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ORIGINAL PAPER

Caring for the Country: Fatigue, Sleep and Mental Health in Australian Rural Paramedic Shiftworkers

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Abstract This study investigated sleep quality, fatigue, mental health and physical activity in rural paramedic shiftworkers. Although limited, previous studies have associated high fatigue levels and poorer health in this sector with shiftwork rostering and occupational demands. A modified version of the Standard Shiftwork Index was completed by 150 paramedics (117 male and 31 females) from rural Victoria. Single sample *t* tests found significantly higher levels of fatigue, depression, anxiety, and stress, and significantly poorer sleep quality than reference samples. Paramedics also reported less physical activity than community samples. By regression analysis, sleep quality explained the greatest amount of variance in fatigue scores, followed by depression and age. No gender differences in levels of depression or fatigue were found. Consistent with an earlier study of metropolitan paramedics based on the same methodology, findings suggest rural ambulance paramedic shiftworkers are at particular risk for increased levels of fatigue and depression (regardless of age or gender) and poor quality sleep. Organisational intervention was suggested.

Keywords Shiftwork · Fatigue · Sleep quality · Ambulance · Paramedic · Depression

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Introduction

Growing research evidence suggests that paramedic shiftworkers may experience more occupational health problems than other healthcare workers and the general community. A recent review of 49 ambulance studies identified high rates of fatigue, poor sleep and other health problems in personnel [41], and concerns have also been raised about increased rates of mental health issues in paramedics [7]. The present study examined several indices of health in ambulance paramedics, specifically, those working in a rural context. This study follows from our recent findings of higher levels of fatigue and mental health issues in metropolitan paramedics [15], and from suggestions in the literature of apparent differences in the general health status of rural versus metropolitan communities (e.g. [28]). Given the critical role of paramedics in delivering essential emergency health services to rural communities, it was considered imperative to understand the physical and mental health status of these workers, which may have some bearing on their service-delivery as well as their own occupational safety.

With respect to physical health, sleep loss and elevated fatigue are of prime concern in healthcare shiftworkers (e.g. [33]. Although targeted studies of ambulance personnel are limited, Courtney et al. [15] reported severe sleep difficulties and elevated fatigue in 342 metropolitan paramedics rostered to a 24-h shift system. Another study of 123 Dutch ambulance workers [45] established levels of fatigue considered to place 10-percent of respondents at risk of sick leave or disability. Only one study of rural-based paramedics was located [25], reporting elevated fatigue in rural paramedics rostered to the dispatch centre; although differences between this role and on-road duties limits direct comparison with other studies. Further

investigation would be useful to extend this initial evidence, to determine occupational prevalence rates and, in particular, to identify predictors of fatigue for this occupational group.

Concerns have also been raised about the mental health of ambulance paramedics. In a mental health survey of 560 UK ambulance workers [7], nearly 10-percent of respondents reported clinical levels of depression, and 22-percent registered clinical levels of anxiety. These were considered to reflect occupational prevalence rates, although a lack of comparison with normative data was noted. Increased stress has also been associated with ambulance work (e.g. [45], although the assessment and conceptualisation of stress varies across studies. A nationwide study of Norwegian ambulance personnel [42] identified significant organisational and occupational stressors for workers, but did not assess psychological stress. Whilst acknowledging the limitations of previous studies, a review of existing evidence [41] suggested that up to 20-percent of ambulance personnel may suffer from poor mental health.

Whilst no previous studies specifically address the question of whether rural paramedics are at increased risk of mental health disorders, it seems reasonable to suggest that their level of risk would be at least commensurate with the general rural community. Epidemiological data certainly suggests that rates of mental health problems are roughly equivalent between rural and metropolitan communities [11, 27], although the methodologies responsible for producing these estimates have been heavily criticised [3, 18]. Indeed the only noted difference between rural and metropolitan communities with some demonstrable relevance to potential mental health issues is a higher rural rate of suicidality, primarily amongst younger adult males [11]. Even in this group, suicide risk was associated with specific risk factors not typical of ambulance paramedics: limited education, a lack of social support and social isolation [11]. Deficiencies in the existing data suggest a need to assess the mental health status of paramedics generally and, specifically, to determine if rural ambulance workers are at increased risk of mental health disorder.

It has been suggested that individual variables such as gender and age may influence health outcomes in shiftworkers, although their actual contribution is debated. For example, it has been speculated that female shiftworkers may be more susceptible to fatigue due to additional domestic and family obligations [14, 23]. By contrast, empirical studies of ambulance shiftworkers have failed thus far to establish gender differences on outcome measures [7, 15]. Conflicting opinions also exist as to whether increasing age either ameliorates (e.g. [2] or compounds adverse health outcomes in shiftworkers (e.g. [13, 32]). Again, empirical investigations have often failed to observe associations between age and measures of health in shiftworkers (e.g. [15, 37]). It is likely that shiftworkers self-select to work irregular hours based on their resources and ability to cope (see [8, 29]), thus reducing the influence of individual variables. Given the disparity between empirical outcomes and theoretical predictions, further measurement would be useful to establish potential associations of age and gender with the health status of shiftworkers.

Several investigators have also posited that physical exercise may influence individual responses to shiftwork (e.g. [4]). Regular physical activity confers a protective role for a wide range of health domains [46], with specific benefits demonstrated for mood states and especially depression [10]. Exercise is known to alleviate depressive symptoms for individuals with seasonal affective disorder, and reduce morning fatigue and the need for sleep [30]. It would seem reasonable, then, to predict that exercise could assist in managing the health-related consequences of shiftwork, although investigation in shiftwork populations specifically is scant. Courtney et al. [15] reported lower physical activity levels in 341 health-compromised paramedics compared to community samples; and one other shiftwork study reported decreased fatigue and sleepiness in nurses following an exercise intervention [19, 20], which suggests that exercise may be beneficial but lacking in shiftwork populations. In order to extend present knowledge, there is a need to first broadly assess levels of exercise behaviour in shiftwork populations, and examine relationships with other behavioural indices. This might provide some basis upon which to potentially prescribe specific exercise guidelines around the disrupted sleep-wake cycle in these workers.

Whilst discussion so far has focussed on individual variables, organisational parameters of shift scheduling also have potential to influence worker health. A systematic review of 26 intervention studies [5] identified that fast rotations (e.g. three or four consecutive shifts) and forward rotating rosters (morning, afternoon, night) produced positive effects on sleep and fatigue. Work-life balance, and organisational effectiveness were also improved when workers could influence their own work hours. Other investigators have found elevated fatigue levels in paramedics working extended shifts [15] and increased risk of accidents and health problems in the work place [17, 40]. Nightwork is considered especially problematic in terms of circadian adjustment and tolerance, and is associated with episodes of involuntary sleep and increased sleepiness at work that extends to days off work [1, 35, 39]. Clearly, organisation-determined parameters of shiftwork have considerable potential to impact on levels of experienced occupational distress.

The present investigation examined physical and mental health variables in shift-working paramedics employed by

Rural Ambulance Victoria (RAV). These workers participate in shiftwork as part of a normal career structure and it was expected that many would work the '10/14' roster: two ten-hour dayshifts, followed by two fourteen-hour nightshifts and four days off (commencing after the second nightshift). This structure has existed for at least 30 years in the ambulance sector and grew from the need to provide 24-h emergency services to the community. Drawing on the literature reviewed here, it was suspected that this shiftwork roster (in particular the requirement to work nightshift) could pose a significant health risk for these paramedics.

This study aims to address the lack of data with respect to the mental and physical health of rural paramedic shiftworkers. Comparisons to general population and other shiftwork samples (where available) will be enabled, permitting a clearer understanding of the potential risks and needs faced by this group of workers. Statistical comparison with our previous study in metropolitan-based workers [15] will investigate rural–urban differences on study variables. In addition, our earlier study observed significant associative relationships amongst study variables, and identified mental health, sleep quality and exercise as key predictors of fatigue by regression analysis. These relationships will be re-examined in this rural sample with a view to informing potential interventional strategies.

The following hypotheses were formulated:

1. Rural paramedic shiftworkers will report poorer sleep quality and elevated levels of fatigue, depression, anxiety, and stress compared to reference samples.
2. No significant age or gender differences will be detected on major study variables.
3. Fatigue in rural paramedic shiftworkers will be positively correlated with depression, anxiety, stress, and age, but negatively correlated with level of exercise and sleep quality. At least some of these variables will explain a significant amount of variance in chronic fatigue scores.
4. There will be no statistically significant differences between rural and metropolitan paramedics on measures of mental and physical health.

Method

Participants

Emergency ambulance paramedics were recruited from RAV; an organisation established in March 1999 as part of the rationalization of existing rural ambulance services [44]. RAV has recently merged with Ambulance Victoria and delivers pre-hospital emergency treatment and medical transport to people in regional, rural and remote Victoria [38]. Participation was voluntary and limited to active personnel who routinely worked a 24-h roster cycle that included a nightshift component. It was expected that many of the paramedics meeting inclusion criteria would be working the 10/14 roster already described.

A sample of 128 participants was required to satisfy planned analyses based on a moderate effect size ($r = .30$), a significance level of .05, and a power of .80 [12].

Completed surveys were returned by 150 paramedics, or around 27-percent of the paramedics employed by RAV and estimated to meet inclusion criteria. The response by gender of 117 males (73.5 %) to 31 females (26.5.5 %) equates to a 2.8–1 male to female ratio. Gender demographics for operational personnel were not available from RAV during the collection period. Fifty-percent of respondents worked the 10/14 roster structure, and the remaining fifty-percent worked a shiftwork roster with a night time component.

Materials

Shiftwork

A modified form of the Standard Shiftwork Index (SSI; [6] was administered, which comprises a battery of instruments to assess shiftwork-related outcomes in workers. SSI measures of psychological distress and sleep were substituted with instruments considered more satisfactory, and a measure of physical exercise added (see following sections). The SSI Chronic Fatigue Scale (CFS) conceptualises fatigue as a general tiredness and lack of energy irrespective of whether an individual has not had enough sleep or has been working hard, and which persists even on rest days and holidays. A score ranging from 10 to 50 is produced, with higher scores indicating more fatigue. Barton et al. [6] found the validity and internal reliability of the CFS (α from .91 to .93) to be satisfactory in a sample of shiftwork nurses and industrial workers.

CFS data was selected from four previous shiftwork studies for statistical comparison, as normative data has not been established in community samples. The most comparable data was obtained from a study of 341 shiftwork paramedics based in metropolitan Melbourne (age range 23–61, $M = 40.00$, $SD = 8.50$) conducted by the present authors [15]. Barton et al. [6] also published CFS scores for 1532 shiftwork nurses (mean age 33.2 years; 91.8 % female) and 332 industrial workers (mean age 39.2; 6.9 % female). Ruggierro [37] reported CFS data from 142 female shiftwork nurses aged from 28 to 63 years ($M = 44.9$, $SD = 8.3$). Iskra-Golec et al. [26] reported CFS data from female shiftwork nurses, but in a more restricted age range of 20–32 years ($M = 25.96$, SD = 3.75).

Quality of Sleep

Quality of sleep was assessed using the Pittsburgh Sleep Quality Index (PSQI; [9]. The PSQI generates component scores for seven domains of sleep quality that are summed to obtain a maximum achievable score of 21, indicating the highest level of sleep disturbance. The PSQI was normed on 52 healthy, 34 depressed and 62 sleep disordered participants and demonstrated sufficient internal reliability ($\alpha = .83$) and validity [9].

Although normative data for statistical comparison was again limited, the authors of the PSQI [9] published scores for a control group of 52 healthy sleepers comprising 40 males and 12 females aged 24–83 ($M = 59.9$). Piperno and Francis [36] also collected local community data from 84 males and 138 females aged 18–66 ($M = 32.5$, $SD = 13.5$). Data from Courtney et al. [15] was also adopted.

Depression

The Depression Anxiety Stress Scales 21 (DASS21) were used to measure the emotional states of depression, anxiety and stress [31]. Seven items on each of the three scales were summed to obtain an overall score for each state. The psychometric properties of the DASS21 were found to be satisfactory by Henry and Crawford [24] in a non-clinical population ($N = 1{,}794$). Alpha values for reliability are: Depression 0.81; Anxiety 0.73; Stress 0.81 [31].

Normative data for the DASS is limited, but three studies were located for statistical comparison. A study that closely matched census data for the Australian population [43] published DASS scores for 219 males and 272 females (age $M = 42.3$, $SD = 17.7$). Henry and Crawford [24] published DASS scores for 979 female and 815 male members of the general UK population (age $M = 41.0$, $SD = 15.9$). Normative data from the DASS manual was also selected [31] which is derived from six samples comprising 1,044 males and 1,870 females aged 17–69 years. Data from Courtney et al. [15] was again used to address specific hypotheses.

Physical Activity

Estimates of physical activity were obtained using the International Physical Activity Questionnaire—Short Form (IPAQ; [16]. IPAQ data was reported as the ratio of the work metabolic rate for each type of activity to the resting metabolic rate (termed METs) derived as follows: Walking = 3.3 METs, Moderate Physical Activity = 4.0 METs, and Vigorous Physical Activity = 8.0 METs. MET-minutes/week were calculated by multiplying the duration (in minutes) and frequency (in days) of each activity type by its corresponding MET value. Results were summed to obtain a total score based on median values. Craig et al. [16] found the validity the IPAQ to be acceptable in a 12-country study, and reported reliability correlations of around 0.8.

Two community studies were located for statistical comparison. Craig et al. [16] published data for the IPAQ—Short Form for a community sample comprising 1974 males and females across 12 countries. Participants ranged in age from 18 to 65 with a predominantly middle aged mean in each sample. Scores from a local community sample [36] were also considered useful. Participant demographics are described in the previous section. Data from Courtney et al. [15] was used to address specific hypotheses in shiftwork samples.

Procedure

Approval to undertake this study was provided by the Faculty of Science, Technology and Engineering Human Ethics Committee, La Trobe University, and the RAV Executive and Research Governance Committee (Medical Standards Committee). RAV managed the internal distribution of 560 surveys to 28 rural Branches. Industry visibility was enhanced through announcements and reminders on the RAV intranet. Participation was voluntary and required about 25 min completion time, with participants mailing surveys directly to the investigators anonymously in reply-paid envelopes. Statistical analyses were performed using SPSS version 15.0

Results

Distributions of all variables were judged adequate in terms of normality, linearity and homoscedacity. Data were also examined for outliers, missing values and data entry errors. Corrections were made in accordance with common statistical practice, or in accordance with data cleansing instructions for specific measures.

Mean global sleep quality scores are shown in Table 1 along with data from the four reference groups. Seventy-percent of the rural sample received a global score greater than five; the cutoff score used to identify 'poor' sleepers. Although the percentage of poor sleepers was almost identical between rural and metropolitan paramedics [15] an independent samples t test found significantly poorer sleep quality in the rural cohort; $t\ (477) = -2.88$, $p = .004$. A single sample t test also found significantly poorer sleep quality for rural paramedics compared to a group mean derived from two community samples; $t\ (146) = 13.78$, $p < .001$.

Mean scores for chronic fatigue are shown in Table 2. Independent samples t tests showed no significant differences in fatigue between genders, $t\ (144) = -1.38$, $p = .17$; roster types, $t\ (146) = .71$, $p = .48$; or rural

Table 1 Mean global score obtained on the PSQI for rural and metropolitan paramedics, and non-clinical community samples

Study	*M*	*SD*
RAV paramedic sample[a]	8.45	3.77
Courtney et al. [15][b]	7.44	3.18
Buysse et al. [9][c]	2.67	1.70
Piperno and Francis [36][d]	5.66	3.00

Global PSQI > 5 = poor sleep quality

[a] $N = 147$

[b] $N = 332$

[c] Control group, $N = 52$

[d] Community sample, $N = 247$

Table 2 Mean scores for chronic fatigue in the two paramedic samples and data obtained from other shiftwork studies

Study	Gender	Sample size	*M*	*SD*
RAV paramedic sample	Male	116	29.01	8.95
	Female	30	31.50	8.14
	Combined[c]	148	29.51	8.76
Courtney et al. [15]	Male	239	28.79	8.80
	Female	98	29.03	9.03
	Combined[c]	338	28.86	8.84
Rugierro [37][a]	Female	142	26.68	9.24
Barton et al. [6]	Male	422	24.77	7.41
	Female	1429	25.12	7.63
	Combined	1,864	25.04	7.58
Iskra-Golec et al. [26][ab]	Female	96	26.97	–

[a] Samples comprised only female participants

[b] 12-h shift rotation sample, no standard deviation supplied

[c] Missing respondent data

versus metropolitan [15] location, $t\,(484) = -.75$, $p = .46$. A single sample t test revealed significantly higher fatigue scores for the rural sample compared to a group mean calculated from three other non-paramedic shiftwork samples, $t\,(147) = 4.56$, $p < .001$.

Mean scores obtained on the DASS21 scales are shown in Table 3.

A single sample t test found significantly higher scores for the rural sample compared to a group mean calculated from three community samples for depression, $t\,(149) = 3.97$, $p < .001$; anxiety, $t\,(148) = 2.32$, $p = .02$; and stress, $t\,(149) = 5.59$, $p < .001$. Rural and metropolitan [15] paramedic samples were also compared using an independent samples t-test, however no significant differences were detected for scores of depression, $t\,(489) = -.88$, $p = .38$; anxiety, $t\,(488) = -.77$, $p = .44$; or stress, $t\,(489) = .24$, $p = .81$.

Table 4 shows the percentage distribution of DASS21 scores by clinical severity [31] for the rural paramedics.

Table 3 Mean scores for depression, anxiety and stress in the rural and metropolitan paramedic samples, and normative data from non-clinical studies

	Depression		Anxiety		Stress	
	M	*SD*	*M*	*SD*	*M*	*SD*
RAV paramedics[a]	9.53	9.28	5.28	6.97	13.63	9.60
Courtney et al. [15][b]	8.77	8.54	4.83	5.25	13.85	9.14
Lovibond and Lovibond [31][c]	6.34	6.97	4.70	4.91	10.11	7.91
Henry and Crawford [24][d]	5.66	7.74	3.76	5.90	9.46	8.40
Taylor et al. [43][e]	5.06	7.57	3.41	5.13	8.18	8.40

[a] $N = 149$

[b] $N = 342$

[c] $N = 2914$

[d] $N = 1{,}794$

[e] $N = 491$

Table 4 Percentage distribution of mean scores for depression, anxiety and stress by clinical severity among rural paramedics

Scale	Normal	Mild	Moderate	Severe	Extremely Severe
Depression	57.3 % ($n = 86$)	15.4 % ($n = 23$)	15.4 % ($n = 23$)	5.4 % ($n = 8$)	6.7 % ($n = 10$)
Anxiety	73.8 % ($n = 110$)	5.4 % ($n = 8$)	12.1 % ($n = 18$)	4.0 % ($n = 6$)	4.7 % ($n = 7$)
Stress	60.6 % ($n = 91$)	12.8 % ($n = 19$)	12.8 % ($n = 19$)	10.1 % ($n = 15$)	4.0 % ($n = 6$)

$N = 150$

Table 5 Percentage distribution of mean scores for depression, anxiety and stress by clinical severity among metropolitan paramedics [15]

Scale	Normal	Mild	Moderate	Severe	Extremely Severe
Depression	63.9 % ($n = 217$)	13.8 % ($n = 47$)	12.0 % ($n = 41$)	4.7 % ($n = 16$)	5.6 % ($n = 19$)
Anxiety	75.4 % ($n = 257$)	8.2 % ($n = 28$)	12.0 % ($n = 41$)	1.8 % ($n = 6$)	2.6 % ($n = 9$)
Stress	60.7 % ($n = 207$)	14.7 % ($n = 50$)	12.9 % ($n = 44$)	7.6 % ($n = 26$)	4.1 % ($n = 14$)

$N = 341$. Missing respondent data on some variables

Rates were above the normal range for depression (42.7 %, $n = 64$), anxiety (26.0 %, $n = 39$) and stress (39.3 %, $n = 59$). Table 5 shows the same analyses for the metropolitan comparison sample [15]. An independent samples t-test found no significant sex difference for scores of depression; $t\,(146) = 1.02$, $p = .31$, and no significant differences were found based on roster type for depression,

Table 6 Correlations Between Scores Obtained on the PSQI, DASS21 and IPAQ in the Rural Paramedic Sample

Measure	Depression	Anxiety	Stress	PSQI	IPAQ	Age
Chronic Fatigue	.51**	.41**	.49**	.56**	−.19**	−.10
Depression		.73**	.76**	.38**	−.15	.19*
Anxiety			.76**	.30**	−.06	.08
Stress				.44**	−.13	.06
PSQI					−.15	.02
IPAQ						−.01

* $p < .05$, two-tailed

** $p < .01$, two-tailed

t (148) = 1.14, $p = .26$; anxiety, t (147) = 1.81, $p = .07$; or stress, t (148) = .76, $p = .45$.

Rural paramedics reported a global median score of 2034 MET-minutes/week on the IPAQ—Short Form. This represented 19-percent less physical activity than participants in a 12-country study [16] median MET-minutes/week) and 13-percent less than a local community sample [36] median MET-minutes/week). Rural paramedics reported only 2.5-percent less physical activity than their metropolitan colleagues [15] MET-minutes/week).

The data were further analysed for correlations amongst variables, and to address hypotheses posited for the study (Table 6). Chronic fatigue was found to have a significant association of moderate to large size with all variables except age.

Multiple linear regression was employed to determine the role of the six major study variables in predicting chronic fatigue. No a priori hypothesis was made to determine the order of predictor variables, so a direct method was adopted. The six study variables produced an adjusted R^2 of .43 for the prediction of chronic fatigue, F (6, 125) = 17.11, $p < .001$. Sleep quality was the most important variable ($\beta = .43$, $p < .001$), followed by depression, $\beta = .25$, $p = .03$, and to a lesser extent age, $\beta = -.0.16$, $p = .02$. The remaining variables did not contribute significantly to the model: total METs, $\beta = -.08$, $p = .26$, anxiety $\beta = .03$, $p = .81$, and stress, $\beta = .0.09$, $p = .46$.

Discussion

To our knowledge, this is the first investigation in the literature reporting psychobehavioural correlates of fatigue in rural paramedic shiftworkers. These results show poorer sleep quality and higher levels of fatigue, depression, anxiety, and stress in the cohort compared to reference samples. As predicted, no significant age or gender differences were detected on any outcome variable. Significant correlations were observed amongst all study variables as hypothesised, except for the association between fatigue and increasing age. Sleep quality explained the greatest variance in fatigue scores, followed by depression and age. Finally, rural paramedics reported poorer sleep quality than their metropolitan counterparts [15].

Poor quality sleep is a well-established outcome of shiftwork, and consistent with this premise, only 30-percent of paramedics in this study were categorised as 'good sleepers'. As such, the majority of this group suffered severe difficulties in at least two domains of sleep, or moderate difficulties in more than three [9]. Although rural workers reported significantly poorer sleep quality than their metropolitan counterparts, the percentage of good and bad sleepers was identical for both groups, and may be the more pragmatic analysis. The significant difference in sleep quality between rural paramedics and community-based normative data is a useful finding given the lack of a control group [41], and acts to highlight the level of sleep disruption in the sample. Given that sleep has been identified as a potential index of health problems in ambulance shiftworkers [41] the present findings may be symptomatic of further problems in these workers.

Likewise, elevated fatigue is strongly associated with shiftwork, and causally linked to sleep disruption by many authors (e.g. [6]. The present findings are consistent with those of our earlier study in a metropolitan sample [15], and given that both groups participated in a near-identical rotating shiftwork roster (and nightshifts), we assert that several elements of the shift schedule place workers at increased risk of sleep loss and fatigue. Note that no statistical differences were detected on study variables between paramedics working the 10/14 and 'other' rosters, so a similar level of shiftwork exposure was assumed.

Early morning shifts, quick returns and the nightshifts are particularly problematic in terms of sleep loss and fatigue [39]. For those working the 10/14 roster, the 7am dayshift limits the opportunity for sleep, as workers need to wake early enough to prepare for the day and then commute to branch. The pairing of two 14-h nightshifts requires a quick return and imposes a strong exposure to these hours, and the intervening rest period is likely to be reduced by travel time, difficulty sleeping during the day, and social factors. The extended shift lengths worked by this group would also contribute to elevated fatigue [39], and contrasts with recommendations to limit shifts of more than 10 h to specific work functions where fatigue is minimised at an organisational level (e.g. [40]). Although not specifically investigated here, the relationship between extended shifts and increased workplace accidents [17, 34] is relevant to ambulance work, which draws on accurate clinical decision-making and advanced driving skills at any time during a shift.

Comparison with data derived from community samples indicates a poor level of mental health in the paramedic sample. In terms of clinical relevance, over twelve-percent of the sample reported Severe to Extremely Severe levels of depression; rates consistent with previous reports [7, 15] and well above those reported in the general population [31]. Clinically significant elevations were also found on measures of anxiety and stress at a level similar to the metropolitan comparison cohort. While the assessment of mental health in shiftworkers is often limited by variations in psychometrics and non-specific diagnostic categories, the DASS21 represents a well-validated instrument in both clinical and non-clinical populations [24]. On this basis, we suggest that, as an occupational group, paramedic shiftworkers are at increased risk of developing clinical levels of depression, anxiety and stress. These findings extend those of our earlier study using identical methodology [15] and support previous concerns regarding mental health in this occupational sector (e.g. [7, 42]).

Paramedics reported lower levels of physical activity compared to community samples, but very similar rates to their metropolitan colleagues [15]. It is possible that shiftwork imposes a lifestyle that limits the opportunity for regular exercise and prohibits a commitment to team-oriented sporting activities. Whilst empirical measurement of exercise behaviours in shiftworkers is lacking, these findings extend those of the metropolitan reference sample (again using an identical measure) and add further weight to an observed trend toward lower physical activity in the ambulance sector. Associations between exercise and other study variables are discussed further on.

A major aim of the study was to examine the data for relationships amongst variables and identify predictors of fatigue. Previous shiftwork investigations have established associations of similar magnitude to the present findings between fatigue and each of depression, anxiety and sleep quality, using comparable assessment instruments [15, 37]. In particular, the significant association between exercise and fatigue extends novel findings in the metropolitan reference sample, and is also consistent with decreased fatigue following an exercise intervention in nurses ([19, 20]). Exercise is also associated reduced fatigue in general populations ([30]) and the present associative evidence suggests that physical activity might be similarly beneficial in reducing fatigue for shiftworkers.

Regression analyses identified sleep and depression as the strongest predictors of fatigue amongst the study variables, and to a lesser extent increasing age. Our earlier study [15] found that these same independent variables explained almost the same variance in chronic fatigue scores (43 vs. 42-percent for the rural group), however depression and sleep quality were reversed in the model and closer in beta weights. The reason for the difference between cohorts is uncertain, however given the strong correlations between chronic fatigue, depression and sleep quality (in both samples) it is clear that these variables are important and related measures of functioning for paramedic shiftworkers. Ruggierro [37] also identified depression and sleep to be the strongest predictors of fatigue in shiftwork nurses using the same methodology.

The negative association between age and fatigue in the regression model suggests that younger workers suffer higher fatigue, although the contribution was small. Younger age was also found to predict fatigue in a large national study in Sweden [2], however other shiftwork studies have failed to establish any association (e.g. [37]. The present findings are consistent with the argument that older workers may adapt better to shiftwork as circadian changes with age result in the need for less sleep [21]. Furthermore, the age of workers was strongly related to years of shiftwork, so older workers may have self-selected to remain in service on the basis of adaptive sleep behaviours that counter work related fatigue (see [8].

Despite regular narrative suggesting poorer health outcomes in female shiftworkers, gender was not significantly associated with any of the outcome variables. Previous empirical studies have similarly failed to observe significant findings [15, 37] and a review of 49 ambulance studies [41] concluded that the influence of gender remains poorly understood. The additional domestic responsibilities presumed to contribute to increased fatigue levels in females [23] may be influenced by culture and demographics (e.g. marital status) and would require specific investigation. A process of self-selection [8] is again likely to produce fewer detectable gender differences and might be the most plausible explanation here. The current findings contribute further empirical validation that gender may not be a reliable predictor of chronic fatigue or other outcomes in paramedic shiftworkers.

The most significant findings in this study were elevated levels of fatigue and depression, and poor quality sleep in paramedic shiftworkers. Initial evidence also suggests that paramedics engage in a lower level of physical activity than reference groups. Almost identical levels of association were evident between variables in the rural sample and those reported by Courtney et al. [15] in a metropolitan cohort. Organisational parameters are likely to influence health outcomes in ambulance workers, which in turn creates a responsibility for organisational management [7, 45]. Workplace monitoring programs would be useful to confirm the prevalence and trends for these important domains of functioning. Subsequent responses could include custom-designed workshops and individual counselling as well as workplace psychoeducation. This would require individuals to comply with monitoring and take responsibility for personal change, which may prove problematic in some

instances. Specific advice regarding sleep hygiene and exercise would seem appropriate for this paramedic group.

Further organisational dimensions include the shift system worked by this group. Although fast and forward rotating rosters are more beneficial for workers [5] it is well established that extended shifts and nightshifts result in significant fatigue (e.g. [35] as detected in the current sample. Previous authors have suggested an organisational focus on fatigue management, including the allocation of breaks on nightshift, regulation of overtime, and staff training programs [25]. Some flexibility offered in self-scheduling has also proven beneficial for health, work-life balance, and organisational effectiveness through reduced absenteeism [5], although the associated difficulties for a large organisation are acknowledged.

The present study addressed several of the methodological concerns raised by previous reviews of literature in the field. We investigated a single occupational group working a known roster system, and scores were reported against relevant reference groups wherever possible [22, 41]). The cross-sectional methodology limits any evaluation of causality, so longitudinal investigations would be useful in further exploring relationships between the key variables. The generalisation of findings is also limited given that the study investigated a group of workers from a single ambulance service. Shiftwork studies are also limited by the self-selecting nature of workers, however the possibility of this effect has been highlighted in the relevant sections.

To conclude, this study examined variables related to health and wellbeing in rural paramedics and extends the investigation of the same parameters in metropolitan based workers. The combined findings add further weight to suggest that paramedics are at particular risk for increased levels of occupational fatigue and depression (regardless of age or gender) and poor quality sleep. The sample also reported less physical activity than reference groups, which has the potential to be associated with negative health outcomes. Organisational attention may assist with several domains of functioning in these workers, and contemporary psychological treatment modalities have much to offer in this respect. However integrated interventions for the negative sequela of shiftwork remain relatively unexplored and would be a useful focus for future studies.

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