



# Health behaviours and outcomes associated with fly-in fly-out and shift workers in Western Australia

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public health, population surveillance, occupational health.

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## Abstract

**Aims:** To examine the association of health behaviours and outcomes with employment type in the West Australian adult population.

**Methods:** Cross-sectional study of employed adults aged 16 years and over using self-reported information collected in the WA Health and Wellbeing Surveillance System between 2008 and 2010. A total of 380 fly-in fly-out (FIFO) workers, 913 shift workers and 10 613 workers of other employment types were identified.

**Results:** FIFO workers exhibited similar health behaviours to shift workers but had a different sociodemographic profile. Compared with other employment types, FIFO workers were significantly more likely to be current smokers, drink alcohol at risky levels, and be overweight or obese, after adjusting for age, sex and survey sampling strategies. They were less likely to report current mental health problems.

**Conclusions:** Self-reported health behaviours of FIFO workers differ from other employment types. FIFO workers are expected to increase in number over the next decade, as the mining and resources sector expands in Australia. Our findings suggest that health interventions, whether in the workplace or clinical settings, need to be informed by the demographic mix of the cohort of workers on entry as they are not a homogenous group, and targeted towards specific employment patterns (length of shifts and type of employment) to improve their current and future well-being.

## Introduction

The work environment in Australia has changed dramatically over recent years because of globalisation and changing market conditions. As a result, there is greater diversification in the arrangement of working hours with increasing numbers of people employed in non-conventional settings including shift work, which refers to work conducted outside of normal working hours (e.g. 9 am–5 pm), and fly-in fly-out (FIFO) work, which is now a common method for operating mines in Australia.

Western Australia is the largest mining state in Australia with over 545 commercial mining projects and sales worth over \$100 billion.<sup>1</sup> It is estimated that over 100 000 people are directly employed in the WA mining industry<sup>1</sup> and approximately 72% of those who work directly in this industry work outside Perth all or some of the time.<sup>2</sup> The resources boom, and strong mining industry has also led to the emergence of the FIFO work

schedule, an arrangement that can involve work for up to 10–12 h per day on a remote mine site for between 1 and 6 weeks at a time. FIFO workers live and work at the mine site for a set period of time then return to their homes in between rosters.

However, there is limited literature examining the impact that FIFO commuting and lifestyle can have on an individual's overall health and well-being. To date, published research has focussed on the impact of this work type on relationships with family, friends and loved ones<sup>3–5</sup> rather than other health behaviours and outcomes, and none has included a comparison group in their analyses.

Several studies have been undertaken to look at the possible health effects of shift work. These studies have found that shift work can disrupt sleep patterns,<sup>6</sup> lead to depression and poor mental health,<sup>7,8</sup> and increase the risk of peptic ulcers and cardiovascular disease<sup>9,10</sup> as well as type 2 diabetes.<sup>10</sup> This type of employment remains common in Australia with an estimated 1.4 million Australians employed in shift work in 2009.<sup>11</sup>

Our study aims to document, for the first time, the health behaviours and outcomes associated with different

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employment settings in a WA context using data from a population-based health and well-being surveillance system.

## Materials and methods

### Data collection

The WA Health and Wellbeing Surveillance System (HWSS) is a population-based continuous data collection system that uses computer-assisted telephone interviews to collect information from a random sample of the West Australian population every month. The response rate for the HWSS is consistently above 80%, which provides strong evidence that the estimates produced are reliable and representative of the general population.<sup>12</sup>

This dataset was used to obtain information on self-reported sociodemographic variables, health behaviours and chronic health outcomes for adult respondents aged 16 years and over, who reported that they were employed, for 2008–2010.

Data collection and reporting were approved by the WA Department of Health Research Ethics Committee.

### Variables

Identification of FIFO, shift work or other employment type was derived from several employment questions in the survey. Initially, all individuals confirmed if they were self-employed or employed for wages, salary or payment in-kind. Respondents were then asked if they work FIFO or do some form of work that takes them away from home for a set period each week or month. Respondents who reported working FIFO were then directed to the sociodemographic module. Individuals who did not report working FIFO were further asked if they were a shift worker before completing the sociodemographic module. Persons who identified themselves as employed but not as being employed in FIFO or shift work were classified as 'other employment types'.

Health behaviour information collected included self-reported smoking status, levels of physical activity during leisure time and work, fruit and vegetable serves usually eaten per day, alcohol consumption, and height and weight measurements. A body mass index (BMI) was derived from these figures by dividing weight (kg) by height (m) squared after adjustment for errors in the self-reported height and weight.<sup>13</sup> BMI were classified as not overweight (BMI < 25) or overweight/obese (BMI ≥ 25).

Health outcome information included self-reported chronic health conditions that had ever been diagnosed by a doctor.

### Statistical analysis

Data analysis used survey procedure functions in SAS Enterprise Guide version 4.2 (SAS Institute Inc, Cary, NC, USA) that take into account the differential probability of survey selection and permit weighting of the data to provide adjusted standard errors and binomial confidence intervals (CI) and Chi-squared test results. Data were weighted for oversampling of non-metropolitan areas and adjusted to the 2009 age and sex distribution of the estimated resident population for WA.<sup>14</sup> This allows extrapolation of the findings to the broader WA population. The responses 'unsure' and 'refused to answer the question' were excluded from the analysis. These categories and missing values comprised <3% of answers for all variables, except BMI where it made up 7% of all responses, and therefore were unlikely to affect estimates.

## Results

### Demographics

Based on our sample of 11 906 WA residents and after adjustment for age, sex and sampling strategy, the weighted prevalence estimates indicate that 4.4% (95% CI 3.8–5.0) of the adult, employed population in WA are FIFO workers, 7.4% (95% CI 6.7–8.1) are shift workers and the remaining 88.2% (95% CI 87.3–89.1%) are in other forms of employment.

The ratio of FIFO workers to shift workers was 1:1.7, and the ratio of FIFO workers to other forms of employment was 1:20 for the period 2008–2010.

The social and demographic characteristics differed between the three employment types (Table 1). A higher proportion of FIFO workers was male and aged between 25 and 44 years compared with both shift workers and other employment types.

Shift workers were significantly more likely to be from the most disadvantaged socioeconomic areas and to reside in non-metropolitan areas.

### Employment characteristics

FIFO workers were significantly more likely to work in jobs that require heavy labour and/or physically demanding work (25.6%, 95% CI 19.6–31.6%) compared with other employment types (16.5%, 95% CI 15.4–17.5%). However, many FIFO workers still spend most of their work day sitting (36.5%, 95% CI 29.8–43.2%). FIFO workers worked the longest mean hours per day out of the three employment types (11.4 h, FIFO worker; 9.7 h, shift worker; 7.5 h, other employment types).

**Table 1** Demographic characteristics by employment type

Demographic characteristic	Fly-in fly-out workers % (95% CI)	Shift workers % (95% CI)	Other employment types % (95% CI)
Gender			
Male	88.5 (83.4–92.6)	65.6 (61.3–69.9)	54.2 (52.8–55.6)
Female	11.5 (7.4–15.7)	34.4 (30.1–38.7)	45.8 (44.4–47.2)
Age (years)			
16–24	4.9 (1.9–8.0)	16.7 (12.9–20.6)	13.4 (12.3–14.4)
25–44	60.6 (54.0–67.1)	48.3 (43.4–53.1)	46.3 (44.9–47.7)
45+	35.5 (28.4–40.6)	35.0 (28.4–40.6)	40.4 (39.1–41.6)
Marital status			
Married/de facto	72.2 (65.4–79.0)	62.9 (58.2–67.7)	69.7 (68.4–71.0)
Widowed	N/A	1.4 (0.7–2.0)	1.0 (0.8–1.2)
Divorced/separated	6.4 (3.6–9.2)	7.1 (5.2–8.9)	6.5 (6.0–7.0)
Never married	20.8 (14.2–27.5)	28.6 (23.9–33.3)	22.8 (21.5–24.1)
Living arrangement			
Living with family	12.3 (7.2–17.4)	22.9 (18.4–27.4)	19.4 (18.1–20.6)
Living with friends	3.3 (0.5–6.1)	4.0 (1.6–6.3)	3.0 (2.4–3.7)
Living with a partner and children	40.1 (33.1–47.1)	32.7 (28.2–37.1)	37.8 (36.5–39.1)
Living with a partner but no children	28.8 (22.7–34.8)	28.5 (24.4–32.7)	29.9 (28.7–31.1)
Other living arrangements	11.0 (7.3–14.8)	9.9 (7.9–11.9)	8.8 (8.2–9.4)
Education			
Less than year 10	1.9 (0.4–3.4)	1.9 (1.0–2.9)	2.1 (1.8–2.5)
Year 10 or 11	12.4 (7.6–17.2)	11.3 (8.6–14.0)	13.2 (12.4–14.1)
Year 12	8.6 (4.9–12.3)	11.9 (8.7–15.1)	13.3 (12.3–14.3)
Tafe/trade qualification	52.0 (44.9–59.2)	55.0 (50.2–59.8)	42.0 (40.7–43.4)
Tertiary degree or equivalent	25.1 (18.3–31.9)	19.9 (15.7–24.0)	29.3 (28.0–30.6)
Area of residence			
Metropolitan	80.4 (76.6–84.2)	68.1 (64.6–71.7)	77.4 (76.9–77.9)
Non-metropolitan	19.6 (15.8–23.4)	31.9 (28.3–35.4)	22.6 (22.1–23.1)
Socioeconomic indexes for areas			
Quintile 1 (most disadvantaged)	9.1 (5.3–12.9)	17.9 (14.1–21.8)	11.2 (10.5–12.0)
Quintile 2	19.2 (13.5–24.8)	16.7 (13.4–19.9)	17.3 (16.2–18.3)
Quintile 3	16.2 (11.6–20.8)	21.3 (17.4–25.2)	18.9 (17.8–20.0)
Quintile 4	29.8 (22.9–36.7)	28.8 (24.3–33.3)	26.5 (25.3–27.7)
Quintile 5 (most advantaged)	25.8 (19.5–32.0)	15.4 (12.1–18.6)	26.1 (24.9–27.3)

CI, confidence interval; N/A, unable to calculate because of numbers <5.

## Health behaviours

Table 2 shows the health behaviours for each group; FIFO and shift workers were generally similar but differed to other employment types. In particular, they were more likely to be current smokers and drink at high-risk levels for long-term harm and short-term harm. In addition, FIFO workers were more likely to be classified as overweight or obese when compared with other employment types.

FIFO workers reported drinking a significantly higher mean number of drinks on a drinking day than other employment types (4.2 drinks compared with 3.4 drinks) and reported a higher mean number of drinking days than both shift workers and other employment types (3 days per week compared with 2 and 2.3 days respectively).

## Health outcomes

FIFO workers had a lower self-reported prevalence of current mental health problems compared with shift workers and other employment types. Shift workers were significantly more likely to report having an injury in the past 12 months than other employment types (Table 3).

## Discussion

Individuals classified as FIFO workers were significantly more likely than workers in other employment types to engage in risky health behaviours, including smoking and drinking excess levels of alcohol, as well as being more likely to be overweight or obese. Shift workers were similar to FIFO workers with regard to most of their

**Table 2** Health behaviours by employment type

Health behaviour	Fly-in fly-out workers % (95% CI)	Shift workers % (95% CI)	Other employment types % (95% CI)
Currently smokes	26.7 (20.5–33.0)†	25.0 (20.9–29.0)†	17.4 (16.3–18.5)
Insufficient physical activity	40.4 (33.5–47.4)	49.1 (44.3–53.9)	46.2 (44.8–47.6)
Insufficient fruit consumption	48.9 (41.7–56.1)	50.6 (45.8–55.5)	47.7 (46.3–49.1)
Insufficient vegetable consumption	87.7 (82.9–92.5)	89.6 (86.6–92.6)	87.9 (87.1–88.8)
Consumes more than two alcoholic drinks per day (high risk for long-term harm)	64.7 (57.5–71.9)†	59.0 (53.7–64.3)†	50.9 (49.4–52.4)
Consumes more than four alcoholic drinks per day (high risk for short-term harm)	29.8 (22.8–36.8)†	30.2 (25.1–35.2)†	21.5 (20.2–22.9)
Overweight or obese	79.3 (73.2–85.5)†	72.1 (67.5–76.8)	68.0 (66.7–69.4)

†Denotes where prevalence is significantly higher. compared with other employment types using  $\chi^2$  statistic,  $P < 0.01$ . CI, confidence interval.

health behaviours but differed in terms of their demographics. In particular, FIFO workers were more likely to be male, reside in the Perth metropolitan region and have a higher socioeconomic status. It is possible that women are less likely to be attracted to a FIFO schedule than shift work in general because of child-bearing or other family responsibilities, as it would keep them away from home for extended periods of time.

FIFO workers were also more likely to be overweight or obese than shift workers. The cross-sectional study design prevents definitive causal inferences being made, but one important distinction between these two groups is that FIFO workers are more likely than shift workers to have the majority of their meals prepared for them. It is also worth noting an additional limitation of the study, namely the self-reported nature of health status that may introduce measurement error, particularly around BMI. To combat this, correction equations were applied to the data to improve the reliability of the estimates.<sup>13</sup>

FIFO workers had a lower self-reported prevalence of current mental health problems compared with other

employment types, a somewhat unexpected finding given the extended periods of isolation from family and friends associated with FIFO work, and medical professional reports of significant relationship and mental health issues.<sup>15</sup> At the very least, we need better longitudinal data on this issue and cannot assume that FIFO workers as a group have overall worse mental health. For example, it is at least plausible that our findings may reflect a degree of self-selection by workers to enter this type of employment, where knowledge of the worksite characteristics attracts individuals who are prepared to endure the working conditions, and thus were always more likely to have a lower prevalence of mental health conditions. This 'healthy hire' effect has been noted previously in the mining industry in a study by Petsonk *et al.*, which demonstrated that miners had better respiratory function than non-miners despite higher exposure to occupational factors that can impact upon lung health.<sup>16</sup> The cross-sectional nature of the analysis precludes further examination of this association.

**Table 3** Prevalence of health outcomes by employment type

Health outcomes	Fly-in fly-out workers % (95% CI)	Shift workers % (95% CI)	Other employment types % (95% CI)
Heart disease	2.3 (0.6–3.9)	2.1 (1.1–3.1)	2.6 (2.2–3.0)
Stroke	N/A (N/A)	0.4 (0.0–0.7)	0.6 (0.4–0.7)
Current asthma	6.4 (3.0–9.8)	11.9 (8.4–15.3)	8.6 (7.8–9.4)
Current respiratory condition other than asthma	0.7 (0.1–1.2)	0.7 (0.1–1.3)	1.2 (0.1–1.4)
Arthritis	10.5 (7.0–14.0)	12.2 (9.5–14.9)	14.4 (13.5–15.2)
Osteoporosis	0.6 (0.1–1.2)	2.1 (1.0–3.2)	2.0 (1.7–2.4)
Cancer (excluding skin cancer)	1.0 (0.2–1.9)	2.6 (1.0–4.2)	3.1 (2.7–3.5)
Skin cancer	8.8 (5.5–12.1)	8.2 (5.9–10.5)	8.1 (7.4–8.7)
Injury in the past 12 months	24.3 (18.2–30.5)	29.9 (25.5–34.3)†	23.3 (22.1–24.5)
Current mental health problem	7.7 (4.4–11.0)‡	13.2 (10.3–16.1)	13.0 (12.1–13.9)
Diabetes	3.1 (0.8–5.3)	3.2 (1.9–4.6)	3.7 (3.3–4.2)

†Denotes where prevalence is significantly higher. ‡Denotes where prevalence is significantly lower. The symbols indicate that there is a significant difference compared with other employment types using  $\chi^2$ ,  $P < 0.01$ . CI, confidence interval; N/A, unable to calculate because of numbers <5.

Shift workers were more likely to report an injury in the past 12 months compared with other employment types, although the surveillance system does not distinguish between work-related and other injuries. However, this finding is consistent with a recent ABS survey indicating that 28.1% of people who experienced a work-related injury or illness in Australia in 2009–2010 were working under shift arrangements despite making up only 16% of all employed persons.<sup>17</sup>

It is probable that the prevalence of FIFO workers and shift workers identified in the population through the surveillance system is an underrepresentation of actual numbers because of the nature of their employment and the need to be contacted on a home phone number between 9 am and 8 pm to complete the survey. Regardless, health surveillance systems are a useful tool to monitor whether these numbers and the ratio between FIFO and shift workers changes in the future.

Billions of dollars of investment is planned for new mining projects and expansions in Western Australia. For example, Chevron's \$50 billion Gorgon project is predicted to employ 10 000 construction workers and 3500 permanent staff by next year, and Rio Tinto will utilise around 8000 FIFOs for its Pilbara expansion.<sup>18</sup> The increasing use of FIFO workers in Australia is the subject of a current inquiry by the House of Representatives

Standing Committee on Regional Australia. While health is not directly cited in the terms of reference, identifying health profiles for specific employment groups is extremely valuable. Adults spend a significant portion of their day in the workplace so it is imperative to build healthy work environments that will encourage and maintain healthy lifestyle choices.

## Conclusion

This study represents the first time that a population-based surveillance system has been used to compare the health profiles of FIFO and other employment types in Australia. It provides important cross-sectional data around their health behaviours and outcomes, without being definitive about the contribution of aspects of the FIFO lifestyle and work patterns to such behaviours and outcomes. Our findings suggest that FIFO workers are not a homogenous group and empirical data are needed to test some of the strongly held opinions about the health effects of FIFO work. Future research should focus on specific aspects of FIFO work, including the length of shifts, the nature of the work (sitting vs manual labour) and patterns of time spent on-site, to inform the development of policies to improve the physical and mental health of FIFO workers.

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