with the stresses and challenges of FIFO work (Cooke et al., 2019; Parkes et al., 2005).

However, our study has showed that more partners experience psychological distress (50.4%) at levels higher than reported among females (14.5%) and the general (13.0%) population in Australia (Australian Bureau of Statistics, 2018b). Our finding is comparable to that of a previous study, which found a higher prevalence of high psychological distress among partners than in the general population (Lester et al., 2015). Another study has also documented higher levels of depression, anxiety, and stress among partners than in partners of non-FIFO workers (Dittman et al., 2016). Qualitative studies have highlighted the increased demands from the additional and multiples roles in the absence of the FIFO workers (Gardner et al., 2018; Parkes et al., 2005) and the emotional demands of and the difficulty adjusting to recurrent 'partings and reunions' (Parkes et al., 2005) as some of the stressors that increase distress among partners. The increasing demands on partners may result in *inter-role conflicts* (Greenhaus & Beutell, 1985), which are indicated to give rise to stress-related outcomes (Allen et al., 2000 Greenhaus & Beutell, 1985;) including psychological strains and depressive symptoms (Allen et al., 2000). Again, partners are frequently separated from their romantic partners over a period of time and in line with the Attachment Theory, such separations threaten the attachments or the emotional bonds between the partners, which foster trust and the sense of security, leading to the experiences of distress (Bowlby, 1980).

It should also be noted that the ongoing COVID-19 pandemic and associated social/travel restrictions have impacted negatively on health-related behaviours (Gravelly et al., 2021; Stanton et al., 2020) and contributed to widespread increase psychological distress in the general population (Fisher et al., 2020; Rossell et al., 2021). This could also contribute to the observed high prevalence of psychological distress and risky health-related behaviours in partners. In Australia, several FIFO workers travel interstate and abroad for work (Lester et al., 2015) and COVID-19 restrictions, border closures and quarantines across the states have resulted in some FIFO workers being separated from their families for a prolonged period.

Our study found partners of FIFO workers working in construction/labourer roles compared to working in maintenance/technicians were less likely to report poor physical health. A study has found construction workers in Australia to have better physical health and suggested to be attributed to their younger age (Lingard & Turner, 2015). It has been indicated that the strains experienced by FIFO workers could also affect the physical well-being of their spouses (Parkes et al., 2005). Our results also revealed poor physical health was less likely in partners of FIFO workers who had worked in FIFO arrangements for 3–9 years compared to working for less than 3 years. It has been established that the longer the duration workers spend in FIFO work arrangements the more their partners develop strategies to adopt to the physical and emotional demands of FIFO lifestyle (Parkes et al., 2005).

Partners who were students were less likely to report higher psychological distress compared to partners who solely undertook house duties. Strategies including being in employment and increasing social interactions have been highlighted to help partners

cope with loneliness and distress in the absence of the worker (Parkes et al., 2005). Being employed outside of the home and/or being a student may promote positive social interactions and help partners mitigate the experiences of stress in the absence of the worker, thus, helping promote their health and well-being. The odds of experiencing high psychological distress were lower among partners who had children aged less than 1 year compared to those without children. Having children at home has been indicated to keep partners occupied and assist to overcome loneliness and distress in the absence of their worker partners (Parkes et al., 2005; Pini & Mayes, 2012). However, qualitative studies have highlighted the difficulties and distress of childcare and having to raise children alone in the absence of workers (Gardner et al., 2018; Whalen & Schmidt, 2016). Another study has indicated that some partners without children get the chance to engage in increased social interactions in the absence of the workers (Mayes, 2020). Further studies are needed to explore the impact of children on the health and well-being of partners of FIFO workers.

Our study found no significant associations between FIFO work characteristics and psychological distress. Another study has also found work-related characteristics, such as FIFO workers' job roles, not to be associated with perceived stress in partners (Cooke et al., 2019). However, other studies have highlighted FIFO work-related factors including job type, roster/shift pattern, shift length and work hours per week to influence the well-being of partners (Sibbel, 2010), and determine the behavioural problems of their children (Dittman et al., 2016). Additional studies are needed with larger sample sizes to further examine the influence of FIFO work characteristics on the health and well-being of partners of FIFO workers.

### ***Strength and limitations***

This study contributes to the limited literature examining the health and health-related behaviours of partners of FIFO workers during the on-and off-shift periods and factors associated with these health outcomes. The study's limitations include the use of cross-sectional design and self-reported health outcomes and related behaviours data, which could be under- or over-estimated. The study is also limited by the larger incompleteness (dropout) rate than was expected. This reduced the precision of our estimated rates of the health outcomes. Nonetheless, the sample size estimated to detect small differences between on- and off-shift at a power of 80% was exceeded. There are usually higher dropout rates with online surveys, where participants have indicated they may be more easily distracted and the relative anonymity of the researcher may lead to higher risk of dropout (Dandurand et al., 2008). Furthermore, the study used snowballing procedures in engaging study participants, which may possibly present samples not typical of the FIFO partners' population and self-selection bias where the partners who were either positively or negatively affected by FIFO lifestyle may select to take part or not to take part in the study. The study sample of more Caucasian/White, female, and being educated reflects that of previous studies (Lester et al., 2015; Parker et al., 2018). The study involved only partners with comparisons of health outcomes and related behaviours made to Australian norms secondary data; assessing partners of workers on standard work schedules may enable for a more direct evaluation of the differences in the groups.



## Conclusions

The partners of FIFO workers showed short sleep duration and poorer sleep quality when workers were on-shift. The study also found that partners of FIFO workers smoked more, drank more alcohol and at risky levels, consumed fewer fruits and vegetables, and engaged in less than 30 minutes of moderate-to-vigorous physical activity as compared to recommended guidelines and the general Australian population. Apart from sleep and smoking, there were no significant differences in partner's health-related behaviours found during the on-and off-shift days of the workers' roster cycle. This study has found that a high proportion of partners had good physical health status, but levels of psychological distress were significantly higher than the Australian population norms. No FIFO work-related characteristics were found to be associated with the partners' physical health and psychological distress. Interventions could target assisting multiple health behaviour changes and reducing psychological distress by supporting partners to adapt to and cope with the demands/stressors of FIFO lifestyles, particularly in the absence of workers. Further studies should explore how behaviour change interventions can positively impact on health and wellbeing of partners of FIFO workers and their families. In order to understand changing nature of FIFO work, further studies also need to investigate how day-to-day fluctuations in psychological and contextual variables change over time and how to best implement just-in-time adaptive interventions that can support FIFO workers and their partners.

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## Data availability statement

The data that support the findings of this study are available on request from the corresponding author, [BYAA]. The data are not publicly available due to ethical restrictions and privacy issues.

## Disclosure statement

No potential conflict of interest was reported by the author(s).

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