

# **COPING WITH SHIFTWORK:**

UNDERSTANDING AND COMMUNICATING RESILIENCE  
STRATEGIES FOR PERFORMANCE, SAFETY AND HEALTH



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University of South Australia, SA Health, SafeWork SA

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# PREAMBLE

This report summarises the main results from a collaborative research project between the Centre for Sleep Research at the University of South Australia (UniSA), SA Health- Department for Health and Ageing (DHA), Northern Adelaide Local Health Network (NALHN) and SafeWork SA, supported by a SafeWork SA Commissioned Research Grant.

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This work was inspired by the increasing body of evidence linking shiftwork and increased risk of gastrointestinal disturbance, heart disease, obesity, type 2 diabetes, psychological illness and some cancers.

However, while some workers are vulnerable to these health concerns, others have engaged in shiftwork for decades and are coping extremely well. The aim of this project was to identify healthy, experienced shiftworkers and interrogate the strategies that they use to cope with shiftwork, pulling together evidence for which are helpful, which are ineffective and which are harmful.

Findings provided evidence of healthy aging in experienced shiftworkers that is linked to coping style. Workers reported many strategies for coping with shiftwork, with varying levels of efficacy.

Strategies are not “one -size -fits all” and may be effective under some circumstances and hazardous under others. Methods for providing individualised recommendations for strategy use are presented, taking into account individual preferences and circumstances. Presentation is also done in the context of potential hazards associated with each strategy.

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# PROJECT SUMMARY

Shiftwork disrupts circadian rhythms and sleep, and is associated with impaired performance, safety and health. The drivers for these adverse consequences are complex - they are influenced by individual factors (e.g. work structure, diet, exercise, sleep hygiene, genetics), team factors (e.g. level of cooperation and support), and environmental factors (e.g. organisational climate). Interestingly, while some experience the adverse consequences of shiftwork, others cope very well. The overarching aim of this study is to examine individual and team strategies for coping with shiftwork. Importantly, such strategies are typically intuitive, not always consciously executed and are frequently tailored to fit within particular work-type processes, cultures and constraints.

This project investigated these issues in the healthcare and social assistance industry, which is one of the priority industries within the Safe Work Australian Work Health and Safety Strategy 2012-2022. Data collection took place in one area of SA Health, the Northern Adelaide Local Health Network (NALHN), with nurses and midwives. We analysed data from the Safety Learning System Database (SLSD), in -depth interviews (n=22), questionnaires (n=130), and saliva samples (to measure cellular damage, n=45), to achieve the following aims:

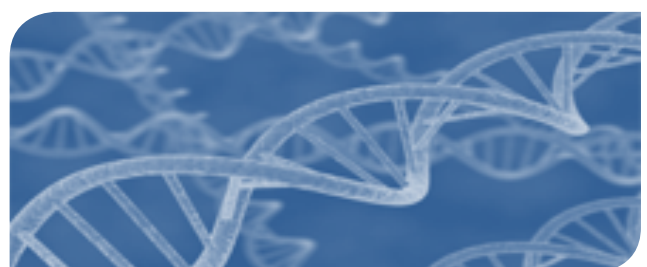
**AIM 1:** To use the SLSD to understand and contextualise reported fatigue-related incidents in nursing, and how they differ in profile from other incident types.

**AIM 2:** Identify whether there are clusters in the data across physical, behavioural and psychosocial variables that may represent workers who experience positive physical, occupational, cellular and psychological health.

**AIM 3:** Identify behavioural strategies at the individual (work structure, nutrition, countermeasure use, exercise, sleep hygiene) and team (assistance, cross-checking, transfer to different duties) levels, that workers with optimal physical, mental and cellular health use to manage the effects of sleep loss and fatigue.

This has yielded a list of strategies for coping with shiftwork. We now have begun to communicate successful strategies more broadly to workers performing the same type of work across SA Health, as well as to Australian hospital nurses and midwives, with a longer-term goal of improving worker mental and physical health and safety and contributing to a reduction in workplace illness and injury.

Recommendations arising from this project are summarised on p. 6-7, and explored in more detail throughout this report.



## Summary of Recommendations

These recommendations are based on strategies identified as being used by nurses and midwives in the current study. Please note that some recommendations may not be achievable or suitable depending on individual circumstances. However, the following recommendations are based on evidence drawn from the literature and are provided as a guide.

### Sleep Strategies

- Sleeping in the morning before your night shift can help to reduce extended wakefulness. However, depending on what time you wake up in the morning, you may likely still accumulate fatigue by the end of your night shift and be prone to sleepiness during the night shift.
- Taking a prophylactic nap in the afternoon before the night shift can help to minimise accumulation of fatigue during the night shift. It is important to be aware that your performance and safety may be affected by sleep inertia when you wake up from a nap, so safety critical tasks such as driving should be avoided soon after napping.
- Taking a short nap during your break on night shift can help to reduce sleepiness on the second half of your shift. However, sleep inertia can lead to impaired performance and safety upon waking, especially between 4-6am. It is also important that you nap in a safe place and let a team member know where you are.
- Avoid using sleeping tablets and alcohol as sleep aids. Although sleeping tablets can be effective in the short term, they can lead to impaired performance and dependence. Alcohol as a sleep aid should be avoided, as it can reduce sleep quality, and chronic use is associated with a range of health issues.

### Workplace Strategies

- Colleague support is important for job retention and satisfaction. This involves helping others with their responsibilities, especially in stressful situations, e.g. helping out a colleague who is obviously extremely sleepy; developing mutual trust is also important for a positive work environment.
- Double-checking work with others and using memory aids can help to manage the potential impact of fatigue on safety so that you are less reliant on memory, which is often impaired during a full night awake.
- Keeping busy can help to promote work engagement and reduce sleepiness compared to undertaking extremely low-event tasks. Where possible, a moderately paced task schedule which avoids under-loading as well as over-loading is ideal.

### Psychosocial Strategies

- Being aware of your coping style and actively attempting to use 'engaged' coping styles may help when dealing with stressful situations.
- Problem-focused coping (solving problems rather than avoiding them), cognitive reappraisal (changing the way you think about a situation instead of using wishful thinking), expressing emotions (instead of being self-critical) and utilising social support from colleagues, family, friends and pets (as opposed to social withdrawal) are all beneficial for shift workers.

## Driving Strategies

- Strategic use of caffeine may help to improve alertness during the morning commute. However it is very important to consider the potential hazards of caffeine consumption, including negative effects on sleep if consumed too near the sleep period, and side effects of consumption in very large doses.
- The only strategy that has evidence to show its effectiveness for drowsy driving is pulling over to rest. Pulling over to rest can be especially useful on a long drive, as performance and alertness deteriorate with increasing time spent driving. Be aware that resting and napping (which can cause sleep inertia) do not completely alleviate the effects of lack of sleep, so driving cautiously after a night shift (if driving cannot be avoided) is important.

## Diet Strategies

- Caffeine use to promote alertness should be guided by consideration of individual caffeine sensitivity. Caffeine should be used strategically (i.e. not too frequently) to avoid tolerance, and not too close to the sleep period (within 4h of bedtime) to avoid sleep disturbance. Consumption of caffeinated products which are high in fat or sugar (e.g. chocolate, cola) should be limited.
- Limiting food during night hours may minimise gastrointestinal upset and metabolic disturbance. Eating smaller snacks rather than a big meal may be beneficial for limiting gastrointestinal and metabolic disruptions.
- Reflecting on motivations for eating on nightshift is likely to be helpful. A focus on reasons for consuming “indulgence” foods and possible substitution for more nutritious snack options may be beneficial, especially in the context of shared food on night shift.

## Exercise Strategies

- Engaging in regular exercise is a coping strategy that is advisable for overall wellbeing, good sleep, and tolerance to shift work. Avoid undertaking high intensity exercise close to bedtime, as this can make falling asleep more difficult.



# BACKGROUND

## Sleep Loss, Fatigue, Safety and Health

Shift workers routinely have reduced sleep quantity and quality, and this chronic sleep deprivation can lead to adverse outcomes for productivity, health and safety [1-6]. Data from the US and Australia indicates that shiftwork-related sleep loss and fatigue present risks for error, injury and accidents for nurses and midwives [2, 3, 7-9].

The schedules typically worked by Australian hospital nurses involve combinations of morning (7am-3pm), afternoon (3pm-10pm) and night (10pm-7am) shifts [3, 7]. The highest levels of sleep loss, fatigue and errors are recorded on the morning and evening shifts [3, 7].

Not only is performance impaired during shifts, but nurses frequently report extreme sleepiness and fatigue while commuting home, contributing to fatal accidents and near misses [3, 10, 11]. A single study of 45 nurses found that 95% of those working 12-hour night shifts reported having had a car accident or near - miss while driving home from work in the morning [12].

Long-term effects of shiftwork in relation to health have been identified, including increased risk of indigestion and gastrointestinal ulcers [13], cardiovascular disease [14-16], type 2 diabetes [17], reproductive health problems in women [18-21] and breast cancer [22-24].

## Stress and Health

Work related stress represents a huge cost for worker health and productivity [25]. It is predicted that by 2020, stress-related illnesses will be the leading cause of the global disease burden [26]. The increased need to protect worker wellbeing has arisen due to the recognition of the potential negative outcomes of psychosocial risk at work [27]. These outcomes include increased rates of psychological illnesses, physical health problems [28] and declines in productivity due to work stress and poor worker health [29].

A cellular mechanism for how chronic stress may cause premature disease onset is change in telomere length and integrity. Telomeres are expendable, protective buffers at the ends of chromosomes. Each time a cell divides, a portion of telomeric DNA is eroded, and after many rounds of cell division, the telomere diminishes to a length whereby the cell can no longer divide [30]. Thus, telomeres play a critical role in determining the number of times a cell divides, its health, and its life span. In a seminal study of healthy women caring for chronically ill children [31], the more years working as a care giver, and the higher the perceived stress, the shorter telomere length was. Shorter telomere length has also been associated with longer work hours and stress in women in full-time employment [32]. This relationship between stress and telomere length has since been reported in many stressed cohorts, suggesting chronic stress modulates the rate of cellular aging to shorten cell life.



## Shiftwork, Circadian Rhythms, Sleep & Aging

Our body processes follow circadian (daily) rhythms – we are designed to be awake during the day and sleep at night. When our rhythms are desynchronised, sleep, performance, health and safety are negatively impacted [33 -35]. Shiftwork disrupts circadian rhythms, and results in sleeping when our body is primed for wake, and working while our body is primed for sleep. Due to these changes in daily rhythms, shiftworkers sleep, on average, 2 -4h less per day than dayworkers. Time in bed is reduced and sleep is more fragmented [36-38].

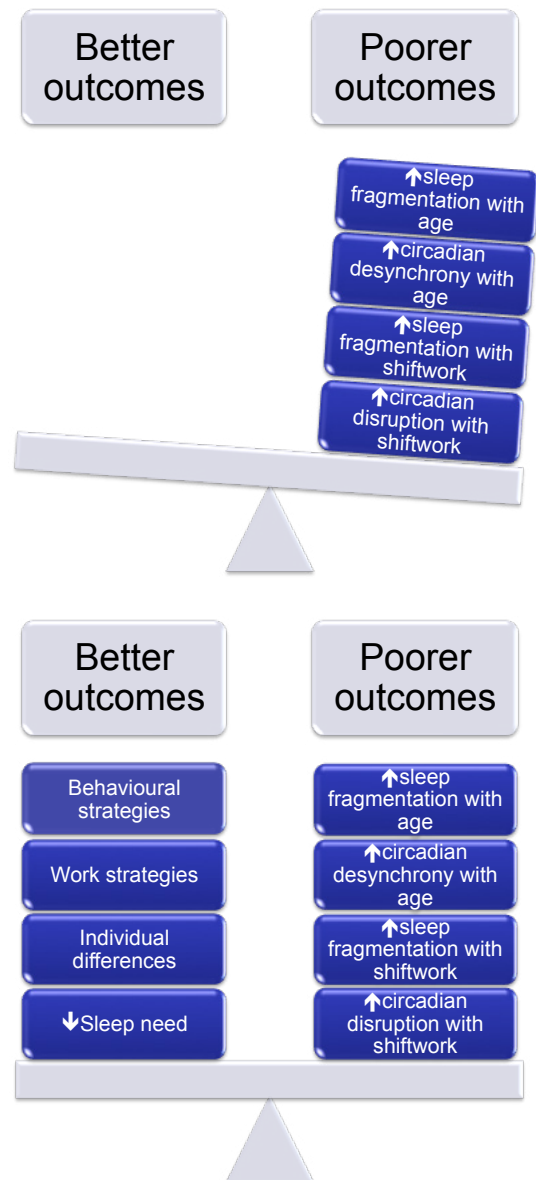
As we age, there are normal changes in our sleep and circadian rhythms. Sleep tends to become shorter, less deep, and more fragmented [39-41]. Our time-of-day preference changes such that we prefer to wake up earlier and go to bed earlier. That is, we become less like an “owl” and more like a “lark” [40, 42]. This morning preference, or “morningness” has been associated with poorer adaptation to shiftwork, night work in particular. Further, the speed of adaptation (how long it takes our circadian timing system to shift), slows with age. As we age, a primary time for sleep loss is during the day following night shifts [40, 42-44]. Therefore, it may seem that the odds are stacked against older shiftworkers, who may become increasingly vulnerable to the negative impact of shiftwork (Figure 1).

However, the literature does not provide evidence of increasing vulnerability to shiftwork with age. In contrast studies investigating what is commonly known as the “Shiftworker Syndrome”, (digestive, cardiovascular and psychological disorders, frequent among shiftworkers [45]) actually show a tendency toward improved health in older, more experienced workers (Figure 1).

Indeed, resesarch also tells us that we may need less sleep as we age [41] and that morning shifts,

which are associated with sleep loss due to early wake times combined with biological difficulty in advancing bedtimes [2], are easier for more “lark-type” older workers. Also, fast rotating shifts may be better for older workers, who have slower moving circadian clocks [42, 43]. Importantly, older workers may have developed successful ways of coping with shiftwork.

“There may also be collective work strategies,



either explicit or implicit, that spare older workers.” [46]

**Figure 1.**

*Upper – Factors tipping the balance towards poorer long-term outcomes for older workers in shiftwork.*

*Lower– Factors that contribute to balance for older workers, supporting healthy aging through shiftwork.*

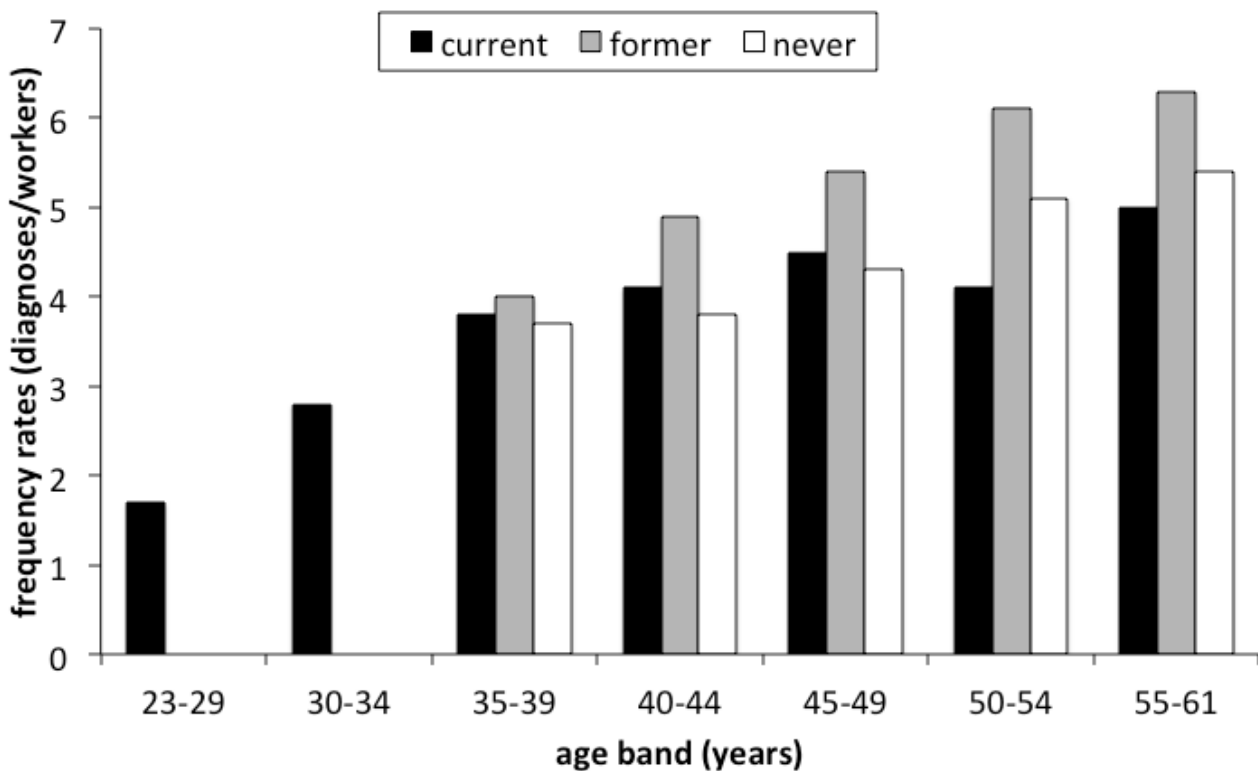
A really clear example of shiftworker health profiles across the lifespan is a study of Canadian petroleum refinery workers [45]. This study looked at the rates of diagnosed diseases in their workers, split into those who were currently shiftworkers, those who used to be shiftworkers, and those who never worked shifts. When they examined diagnosis rates across age groups, they noticed that older current shiftworkers remained relatively healthy, especially compared to former shiftworkers (Figure 2).

This illustrates a “healthy survivor effect,” where those who are less healthy leave the workplace, and therefore, remaining workers over time tend to be healthier [47]. In the case of shiftwork, the “healthy survivor effect” may be exemplified by workers who are less able to cope with the negative effects of working shifts opting out of shiftwork in favour of jobs solely involving

day work. Therefore, the remaining cohort of experienced shift workers consists mostly of a ‘healthy survivor population’[48, 49].

“The oldest current shiftworkers are remarkable in that they show the best adaptation to the schedule, thanks to their initial good health, the less negative type of reaction of their physiology to this type of schedule, the existence of a social circle able to cope with it, and the fact that they are sufficiently disciplined to use their schedule to their advantage” [45].

A further interesting point noted in the petroleum refinery study was the suggestion that workers’ social circles may help in coping, and that more experienced workers may have ways of making the most of their work patterns [45].



**Figure 2.**

Data from a study of Canadian petroleum refinery workers (12h shifts) [45]. The x-axis shows age groups, the y-axis shows diagnosis rates. Black columns indicate current shiftworkers, grey columns indicate former shiftworkers and white columns indicate those who have never worked shiftwork.

## Managing Fatigue

The traditional approach to fatigue management in the workplace has focused on fatigue-reduction – trying to remove as much fatigue from the workplace as possible. This has typically been done through hours of service (HOS) regulations [57, 58]. While there is evidence that HOS regulations are helpful for managing fatigue, there is less evidence that they are sufficient [57, 59].

As is the general trend in workplace safety, current policy initiatives to manage fatigue include HOS as part of a Safety Management Systems Approach [57, 58, 60, 61]. Such systems acknowledge that no single system to prevent error or incident is perfect, so you need multiple, overlapping and redundant levels of protection.

The Hierarchy of Risk Controls fits within this framework. The aim of this study is to identify strategies at all levels of this hierarchy to contribute to fatigue-related worker health and safety. This hierarchy is presented, with some examples we collected in a smaller scale, in a recently completed study in the residential care industry [77], and a previous study in healthcare [3]:

1. Eliminate the hazard: batching tasks on nightshift to allow for naps to reduce/ extinguish fatigue
2. Substitute the hazard for something of lesser risk: substituting safety-critical tasks (e.g. swap roles in team-transfer decision-making to another team member)
3. Isolate the hazard: self-identification of fatigue, or ability to recognise it in others in order to target countermeasures
4. Use engineering controls: clearly written reminder notes, lists to ensure completion of tasks
5. Use administrative controls: deliberate increases in communication, double-checking
6. Use personal protective clothing or equipment, safety training, fatigue education.

While these previous examples may be useful, they were collected across a number of different work environments, with workers in different job roles. Further, strategies for fatigue management were not a central focus of the study, with this information arising in interviews through extra discussion.

This study will build on previous work by (a) gaining richer interview information through a study design focused on fatigue-management strategies; (b) supplementing this information with quantitative survey and physiological data relating to broader life coping strategies and health; and (c) conducting the study in a specific group, hospital nurses, who have a workers compensation profile [62] that signals the need for attention in this population.

Indeed, in the WorkCoverSA Statistics 2011-2012 [62], Registered and Enrolled Nurses were in the top three (along with personal care assistants) for occupations with the highest number of total injury claims for females with self-insured employers. Nursing claims represent 13% of the total claims for females with self-insured employers during this period, or \$10.4 million.

It is difficult to estimate the proportion of these injuries that would be attributable to fatigue. In an analysis of the data from a previously-published random sample of US hospital nurses [28], we found that having 3h sleep as compared to 9h in the 24h before starting work was associated with 1.29% increase in error, and that being awake for 20h awake compared to only 8h was associated with a 3.69% increase in error. Therefore, if nursing claims are worth \$10.4 million, then managing sleep time and time awake may prevent \$133,730 and \$382,530 in claim costs in a single year.

However, we know that fatigue interacts with other factors that contribute to performance errors and incidents such as heat [63, 64], noise [65, 66], chemical exposure [67-69], mental health/stress [70-72], alcohol and other drugs [73], and illness and injury [74-76], which can all amplify the negative impact of sleep loss and fatigue. It is likely then, that managing sleep and fatigue may also reduce a larger proportion of claims.

Further, given the mounting evidence linking shiftwork-related sleep loss and circadian disruption to chronic illness [32-43], managing fatigue in nursing may have longer-term benefits in reducing missed work and health costs resulting from chronic health issues. Data from the proposed study on strategies for coping with fatigue, health and time in (exposure to) shiftwork will allow us to identify patterns of behaviour (sleep, diet exercise) that may promote long-term health under shiftwork conditions.

## Study Aims

While some people with stressful and fatiguing work conditions cope very well, others do not [52]. This project will investigate markers of health at a biological (telomere shortening), psychological (distress, depression, exhaustion) and social (interpersonal) level. This will form a critical first step in mapping the factors that make a person resilient to long and irregular hours, fatigue and work-related stress.

First, we will consider the Safety Learning System Database, and examine this repository of incident information to contextualise the reporting of incidents that may be fatigue-related.

# SAFETY LEARNING SYSTEM DATABASE ANALYSIS (AIM 1)

**AIM 1:** To use the SLSD to understand and contextualise reported fatigue-related incidents in nursing, and how they differ in profile from other incident types.

The Safety Learning System (SLS), introduced in 2010, is the central database where all Work Health and Safety (WHS) incidents are recorded for SA Health (consistent with the WHS Act 2012, SA). The SLS was originally developed to capture patient safety incidents and was later expanded to include staff incidents. This report focuses on staff incidents only.

Recorded fields include date and time of incident, local health network (LHN), location, employment status, age band, gender, occupation, hours per week, length in current position, injury type and level, incident description, and WHS likelihood, consequence and risk.

In 2013, questions about fatigue were added:

- At the time of the incident, estimate how long you had been awake
- At the time of the incident, what kind of shift were you working?
- Estimate the amount of sleep that you had in the prior 24h
- Estimate the amount of sleep that you had in the prior 48h

The following analyses were conducted on data from July 2013 to July 2015, from Central Adelaide Local Health Network (CALHN), Country Health SA Local Health Network (CHSALHN), Department of Health and Aging (DHA), Northern Adelaide Local Health Network (NALHN), Southern Adelaide Local Health Network (SALHN), and Women’s and Children’s

Local Health Network (WCHN) (i.e. excluding ambulance). This yielded a total of 21610 records (Table 1).

Of these, 12972 (60% of records) had information for time of incident, time awake, and sleep in the prior 24h and 48h. We investigated reporting rates, indicators of fatigue (time of day, time awake, prior sleep and shift type), shift type and fatigue risk, and fatigue and occupation.

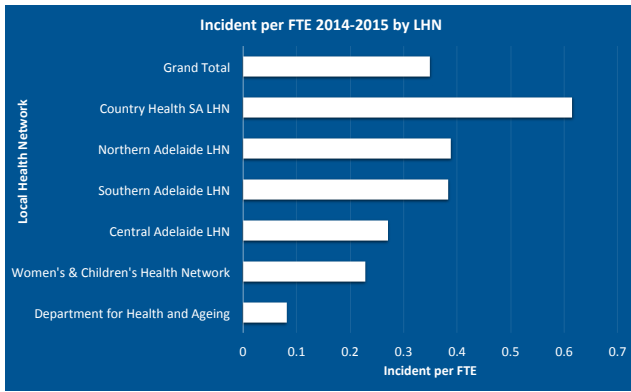
## Reporting Rates: Incidents per FTE

In order to take into account different workgroup sizes, incidents were expressed relative to full time equivalent (FTE) employed in each group. The following figures show incidents for 2014-2015, divided by the FTE equivalent for that year (e.g. there were a total of 10,410 incidents in 2014-2015, with 29,772 FTE across all areas,  $10,410/29,772=0.35$ ). Overall, there were 0.35 incidents per FTE in 2014-2015. As a relative proportion of FTE in each network, Country Health had the highest reporting rate, followed by Northern, then Southern (Figure 3).

**Table 1.**

*Work Health and Safety (WHS) incident counts for the SLSD from July 2013-2015 by year and Local Health Network (LHN).*

AREA		YEAR		TOTAL
		2013-14	2014-15	
AREA	CALHN	2934	2934	5868
	CHSALHN	3449	3449	6898
	DHA	242	187	429
	NALHN	1947	1225	3172
	SALHN	2021	2013	4034
	WCHN	607	602	1209
TOTAL		11200	10410	21610



**Figure 3.**

WHS incident counts per FTE for each LHN.

As a proportion of FTE, younger workers (in the 15-24 age band) had the highest reporting rate, followed by those in the 50-54 age band (Figure 4A).

Weekly paid had the highest reporting rate, followed by nurses/midwives (Figure 4B).

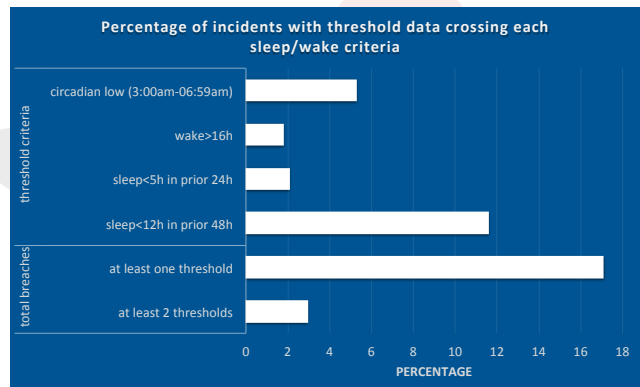
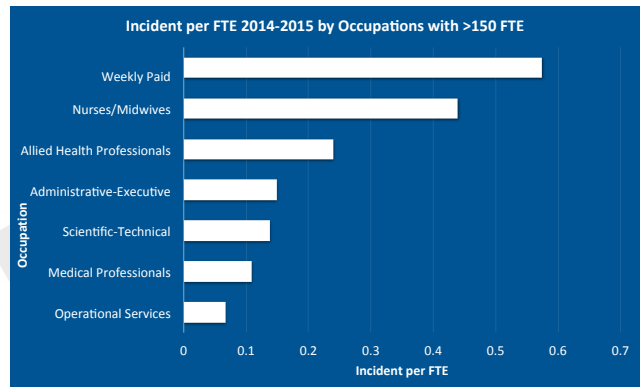
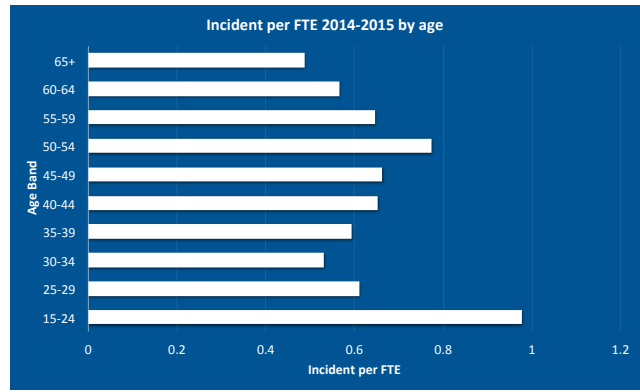
## Indicators of Fatigue

Incidents with sleep/wake/time data were investigated to examine the proportion associated with what we would consider to be indicators of fatigue [1]:

- during the circadian low;
- following >16h of wake;
- following <5h sleep in the prior 24h; or
- following <12h sleep in the prior 48h

17% of incidents (roughly one in six) were associated with at least one of these indicators (Figure 4C). The odds of the incident being classified as moderate, high or extreme risk (as opposed to low) was 19% higher for fatigue-indicator incidents. This increase was significant (OR=1.19, Wald  $\chi^2_1 = 10.28, p < 0.001$ ).

Nearly 20% of incidents (one in five) that were associated with moderate, high or extreme risk met fatigue-indicator thresholds.



**Figure 4.**

A – WHS incident counts per FTE for each age band.

B - WHS incident counts per FTE for each occupation, excluding occupations with small numbers (<150 FTE).

C - Percentage of WHS incidents that were associated with indicators of fatigue. Upper part of the y-axis shows each threshold indicator of fatigue, the lower part shows the number of thresholds crossed.

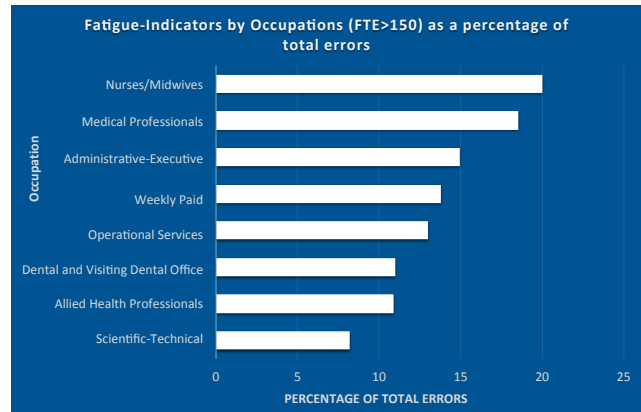
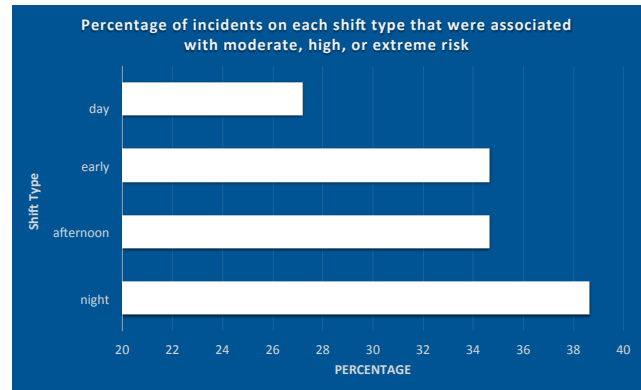
## Shift Type and Fatigue Risk

Nearly 40% of the incidents that occurred during night shift were associated with moderate, high or extreme risk (Figure 5A).

Early, afternoon and night shifts all had a significantly higher proportion of moderate, high or extreme risk accidents, compared to day shifts (ref=day shifts; early OR=1.42, Wald  $\chi^2_1 = 44.65$ ,  $p < 0.001$ ; afternoon OR=1.42, Wald  $\chi^2_1 = 37.46$ ,  $p < 0.001$ ; night OR=1.69, Wald  $\chi^2_1 = 64.71$ ,  $p < 0.001$ ).

## Indicators of Fatigue and Occupation

Nurses/Midwives had the highest proportion of incidents with fatigue indicators (Figure 5B). To avoid problems with small cell sizes, occupations with small numbers (<150 FTE) were excluded from this analysis.



**Figure 5.**

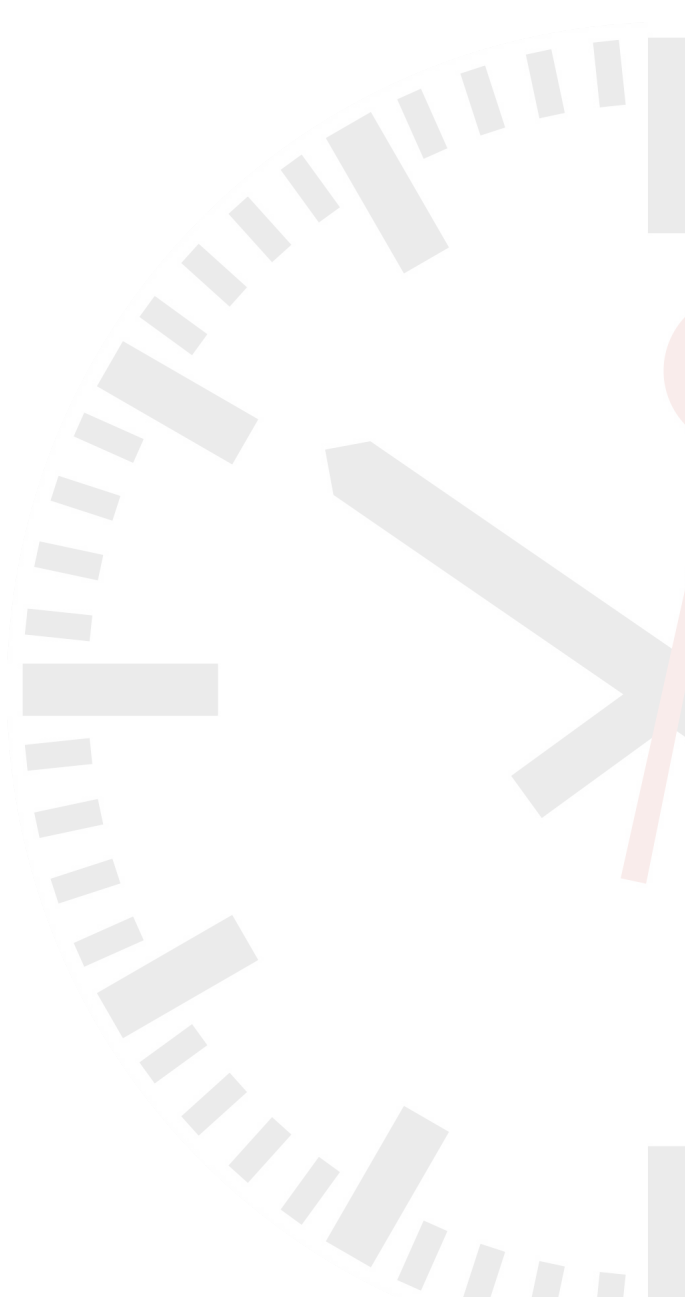
*A - Percentage of WHS incidents for each shift type that were associated with moderate, high or extreme (as opposed to low) risk.*

*B - Percentage of WHS incidents for each occupation >150 FTE.*

## AIM 1: Summary Points

Analysis of the Safety Learning System Database Work Health and Safety Incidents revealed:

- Relative to FTE, Country Health, followed by Northern, then Southern, had the highest reporting rates
- Younger workers (15-24) had the highest reporting rates
- Weekly paid had the highest reporting rates, followed by nurses and midwives
- 17% of incidents were associated with fatigue indicators (during the circadian low, >16h wake, <5h sleep in prior 24h, <12h sleep in prior 48h)
- The odds of the incident being classified at a moderate level of risk or higher were nearly 20% higher for incidents associated with a fatigue indicator
- One in five incidents associated with a moderate level of risk or higher met fatigue-indicator thresholds
- More than one in three incidents on night shift were associated with a moderate level of risk or higher
- The odds of an incident with a moderate or higher level of risk were increased by 40-70% on early, afternoon and night shifts compared to day shifts
- Nurses and midwives reported the highest proportion of incidents with fatigue indicators.





# IDENTIFY HEALTHY CLUSTERS (AIM 2)

**AIM 2:** Identify whether there are clusters in the data across physical, behavioural and psychosocial variables that may represent workers who experience positive physical, occupational, cellular and psychological health.

## Methods

This was a mixed-methods study to find converging evidence across quantitative and qualitative methods, across self-report and biological data, to understand how nurses and midwives cope with night shift. Participants completed the Standard Shiftwork Index (SSI) (n=130) [10, 11], which measures demographics (e.g. age, shiftwork experience), personality variables, coping strategies, physical and psychological health, sleep disturbances and social and domestic disruption. They then had the option to complete one or all of the following: (1) A food frequency questionnaire (n=50) [12], to give a dietary profile (energy consumption, macronutrient content); (2) A saliva sample (n=45), used to measure telomere length; and (3) An in depth interview (n=22) about experience of nightshift (including preparation and recovery).

## The Standard Shiftwork Index (SSI)

The main outcome measures derived from the SSI, which are reported in the following sections, are described below.

### Sleep

Questions identify sleep habits according to shift type, e.g. early, late or night, or if on a rest day, as well as the extent to which sleep is disturbed depending on which shift has been or is about to be worked. Subjects were asked to report the time they go to sleep and wake up before and after each type of shift to allow for calculations of total sleep time.

## Coping

The subject was asked to indicate to what extent coping strategies were used with regard to 4 problem areas concerning shiftwork: sleep, social life, domestic life and work. Subjects were also asked to report the extent to which working shifts cause disruptions to their sleep, social life, domestic life and work. The two main types of coping styles are:

### Engagement Style Coping

This coping style involves problem solving, cognitive restructuring, social support, and expressing emotions. Engaged coping involves attempts by the individual to engage in efforts to manage the stressful person/environment transaction. Through these coping strategies individuals engage in an active and ongoing negotiation with the stressful environment.

### Disengagement Style Coping

This coping style involves problem avoidance, wishful thinking, social withdrawal and self-criticism. Disengaged coping includes strategies that are likely to result in disengaging the individual from the person/environment transaction. Feelings are not shared with others, thoughts about situations are avoided, and behaviors that might change the situation are not initiated.

### Physical Health

Measures of cardiovascular and gastrointestinal disorders, both known to have a high incidence in shiftworkers, were included in the questionnaire. Subjects were asked to rate how frequently they experience symptoms, such as heart palpitations and digestive difficulties.

### Psychological Health

The General Health Questionnaire was included in the SSI and is used for detecting minor psychiatric disorders in the general population, and gives a single measure of mental health.

It covers recent levels of self-confidence, depression, sleep loss and problem solving. Subjects are asked to think about their health over the past few weeks and answer the questions accordingly. This questionnaire is well-validated and has been previously used in studies on nursing [50]. The clinical cut-off indicating psychological distress is a score of 11-12.

## Personality

The Eysenck Personality Inventory measures two major dimensions of personality, extraversion and neuroticism, which are facets of personality that may contribute to differences in ability to cope with shift work.

## Saliva Samples

Saliva samples, taken by spitting into a collection tube, were used to measure telomere length. The telomere is the region of DNA that caps and protects the ends of every chromosome, and as they shorten with age, they represent a marker of biological aging. Studies have found telomeres shorten more rapidly in individuals under conditions of chronic stress. Consequently, shortening of telomeres can be used as an indicator of stress-related cell damage.

## Food Frequency Questionnaires

Dietary profiles were examined using a food frequency questionnaire (FFQ) designed by the Cancer Council Victoria [51], which asks about food frequency and portion size. The FFQ has demonstrated validity [52, 53]. Daily macronutrient intake was calculated as a percentage of total daily energy intake in kilojoules (using standard macronutrient values: 17kJ/g for carbohydrate and protein, 29 kJ/g for alcohol and 37 kJ/g for fat).

## Interview Technique

In our previous research with shiftworkers, we have found that when asked specifically about sleep loss and fatigue, they may report that it is not an issue for them, but that may be because they are actively engaging in fatigue-mitigation

strategies without necessarily being consciously aware of it [5, 6]. In order to avoid this issue, we used a Critical Incident Technique (CIT) [3, 4], which is a classic approach that has been used heavily in aviation research, and more recently health care research. In this way, participants in the proposed study were asked to describe a typical night or early morning shift (the shifts of primary fatigue-related interest, based on our past studies [7, 11, 12]). They were then asked to describe a “good” shift, then a “bad” shift. This includes what happened at home and during the commute immediately pre- and post-shift.

This approach is particularly suited for studies that are focused on recall of specific events that may be classified in terms of their importance or impact and how much these examples of the event deviate from what would be considered typical. CIT is also designed to minimise recall bias by requesting detailed information for the event systematically.

Once we collected descriptions of “good”, “bad” and typical shifts at work, we then asked participants to estimate how frequently these types of shifts might occur. The interview schedule was based on the parameters outlined in Flanagan’s original [3] article.

After we completed the CIT discussion, we asked some more specific questions relating to individual factors for coping with shiftwork-related fatigue (sleep hygiene, sleep aids, diet, exercise, countermeasure use), team factors (assistance, cross-checking) and organisational factors (procedures, support, culture).

## There is evidence of healthy aging in these shiftworkers

We performed a cluster analysis to investigate whether there were patterns across sleep, social, and domestic indicators, as well as physiological and psychological health. Interestingly, two clusters emerged.

(1) “Healthier” cluster, with significantly less sleep disturbance, social, domestic, sleep and work performance disruption due to shiftwork, fewer gastrointestinal and cardiovascular symptoms, and lower neuroticism ( $p < 0.05$ )

(2) “Less Healthy” cluster, with significantly worse scores across all of these variables. In Figure 6 you can see the distributions of each of the variables that were significantly different ( $p < 0.05$ ) between clusters. For example, looking at the first variable, Shiftwork-Related Sleep Disruption, you can see that in the “Healthier” cluster, there were more people with very low Sleep Disruption scores, compared to the “Less Healthy” cluster, where scores were more frequent at the high end (representing more severe disruption).

The other variables are Shiftwork-Related Social Disruption, Shiftwork-Related Domestic Disruption, Shiftwork-Related Performance Disruption, Gastrointestinal Symptoms, General Health Questionnaire (GHQ), which is an indicator of Psychological Wellbeing, Neuroticism, Sleep Disturbance and Cardiovascular Symptoms. This model was associated with fair-good model fit.

## Healthy aging is strongly linked to coping

If we look at factors that relate to “Healthier” or “Less Healthy” cluster membership, years of shiftwork experience is very important. Figure 7 shows that the proportion of people in the “Healthier” cluster is higher for those who have been working shiftwork for 20 years or more. This is somewhat counterintuitive, since we may expect that with increased time in shiftwork, health should get worse. However, there may be two reasons for this somewhat surprising finding.

First, there is the “healthy survivor effect,” mentioned earlier, where those who find it difficult to cope with shiftwork transition to alternative work arrangements, leaving those that cope best over time [45, 47, 49].

A second reason for this surprising finding is that we had a clear focus on coping with shiftwork and identifying resilience in this study, so we may have had more interest in participation from healthier, experienced workers with helpful strategies to share. Nevertheless, this would suggest that it isn’t that difficult to find healthy experienced workers!

To put this another way, the odds of being in the “Less Healthy” cluster were reduced by more than 80% for experienced workers. There were other factors that influence cluster membership. The odds of being in the “Less Healthy” cluster were also reduced by engaged coping, and were increased by disengaged coping and increasing weekly work hours.

Coping styles are particularly important in this context given that nurses cannot change most of the stressors they encounter in their work life. Therefore, individual coping styles may differentiate nurses who do cope well from those who don’t. Evidence from the literature shows that the individual coping strategies people use to deal with stressful situations can impact their overall wellbeing. People who have engaged coping styles (Figure 8) and use problem-focused strategies (defining problems,

generating solutions, weighting costs and benefits, and acting on solving the problem) have better wellbeing and less work- family conflict [54].

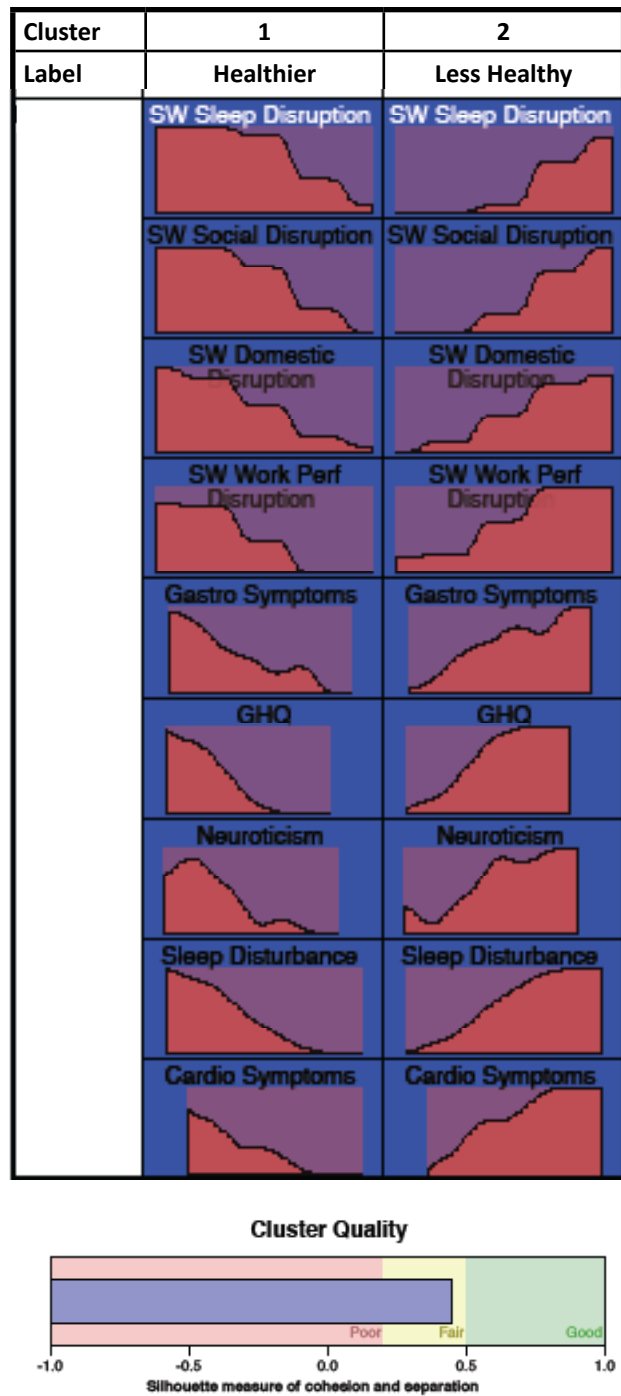
This relationship has been identified before in shift working nurses. Those using problem-focused coping had better psychological health, while nurses who had disengaged coping styles (Figure 8; feelings are not shared with others, thoughts about situations are avoided, and behaviours that might change the situation are not initiated) had more psychological and physical health symptoms [55, 56].

Two of the aspects of engaged coping, seeking social support and expressing emotions, would rely on the individual having some degree of social support. Therefore having a supportive work environment may be an important factor in encouraging engaged coping, and seeking social support at work was in fact a commonly identified strategy in our group of nurses and midwives (data described in “Psychosocial Factors” section).

Given the findings that years of shiftwork experience and engaged coping styles reduce the odds of being in the “Less Healthy” cluster, teaching engaged coping strategies to less experienced workers may be effective for helping more shift workers better cope with shift work and eventually become “healthy survivors”.

Controlling for gender and age, odds of being “less healthy” were:

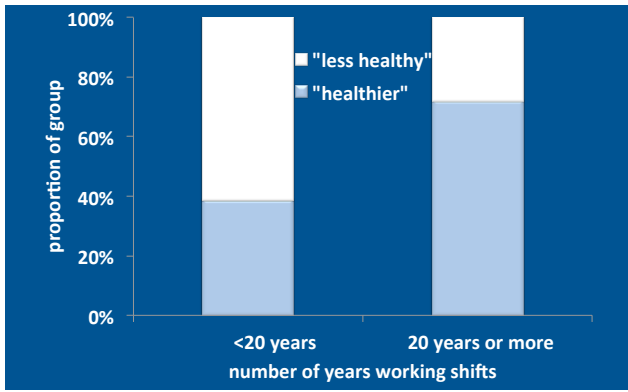
- Reduced by more than 80% for experienced workers (OR=0.16);
- Reduced by engaged coping (OR=0.92);
- Increased by disengaged coping (OR=1.20); and
- Increased by increasing weekly work hours (OR=1.09).



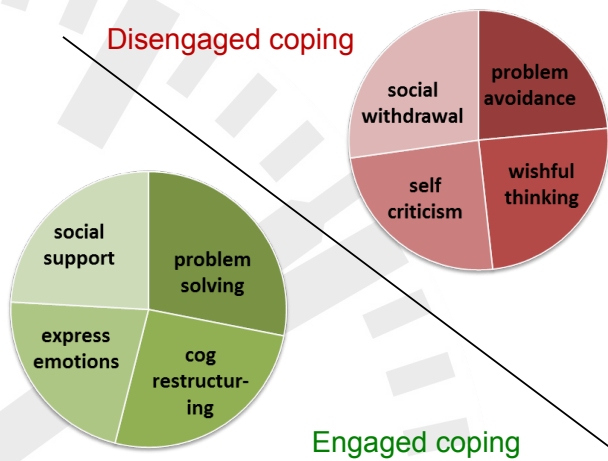
**Figure 6.**

Upper – Results of cluster analysis. Distributions of variables (rows) that were significantly different between clusters (columns).

Lower – indicator of cluster quality.



**Figure 7.**  
The proportion of those in the “healthier” cluster (blue) and the “less healthy” cluster (white) by shiftwork experience.



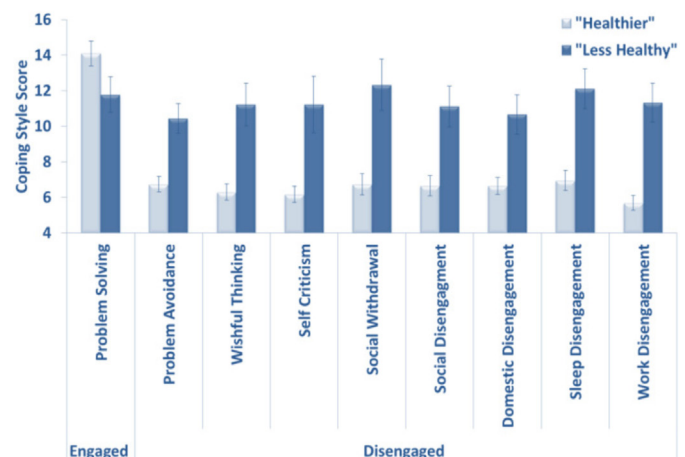
**Figure 8.**  
Disengaged coping (problem avoidance, wishful thinking, self-criticism and social withdrawal) and engaged coping (problem solving, cognitive restructuring, expressing emotions and relying on social support).

## What makes our experienced workers in the “Healthier” cluster special?

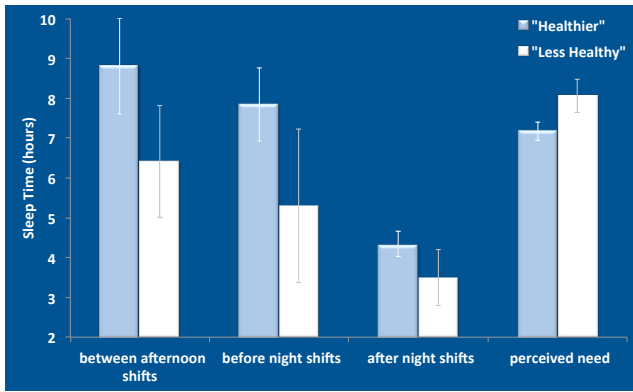
Experienced “healthier” workers are engaged problem solvers, who are low in self-criticism and social, domestic, sleep and work disengagement.

There were significant ( $p < 0.05$ ) cluster-based differences in coping style for experienced workers. “Healthier” experienced workers had higher problem-solving scores (indicating Engaged Coping), and lower scores in problem avoidance, wishful thinking, self-criticism and social withdrawal in response to problems (indicating Disengaged Coping) (Figure 9). Specifically, Disengaged Coping in response to shiftwork-related social, domestic, sleep and work problems was significantly lower for workers in the “Healthier” cluster.

Our experienced workers in the “Healthier” cluster reported significantly more sleep between afternoon shifts, and before and after night shifts. They also reported a significantly lower sleep need ( $p < 0.05$ ) (Figure 10). There was also evidence of more positive sleep hygiene among experienced “Healthier” workers. For example, odds of using alcohol as a sleep aid were nearly 17 times lower among “Healthier” experienced workers.



**Figure 9.**  
Coping style scores for experienced workers (working shifts  $\geq 20y$ ) in the “healthier” (light blue bars) and “less healthy” (dark blue bars) clusters by coping style domain.



**Figure 10.**

Sleep (hours) for experienced workers (working shifts  $\geq 20y$ ) in the "healthier" (blue bars) and "less healthy" (white) clusters by shift type and time.

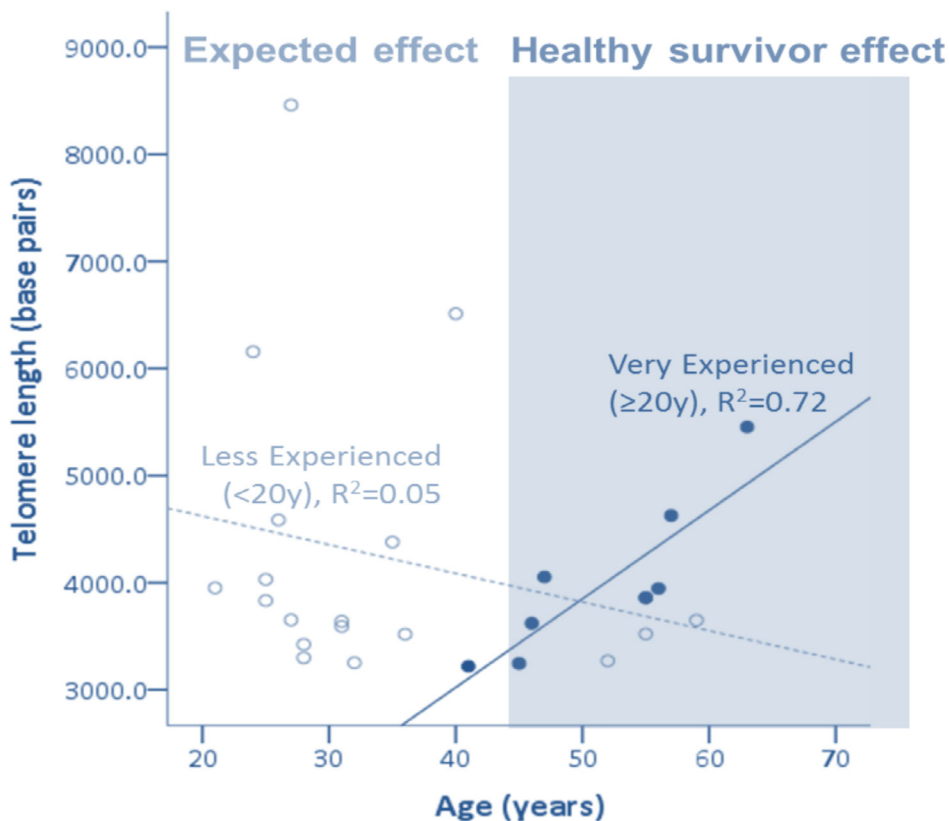
## The relationship between telomeres and age may depend on shiftwork experience

Figure 11 shows results of the telomere analysis. We have a very small sample, and this work is very new, but the patterns we see support findings that we've already discussed.

If our DNA were shoelaces, telomeres would be the aglets (end protector bits) on the ends. They get shorter with age, and under conditions of high stress (e.g. among carers).

In our dataset, if we look at everyone together, we do not see the expected relationship between age and telomere length. Interestingly when we look at those who have been doing shiftwork for  $< 20$  years, we do see the expected relationship – as age goes up, telomere length goes down. When we look at our very experienced workers, as age goes up, telomere length goes up.

This is another counterintuitive finding that could be explained by our "healthy worker survivor effect" – the more experienced you are, the more likely it is that you are healthier, since you have coped with shiftwork for so long without dropping out. There are other potential explanations for this result, and this is of course, speculative, but in combination with the other results, it provides interesting converging evidence.



**Figure 11.**

Telomere length (y-axis) by age (x-axis). Open markers indicate less experienced workers ( $< 20y$ ) and filled markers indicate very experienced workers ( $\geq 20y$ ). Lines are best fit from regression, with  $R^2$  indicated.

## Aim 2: Summary Points

Analysis of the field study with nurses and midwives revealed:

- Two clusters emerged from the data: a “healthier cluster” with significantly better scores, and a “less healthy cluster” with significantly worse scores across a range of biopsychosocial outcomes
- More experienced workers had significantly increased odds of being in the “healthier cluster”
- Healthy aging was also strongly related to engaged coping style
- Experienced, “healthier” workers are engaged problem solvers, who are low in self-criticism and social, domestic, sleep and work disengagement
- Experienced, “healthier” workers also have more sleep before and after night shifts and report a lower sleep need
- The relationship between telomere length and age may depend on shiftwork experience, with more experienced workers showing a positive relationship between age and telomere length
- Overall, we have evidence for a “healthy worker survivor effect” where those who cope well remain in shiftwork for longer

# IDENTIFY HEALTHY STRATEGIES (AIM 3)

**AIM 3:** Identify behavioural strategies at the individual (work structure, nutrition, countermeasure use, exercise, sleep hygiene) and team (assistance, cross-checking, transfer to different duties) levels, that workers with optimal physical, mental and cellular health use to manage the effects of sleep loss and fatigue.

## Workers use many strategies to cope with shiftwork, with varying evidence for efficacy

Figure 12 shows the many strategies for coping with night shift uncovered in this study. The six pillars represent the overall focus of each group of strategies. At the top of each pillar, you can see the data source(s) where the strategies were identified, the survey (SSI), the interview, and/or the Food Frequency Questionnaire (FFQ).

The colours of the boxes signify the level of evidence for the effectiveness of the strategy from the literature, and from our study results, and whether the strategy could be considered helpful or harmful.

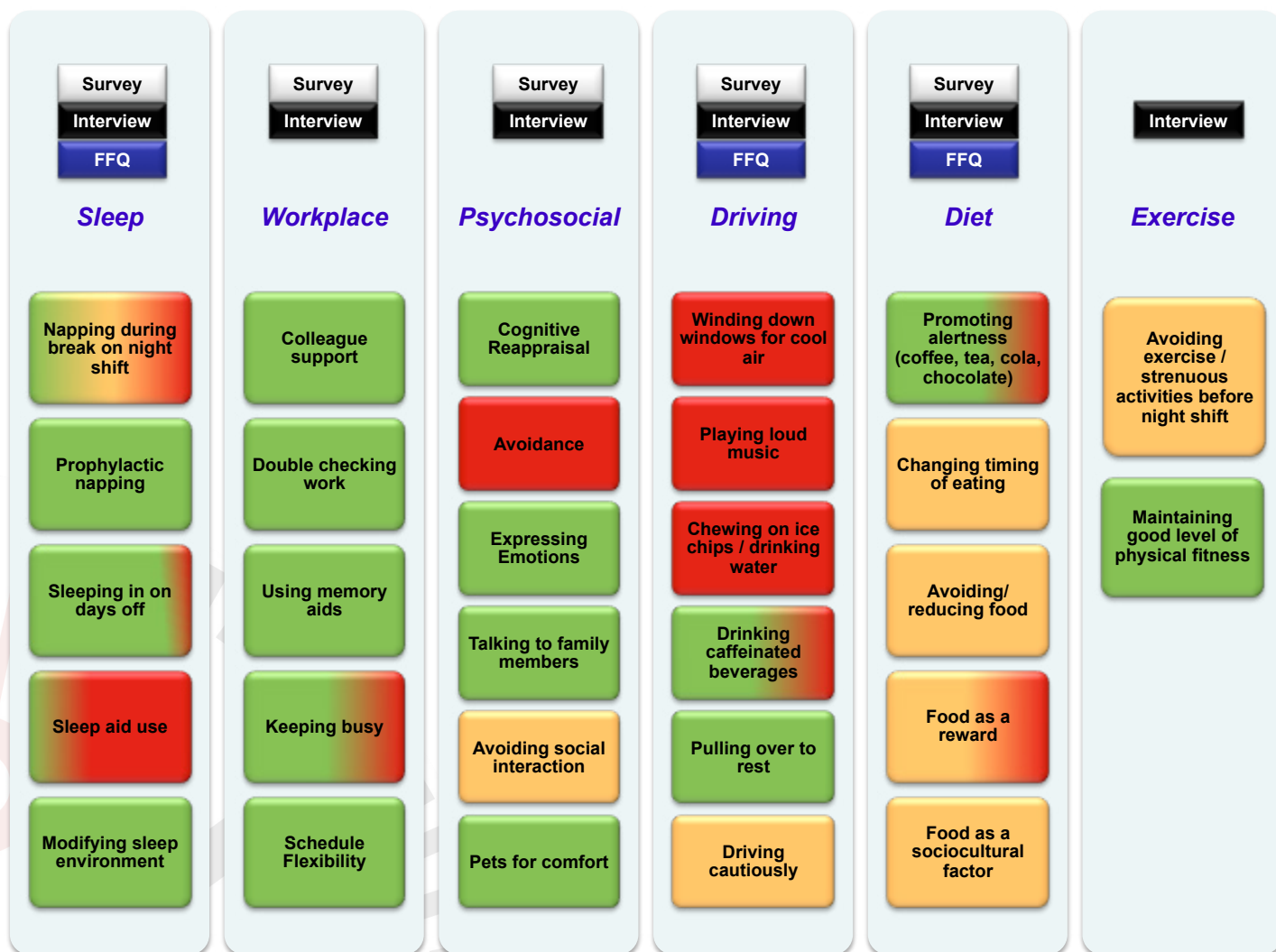
For example, “pulling over to rest” if sleepy while driving home from nightshift is considered helpful (green), whereas research investigating whether playing loud music or winding down the windows are helpful for driving fatigue has indicated that these strategies are not effective (red). Avoiding exercise before a night shift is orange, since we were unable to find evidence to support or refute this strategy. Sleep aid use has gradient shading from green to red, since certain sleep aids (e.g. prescription medication) may be effective for short periods, but become harmful with extended use.

The majority of strategies in the workplace are green. There were some interesting and useful strategies for maintaining performance through the night. The driving-related strategies reported have had little support from the literature.

When we were considering the effectiveness of each of these strategies, we found that there were important factors that impacted on whether or not a strategy would be useful for a particular individual. We have therefore begun to develop a framework for an individualised method to aid in strategy selection. In addition, many strategies are associated with potential hazards, depending on the context. We therefore think it is important to present any aids to strategy selection in the context of any potential hazards.

The following section of the report will consider each pillar in turn, considering evidence, efficacy, individual use and hazards.





**Figure 12.**

Strategies for coping with nightshift. Each pillar represents a theme (sleep, workplace, psychosocial, driving, diet, exercise). Data sources for each theme are presented in the grey (survey), black (interview) and blue (FFQ) boxes at the top of each pillar. Green represents strategies with evidence from the literature and/or our dataset that the strategy is effective, orange represents strategies requiring more study, and red represents strategies that have been associated with no evidence that they are helpful, and possibly also evidence of associated hazards.

## Sleep Strategies

There were three main ways in which participants altered their sleep to manage sleepiness and time awake across nightshifts. Some slept in on the morning before the nightshift, others had a nap in the afternoon, and some took a short nap while on shift.

We also saw strategies concerning use of sleep aids (prescription and non-pharmacological) and modification of the sleep environment, particularly to facilitate sleep during the day following night shifts.

## Napping During Break on Night Shift

Napping during night shift may be an effective strategy for some shift workers to help manage sleepiness, although there is limited evidence in the literature for the efficacy of naps during night shift, particularly for short naps which are easier to take on breaks compared to longer naps.

The only study to look at nap opportunities of less than 30 minutes at night found that there were no benefits to performance in the following hours, but subjects reported feeling less sleepy [57].

However, these short naps induced 'sleep inertia' after waking [58]. Sleep inertia refers to a feeling of 'grogginess' and impaired performance immediately after waking. This is a potential hazard given nurses and midwives need to resume work following a nap on night shift. Sleep inertia can vary in severity and length depending on the individual, the time of night, and how sleepy the individual is. Therefore while napping on night shift may help individuals to feel less sleepy, they may in fact have a period of worse performance and mood upon awakening, and there is limited evidence on whether performance is improved in the hours following short night time naps. Nonetheless, we did find reports of participants napping on night shift, while others abstained.



Napping on night shift was reported as a strategy by 16% of survey respondents (Figure 13). Participants reported napping during their break between approximately 3-4am, for between 30-45 minutes:

"About 4:30 I've hit a brick wall so I'll take my half hour break and I'll...fall asleep." #3103CO

We also found that some participants were aware of the negative effects of napping, with reports of avoiding napping during the shift due to sleep inertia:

"I find it makes me feel terrible if I nap." #3207ST

We found that those who used napping strategies had significantly ( $p < 0.05$ ) higher scores on sleep flexibility (the ability to sleep easily at unusual times or places):

"Noise, bells all the codes...they get broadcast very loudly at night it's a wonder everybody doesn't wake up when they come over. They're very, very loud." #6404PY

Nurses and midwives who napped during night shifts also reported less sleep on days off. Therefore napping on night shift might be a reactive strategy that is being used if people are unable to sleep enough at home, either due to environments that are not sleep-conducive (e.g. too much noise) or not prioritising sleep on days off.

We also found that by the end of their night shift non-nappers had been awake for an average of 19h, which puts them in a zone that has been identified in the literature as producing performance impairment equivalent to having a blood alcohol concentration of 0.05-0.10% [59, 60]. This is of potential concern for those who are driving home from night shift.

## Prophylactic Napping

Some nurses may choose to avoid naps on night shift or are not able to nap during night shift due to low sleep flexibility or lack of safe places to nap. Taking a 'preventative' nap in the afternoon, known as prophylactic napping, may be an alternative way to manage sleepiness and time awake while on nightshifts. In our sample, approximately 22% of participants reported taking prophylactic naps before night shifts (Figure 13). Research shows that prophylactic napping can help to counteract declines in performance in the evening [61, 62].

Some participants reported prioritising a prophylactic nap in their routine before a night shift:

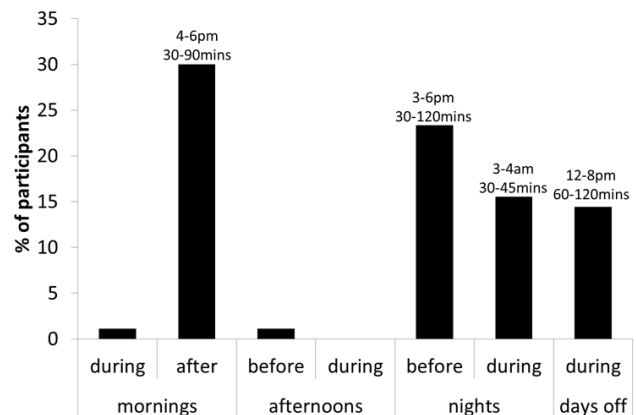
"I might do shopping, do whatever, but only really until about 1:00 o'clock... I'll sort of organise myself to have a sleep, and take the phone off the hook, take away distractions, have the house quiet and dark, and then go to bed and read until I get that first big blink, put the book down, go to sleep." #4712HU

Participants also reported avoiding prophylactic naps due to concerns that the quality of their daytime sleep after the night shift would be minimised, although research shows that the effects of short naps (30 minutes or less) on 24-hour sleep quantity and quality are minimal [57]:

"I'd just sleep in in the morning and get up and have my normal day and work through the pain. Then I found that I slept properly because if I slept through the day...in preparation for nights then you'd come home the next morning and you wouldn't be ready for sleep again. So it was easier just to try and sleep in to 11.00 and then get up and go, and that was fine." #5106MC

We also found that not everyone was able to obtain extra sleep at home by napping before night shifts – there were many households not conducive to sleep:

"I live right next to a school...I hate sports days.... I don't get any notice, and I've done nightshift when they've had sports days...I'll get woken up, I don't know, every time the starter gun goes". #3103CO



**Figure 13.**

*Percentage of participants reporting naps during and after morning shifts, before and during afternoon and night shifts and on days off. Approximate nap times and lengths are also shown.*

Although prophylactic napping may not be possible for some individuals, it is a strategy that minimises extended time awake over the night shift [36], which may have protective benefits for performance towards the end of the night shift. Prioritising a prophylactic nap into the daily routine during night shifts may be a useful where possible.

## Sleeping in on Days Off

Consistent with other studies [2], days off are frequently used to catch up on sleep debt accrued during a period of work. In our sample, sleeping in on days off was not achieved by everyone. We noticed that those who reported napping on shift achieved significantly less sleep than others on their days off.

It may be that not everyone has a home environment that is conducive to sleep. Since creating a bedroom environment that is cool, dark and quiet [63, 64] is beneficial to promote sleep, especially in the daytime, communicating the previously discussed strategies about sleep hygiene and bedroom environment would likely be advantageous.

## Sleep Aid Use

Sleeping pills can be useful in the short term, but are associated with impaired performance and increased risk of driving accidents, and can lead to issues with dependence and increased tolerance with chronic use [65]. Frequent use of sleeping pills was reported more for night shifts than other shift types, and this pattern was also identified in the interviews:

“Usually if I’ve got multiple nights, I’ll take either a sleeping tablet or Phenergan which is an antihistamine that makes you drowsy, so I’ll have some chemical assistance to try and sleep a bit longer.” #2701NA

There were also reports of using sleeping pills after night shifts to assist with adjusting back to a normal daytime schedule:

“I would usually have a sleeping tablet that night (after a night shift) to then sleep normally again and then get up at normal time.” #3207ST

Alcohol was also identified as a sleep aid being used by nurses and midwives. Using alcohol as a sleep aid was most commonly reported on quick returns (late shift followed by an early shift) and on days off, and in our sample, standard drinks per day exceeded national guidelines (Figure 14). 20% of the adult Australian population drink at levels risky for lifetime harm [66], but in our sample 24% of participants reported drinking at levels risky for lifetime harm. In the general Australian population, 45% of adults report drinking at levels for short-term risk [67], whilst 63% of our sample drank at levels for short-term risk. This is consistent with findings of a recent study in 8-hour rotating nurses, with 65% drinking at levels for short-term risk [68].

Alcohol use has also been implicated with a range of physical and psychological health issues [69]. This was consistent with our findings that the odds of using alcohol as a sleep aid were lower amongst “healthier” experienced workers.

There is also a common misconception that alcohol helps improve sleep. However, alcohol intake can reduce quality of sleep, even in low doses [70], and can have detrimental effects on waking performance e.g. driving [71]. Therefore, it is important that the lack of efficacy of alcohol as a sleep aid is reiterated to workers.

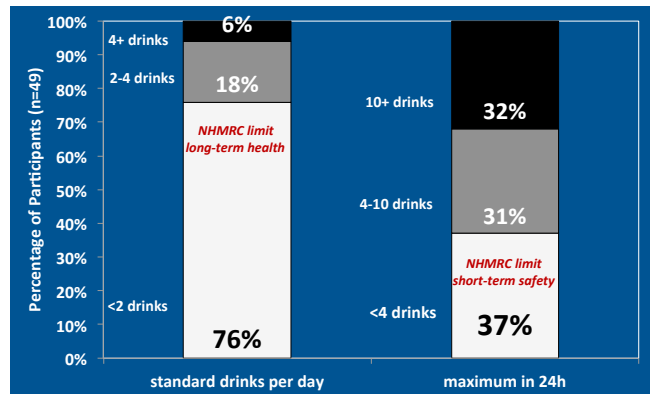


Figure 14.

Percentage of participants reporting consuming <2, 2-4, and 4+ standard drinks per day and <4, 4-10, and 10+ standard drinks in a 24h period. NHMRC guidelines for long-term health and short-term safety are also shown.

## Modifying the Sleep Environment

Eliminating noise and having a cool, dark sleeping environment can assist in achieving good quality sleep during the day [72]. Several strategies to modify the sleep environment were identified in the interviews. Limiting light exposure in the bedroom and using fans or ear plugs to block out noise were common:

"I have roller shutters on my bedroom windows and I keep all my ensuite and bedroom shut to block out the light and I've got a ceiling fan and I put that on really high because...that blocks out the street traffic noise." #240417

Ensuring that the sleep environment was cool was a theme found in the interviews:

"I make sure that my air conditioner is set to come on if it's a hot day. If you wake up in the middle of the day and it's too hot I can't get back to sleep again, so I've worked out how to work the little timer so it comes on at 11 o'clock, so it's not on straight away but when it needs to be on it will be on." #3611WE

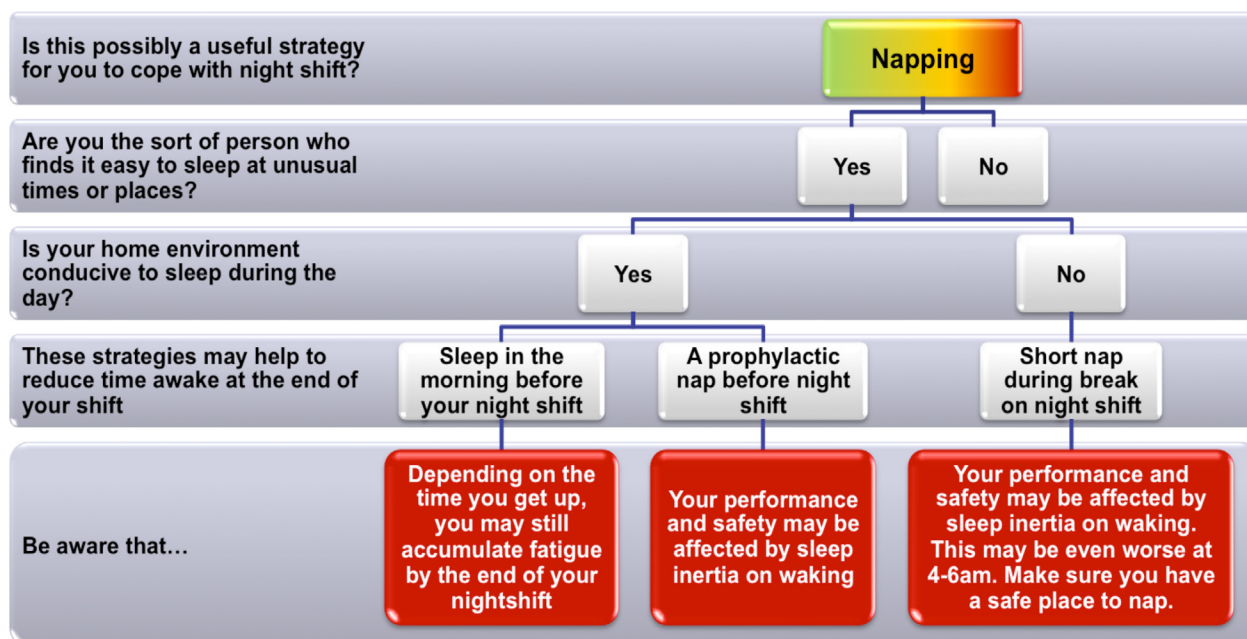
This is important for sleep, as during the day core body temperature is higher than at night, which can make achieving sleep more difficult [73].

Reducing interruptions to sleep caused by phone calls was also a commonly reported strategy:

"So I've got a blocking on my mobile phone so that only my husband or daughter will make noise on the phone, and everything else is blocked, and I take the home phone off the hook." #4712HU

These behavioural strategies are all in line with good 'sleep hygiene' practices, and are especially important during the day when sleep quality is already impaired due to biological reasons.

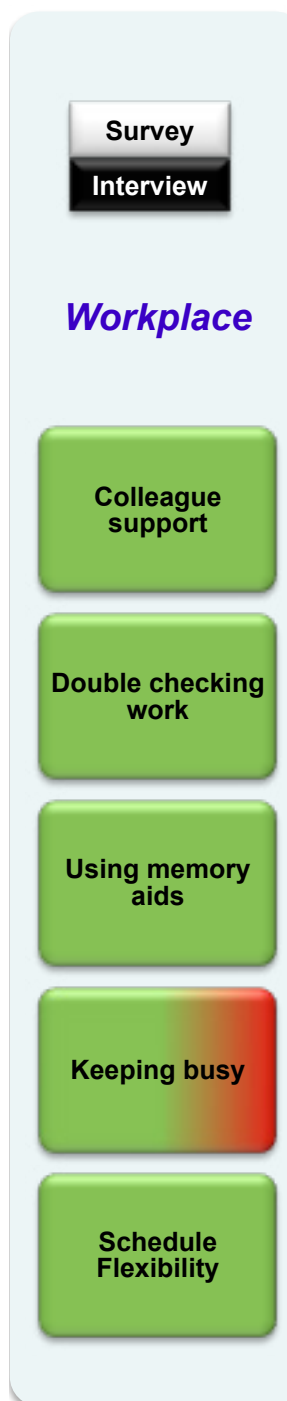
This section has highlighted the ways in which napping and sleeping in are used to augment sleep associated with night work. We know that not everyone is able to sleep in and/or nap, and we identified factors that may help people to consider whether these sleep strategies could



**Figure 15.**

Decision Tree to help in decision making about napping and sleeping in as potential countermeasures. The diagram shows a series of questions about sleep flexibility and home sleep environment. Following this, the individual can be shown targeted suggestions about how these sleep strategies may be used, in the context of the potential associated hazards.

be beneficial for them. As with many strategies, napping is not simply “effective” or “harmful,” but can actually be either depending on the circumstances. Therefore, we wanted to provide strategy options while also providing information about the possible hazards associated with each strategy. These include sleep inertia following waking, potential issues with napping during the circadian low, and making sure there is a safe nap space. This is summarised in Figure 15.



## Workplace Strategies

Not surprisingly, given the team environment, the importance of teamwork was a critical linking concept throughout workplace strategies to deal with night work. Peer support has been demonstrated to be critical in environments such as healthcare, in particular to cope with stress following adverse events [74]. Research has shown that interpersonal work context is related to job retention, with those with unsupportive work environments reporting a stronger intention to leave nursing [75].

Studies of teamwork in nursing have identified several core components of teamwork [76], These include:

- Teamwork leadership, which involves watching over the staff and helping when assistance is required;
- Mutual performance monitoring, which involves obvious indicators of how team members are coping with their work;
- Backup behaviour, which involves helping others with their responsibilities, especially in a crisis;
- Adaptability, which involves being able to change with the changing demands of the workplace;
- Shared mental models, which refers to the consistency with which team members understand their roles,
- Closed-loop communication, which involves complete and accurate handover, knowledge of the workload of all team members and conflict resolution; and
- Mutual trust.

Clear examples of the way in which these aspects of teamwork are applied in relation to night work and fatigue are exemplified in many quotes from the interviews in our study.

## Colleague Support

Colleague support was identified as very important, not only for work safety (below), but also at a social/staff morale level.

Participants' accounts of nightshift reflected engagement in Teamwork Leadership and Mutual Performance Monitoring:

"I notice others' tiredness and help them out." #6302HA

Backup Behaviour:

"Letting people go for extra breaks and stuff, go and make a coffee, we do that for each other. If we're sort of like, "Man, I'm struggling," you're like, "Go and make a drink." #3207ST

and developing Mutual Trust:

"you work so closely with these people they become your work family, so it's really nice to come to work because you think I'm going to see that person and it's good because nobody likes nights." #4206RA

From the literature, these approaches are consistent with core components of positive teamwork. Further, these skills in teamwork can be developed [76], suggesting that interventions to improve teamwork may also be beneficial for improving outcomes relating to night and shiftwork. This is in line with previous studies that highlight the importance of teamwork for health professionals and patient safety under conditions of sleep loss [7, 77].

Double-checking work: double-checking work processes, including drug calculations, is something that has been found before among healthcare professionals as a way to manage the potential impact of fatigue on safety [10, 77]. This was also the case in this study:

"Check what I'm doing...I've done this and this and this...Is there anything you think I need to do?" #5312JE

This is consistent with core teamwork concepts of Mutual Performance Monitoring and Backup Behaviour, which contribute, not only to a positive teamwork environment [76], but also to increased patient safety through potential errors being caught before they cause harm [7].

## Using Memory Aids

Since memory is one of the many aspects of functioning that is negatively impacted by sleep loss and remaining awake at night [78, 79], memory aids on night shift are likely to add a degree of protection. Indeed, a recent study demonstrated that providing additional information to a task (referred to as "augmented reality") so that the participant was less reliant on memory made the task less vulnerable to the negative effects of a full night awake [80].

"Maybe write lists a little bit more just to jog or – we've got our big chart so I'll put dots of where everything is due, like that visual cue so I don't rely on my memory." #3207ST

## Keeping Busy

A common theme regarding coping with nightshift was related to keeping busy. Participants reported that being busy kept them feeling alert:

"If you're busy you're stimulated and because of the nature of the unit you're concentrating all the time so it wakes you up." #4206RA

Research has suggested that low-event tasks may be particularly vulnerable to the negative effects of fatigue [81, 82], and that this may be, at least in part, due to boredom and/or cognitive disengagement with the task [81, 83, 84]. Tasks that are more interesting, and are moderately paced, are likely to be associated with engagement, and ultimately improved performance compared to extremely low-event tasks. In this way, keeping busy may act as a countermeasure to sleepiness on the nightshift, promoting work engagement.

However, it is important to note that very fast-paced tasks, or tasks that involve a high workload, are often more vulnerable to the effects of sleep loss. This relationship is consistent with what we know about the relationship between workload and performance more broadly. Therefore, optimal workload on nightshift is most likely to be a balance – keeping a moderately-paced task schedule, and avoiding both under- and over-load.

### Schedule Flexibility

Allowing a degree of flexibility in the schedule was reported to be helpful by many. This included coordinators who specifically allowed sufficient time off to recuperate following fatiguing work patterns. While at a basic level, this is part of safe work schedule design [85], some participants felt that their roster coordinators went above and beyond to create optimal schedules for their team:

“So I could have worked nightshift last night and then work an early tomorrow. Our coordinator is pretty good. She doesn’t do that. She gives you a couple of days off after nights.” #3103CO

Participants also reported that it was really helpful that they could call in sick if they had insufficient sleep to work safely:

[So if you called up and said I’m so sorry but I didn’t sleep at all...?] “Yes..it’s about recognising limitations to your practice, that you’re not right to do your job properly so you’re doing the safest option and that is to not come.” #4206RA

“Well the worst shift, I called in sick for it, because I just couldn’t sleep at all...So being awake all day, doing nightshift, and then being awake all the second day, I’m like there’s no way I’m working tonight, so I called in sick. I wasn’t willing to risk driving, and then being here and putting others at risk.” #3103CO

This is consistent with results from other

qualitative work in healthcare [10]. It also demonstrates adaptability in the team, one of the previously identified cores of teamwork [76].

### Psychosocial Strategies

Psychosocial strategies were used that were consistent with classic coping styles. Engaged coping styles including cognitive reappraisal and expressing emotions were commonly reported. However, some also reported problem avoidance and social withdrawal, which are aspects of disengaged coping. In our sample we found that engaged coping and social and domestic support were important for sleep. Those who reported expressing emotions and seeking social support more frequently (engaged coping) also reported obtaining more sleep overall. In comparison, those who reported using problem avoidance as a strategy (disengaged coping) reported obtaining less sleep before the first night shift. Engaged coping has been associated with overall wellbeing [54] and thus may be a useful skill for improving resilience to shift work. Descriptions of the experience of nightshift highlight the importance of psychosocial support and engaged coping styles.

### Cognitive Reappraisal

Cognitive reappraisal is a psychological strategy that is useful when the stressful situation at hand cannot be changed. It involves reappraising a stressful situation in a way that lessens its emotional impact [86]. This strategy has been associated with less depression, anxiety, less negative mood and increased life satisfaction [87, 88]. Evidence of cognitive reappraisal was reported by our participants, who described reframing the negative emotions associated with night shift:

“I remember...working with somebody who was a bit of a sadsack and hated night duty and would moan continuously all night. So I wrote up a list of all the goods about doing night duty...it was as small as being...(cont'd)





(cont'd)...able to eat chocolate in the middle of the night and nobody judging you, if you have a really bad shift, you can go home and have a beer at 8.00 in the morning and nobody judges you, you have a better chance to get to know your workmates, especially if you do regular nights with people, you develop a real intuitive bond...you don't have to wear make up on night duty, you can even be a bit slack with your uniform. I was just getting sillier and sillier but in the end it just comes down to attitude and the way you look at it...It's like if you've got a sore toe, if you're banging on all the time about how sore your toe is, it seems to be a lot worse. I think it's the same for shift work, if people are really whinging and moaning about it, it makes it worse." #5906SO

## Expressing Emotions

Expressing emotions was identified as a useful strategy, in particular talking to friends or colleagues about stressors:

"Most of my friends are nurses as well so quite often we'll have little chats about it" #3611WE

Communicating with others encourages problem resolution, reassures an individual that their efforts will result in positive outcomes, assists in enduring frustration and provides a sense of optimism [89]. This type of communication affirms the appropriateness of how an individual is feeling and behaving and is referred to as appraisal support [89]. Debriefing or 'venting' as a form of seeking appraisal support was identified as a coping strategy used by nurses and midwives:

"Probably perhaps have a bit more of a vent [on a bad night shift]. Not a vent so much, but just talk about the night or whatever." #5708BR

Expressing emotions through talking about negative feelings such as hopelessness is associated with drops in blood pressure [90], whilst suppressing emotions is related to negative outcomes like depression and more negative emotions and social consequences [86]. Expressing emotions also allows for greater opportunities for help to be received:

"If it's a good team, you support each other. It could be "Just go have a rest. We'll cover your thing, we'll keep an eye on it." #5312JE

## Talking to Family Members

Family support via talking to family members was identified as a pivotal factor in coping with shift work:

"[family support is] Imperative, absolutely essential because there's so many people that just don't understand, as a nurse we do get a lot of time off but we have to work a lot of unsocial hours, it's actually exhausting."  
#4206RA

The benefits of family support are reinforced by the literature which has found that support from families, partners and friends can have positive effects on the physical health of shift workers [56]. Given that the daily routines of families and friends often differ to that of a shift worker, communication, sensitivity and compromise are all important factors in helping to cope with shift work [91].

Emotionally supportive interactions with family members can foster feelings of being cared for, empathised and respected [92], despite the difficulties associated with shift work.

"I definitely always text my dad to say that I'm home and then once I've woken up for the day and got up we would definitely speak before I go to work just to touch base and say how was your day and how's mum and how's my brother and all that kind of stuff. If you're feeling a bit grumpy it makes you feel a bit better having actually spoken to a living person."  
#240417

Social support from a spouse can also help to buffer the negative effects of job stressors [93]:

"My wife and I, we debrief. Except for when my wife says "Okay, you've talked enough about that. You can stop that."  
#5312JE

There is also evidence in the literature to suggest that spouse support can help by facilitating the use of effective coping strategies [94].

"Sometimes you can be a bit more ratty or a bit sharp but because we both [spouses] work shift work, he doesn't work nights, but he gets it because he has in the past."  
#4206RA

## Avoidance

Avoidance coping, or avoiding the stressful situation, is a component of a disengaged coping style, which as described earlier in the report, is associated with more depressed mood and lower job satisfaction [95].

"I tend to shut the world out for a while, you just have to."  
#5107PA

Studies on nursing stress have found that avoidance coping predicts mental distress and mood disturbances [96]. Avoidance coping was reported by our participants, particularly on the days following a night shift:

"Usually you just want to sit on the couch like a lump [after a night shift]. Less likely to go places, do stuff, clean house, do anything."  
#3611WE

In comparison, problem focused coping rather than avoidance coping has been found to positively relate to job satisfaction and health in nurses [97]. Therefore, the evidence suggests that nurses are at greater risk of negative health and mood problems if using avoidance as a coping strategy.

## Avoiding Social Interaction

Avoiding social interaction is an established response to job strain [98], and was a theme identified in interviews with our participants:

“My family know mum’s on nights, so we don’t organise anything socially. If I can avoid it, I don’t want to go to dinner in the middle of when I’m on night duty, because I don’t want to listen to people ‘blah, blah, blah’ing’. Just leave me alone. So it’s worse. If I’ve been on a bad night, then it’s even more so. I can do what my function at home is. You know what I mean? I can come home, I can cook dinner, I can hang clothes, do what I need to do, but I don’t want to be talked to a lot. I don’t want to answer the phone. If the phone rings I won’t answer it, because unless it’s an emergency I don’t want to talk to people. So I sort of retreat a little bit in night duty, and that retreating is more pronounced if the night duties are bad and I’m tired.” #4704ER

Social avoidance was reported to last several days following a night shift, and many participants acknowledged that tiredness was the main factor contributing to social avoidance:

“I’m not a person to be moody or angry at the people I love but it’s just the fact that you’re so tired that you don’t want to engage in any conversation much and post the night duty I sleep that four hours then I get up have a coffee and then I’m sitting there for about an hour and then I’ve got to lie down on the couch, I don’t go to sleep I just can’t hold myself upright. So I’m not in the mood for light conversation, so you’re a bit of a drag and that happens for three days.” #6404PY

There is insufficient evidence available to determine whether avoiding social interaction is an effective strategy. However, expressive suppression, or not expressing emotions, is associated with greater mood disturbances and impaired interpersonal communication [99, 100] compared to seeking social support and expressing feelings, which have many benefits

for wellbeing. Therefore it is likely that in the long term, avoiding social interaction is probably less beneficial than seeking social support.

## Pets for Comfort

Support from pets may mimic elements of human relationships known to have benefits to health [101]. Research has shown that pets, in particular dogs, can help to lessen the effects of stressful life events [102]. Reports of engaging with pets for comfort were identified in our sample:

“You might have the dog, of which you say ‘[dog’s name], how are you? I had a shit day at work. Come and have a talk here’. Rub his belly, ‘It’s okay [dog’s name]. It’s cool!’ #5312JE

Many psychological benefits can result from the companionship that pets offer, and engaging with pets for comfort can reduce levels of anxiety, loneliness and depression [102]; benefits that are similar to those arising from social support from humans.

As discussed at the beginning of the report, coping style emerged as an important predictor of health. It may therefore be useful to provide workers with some self-assessment tools for coping style awareness.

Coping style is something that can be taught, and our dataset provides examples of the way in which these styles manifest in response to shiftwork-related sleep, work, social and domestic problems. Together, this could form the basis for coping style interventions to help overall approaches to shiftwork-related coping. Figure 16 shows a decision tree that could be helpful in assisting workers to reflect on their own coping styles and assess whether they are reflective of engaged or disengaged coping.



**Figure 16.**

Decision Tree to help reflect on coping style and to highlight strategies associated with positive (engaged) and negative (disengaged) coping.

## Driving Strategies

The drive home following night shift is a danger zone for shift workers because they have often been awake for approximately 24 hours by the end of the night shift, which is equivalent to having a blood alcohol concentration above the legal limit for driving [59, 60]. Winding down the car windows, playing loud music and chewing ice or sipping on drinks are countermeasures that individuals often assume can help improve their alertness when driving home following a night shift. Reports of these strategies were very frequent in our sample:

"I've certainly had mornings where I've had to roll down a window and blast music and the air conditioner to try and keep awake driving home." #240417

The majority of these countermeasures do not actually improve alertness, or lack support from the literature regarding efficacy.

## Winding Down Windows

There were several reports of winding down car windows in an attempt to be kept awake by cool air:

"I usually have my head half out the window, like cold air, because I do sometimes feel your head just dropping down at the lights." #2701NA

"There was certainly moments where you feel like you are so tired that you're struggling to keep yourself awake behind the wheel and that's where the window is all the way down and the fresh is air is smack on your face on that cold winter morning and that's waking you up." #4001NA

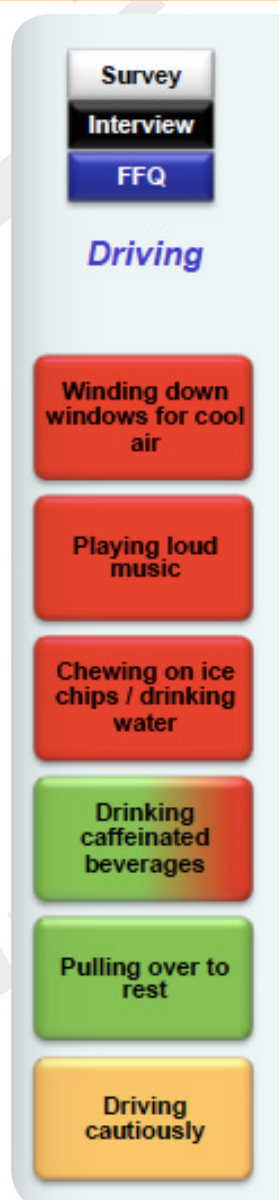
Although this strategy appears to be used by many of our participants, significant effects of cold air on driving performance have not been found [103].

Therefore it is important that shift workers are aware that this strategy does not improve driving performance or alertness, and they are still at high risk of driving incidents on the morning commute.

## Playing Loud Music

Likewise, several participants reported playing loud music during the morning commute to increase their alertness; however listening to the radio while driving drowsy does not improve driving performance [103]. In fact in some cases, listening to the radio distracts sleepy drivers from being aware of their sleepiness and impaired driving [104].

“Rolling the window down, putting the air conditioner on, radio up loud.” #5906SO



## Chewing Ice

In our sample, chewing on ice chips was identified as a strategy being used during the morning commute:

“If you’re dozy when you’re driving, crunching on ice will get you there.” #4712HU

Some participants reported using this strategy to keep themselves awake when having to drive for an hour or more following a night shift:

“I never stop to rest but sometimes I need to keep myself awake by having ice chips on the way home...to keep myself awake for the whole hour.” #4501TH

Despite common reports of this strategy, there are no existing studies validating this strategy as a countermeasure for drowsy driving [105]. Therefore, shift workers should be aware that their performance is probably not improved by this strategy.

## Drinking Caffeinated Beverages

Some nurses reported drinking caffeinated beverages before or during the drive home from night shift:

“I used to drink a bottle of Diet Coke on the way home because sometimes I wouldn’t remember getting home, I wouldn’t know which way I’d driven home. So I did used to use Coke as a stimulant to get me home.” #5906SO

This strategy may be useful as caffeine consumption is associated with reduced sleepiness and less lane drift when driving [106-108]. However, drinking caffeinated beverages at the end of the night shift may impact on ability to sleep during the day:

“If I needed to, if I really needed it, about 6.00am cup of coffee but other than that no, because then I start running the risk of not being able to sleep when I get home.” #4001NA

Several studies have found that caffeine negatively affects daytime sleep, especially high doses of caffeine such as those found in energy drinks. Following approximately 24 hours awake, which is a level similar to the extended wakefulness seen in our sample by the end of the night shift, caffeine has been found to increase wakefulness and worsen the structure and continuity of daytime sleep [109, 110]. However, the impact of caffeine on sleep may differ depending on the timing and amount of caffeine consumed, as well as how sleep deprived the individual is. For example, following two nights awake instead of one, caffeine as late as 07:00am has been found to have no effect on subsequent sleep quality or quantity [111].

Although caffeine can improve driving performance, shift workers should be aware that caffeine generally takes around 20-30 minutes to be absorbed and take effect [112], so consuming caffeine right before or during the drive home may not be beneficial for alertness. Further, caffeine stays in the system for around 6 hours [112]. It is also important to note that some people are more sensitive to the effects of caffeine and may find that caffeine affects their daytime sleep more than others. It is also important to note that some people are more sensitive to the effects of caffeine than others and may find that caffeine affects their daytime sleep to a greater extent.

### **Pulling Over to Rest**

There was a theme identified whereby participants reported pulling over to rest if they were drowsy during the morning commute:

“Sometimes (I feel) unsafe because if you’ve been really busy and you’ve not driven but if I do I stop and pull over.” #4206RA

Having a rest break (e.g. pulling over, getting out of the car) is in fact recommended, especially on long drives [105]. This is due to the fact that performance and alertness deteriorate the longer an individual is required to maintain

attention on a task such as driving. This phenomenon, known as the “time-on-task” effect has been found in many driving studies, whereby lane drift and speed variability worsen over the course of the drive [57, 113]. Therefore, pulling over to rest resets the time-on-task counter, which may be protective for performance.

Some participants reported napping when they pulled over to rest:

“I used to travel an hour home and I’d just pull over and go to sleep, have a nap.” #3412CA

Individuals that doze off or nap when they pull over to rest need to consider that naps as brief as 10 minutes in length can result in some impairments to performance after waking, known as ‘sleep inertia’ [58]. Therefore, resuming driving immediately after a nap is not advisable.

### **Driving Cautiously**

Another theme identified in the interviews was that participants were aware that they were drowsy and changed the way they drove to reduce the chances of having a crash:

“I have felt a bit slower in my response time and stuff, so obviously I just make sure that I’ve got that big gap.” #3103CO

Sleep deprivation impairs reaction time, motor function, attention and decision-making [114] - some of the fundamental cognitive abilities required for safe driving. Therefore taking cautionary measures such as leaving large gaps between cars may be useful during the commute home in order to account for slower reaction times. However there are no studies that provide support for this strategy as being effective for reducing vehicle accidents specifically when driving drowsy following a night shift.

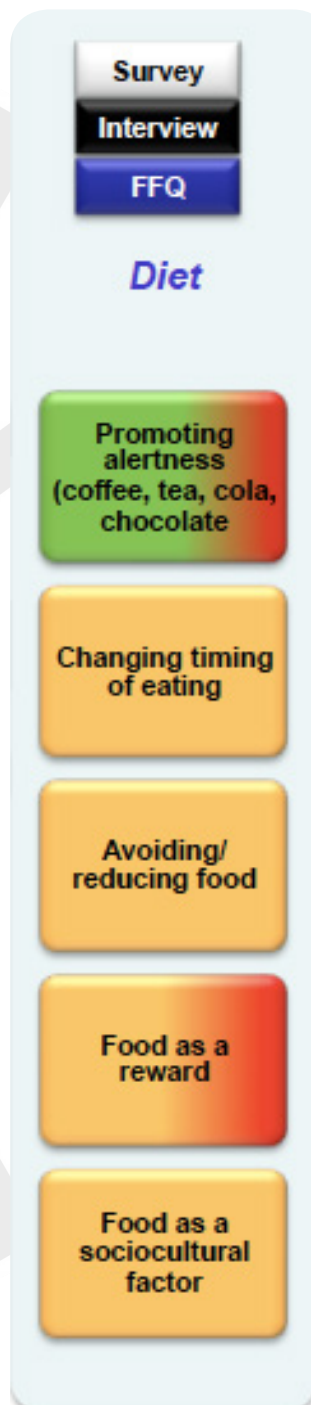
In summary, the majority of driving strategies reported by participants have no evidence of efficacy. Caffeine and rest breaks can be used to improve alertness under some conditions, although it is likely that driving performance

will still be impaired compared to when an individual is fully rested.

## Diet Strategies

### Promoting Alertness with Caffeine

Caffeine is commonly used to maintain alertness at work [115]. Studies have suggested that shift workers consume more caffeine than day workers [116], and that nurses consume more caffeine at work than on days off, especially on days where they have had less sleep the night before [2].



In low-moderate doses, caffeine is generally regarded as an effective countermeasure for sleep loss and fatigue [36]. However, as with many other drugs, with repeated consumption, tolerance develops, and more is needed to get the same boost. Excessive consumption, in higher doses, can result in a number of negative side effects, including trembling, tension, anxiety and sleeping issues [117]. Further, some people are particularly sensitive to caffeine and may reduce their consumption or avoid taking it [118]. For these reasons, it is often recommended that caffeine be consumed strategically [119], using it only when really needed to limit tolerance, and avoiding caffeine too close to bedtime to minimise the potential impact on subsequent sleep. In this study, caffeine was frequently used in many forms (coffee, tea, cola, and chocolate) to promote alertness on shift.

“You’re all in the same boat, you’re all looking to where the coffee is...” #4001NA

Since starting shiftwork, the percentage of high caffeine consumers more than doubled (Figure 17). In addition, consistent with previous research [117], caffeine use in our sample was correlated with negative health indicators, including psychological disturbance (which includes anxiety symptoms) and sleep disturbance (Table 3). Increased caffeine consumption in our study was also associated with increased reports of abdomen pain (Table 3), which is in line with studies linking high caffeine consumption to gastrointestinal symptoms [120].

Results also showed an association between caffeine consumption and weight gain (Table 3). While research has suggested that increased caffeine consumption may be associated with small decreases in weight over long periods of time (>10 years) [121], it could be that weight gain arose due to the ways in which caffeine was being consumed. Certainly, the link between sugar-sweetened drinks (e.g. cola) and weight

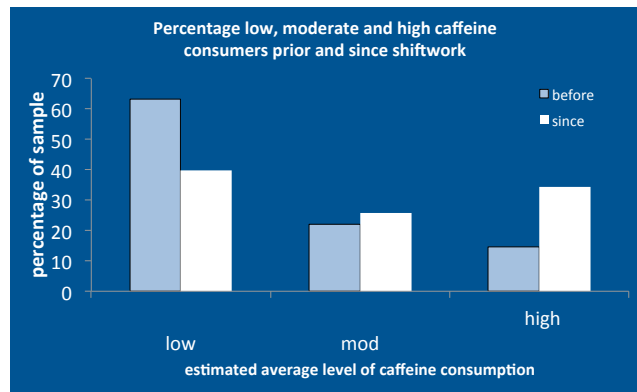
gain is well-established [122, 123]. Caffeine consumed in chocolate is associated with high levels of sugar and fat, which can also contribute to weight gain.

With this in mind, a Decision-Tree (Figure 18) was developed in order to assist with individual decision-making about whether caffeine may be an appropriate and effective countermeasure. Based on a combination of previous literature, and findings from this study, the individual could be asked about their caffeine sensitivity and preferred method of caffeine consumption (e.g. in coffee, or other forms), which could then lead to targeted recommendations.

For those who are not over-sensitive to the effects of caffeine, and who drink coffee, we may recommend strategic use of coffee at work [119], limiting tolerance and impact on subsequent sleep.

The “caffeine nap” (coffee nap) could also be recommended [124]. This involves ingesting coffee, immediately followed by a short nap [125]. The combination is designed to avoid grogginess on waking, or ‘sleep inertia.’ Short naps (<20 mins) are thought to decrease risk of sleep inertia by reducing the likelihood that someone will enter deep sleep [126]. It has also been found that caffeine can eliminate sleep inertia [127]. Therefore, the combination gives the value of the short nap while minimising the potential for grogginess on waking. However, it should be noted that the primary evidence for the efficacy of the coffee nap comes from studies conducted in the afternoon in small samples. Findings do not necessarily translate directly to nighttime naps, where it is likely that workers will have been awake for longer with a higher level of sleepiness [126].

For those who consume caffeine in other forms, it is important to highlight considerations about concomitant sugar and fat consumption.



**Figure 17.**

Percentage of participants (y-axis) who would be classified as low, moderate (300-400mg/day) or high (>400mg/day) caffeine consumers (x-axis) before (light blue) and since (white) starting shiftwork. Cut-off values from Smith (2002). Levels conservatively estimated using ANZ Food Standards (2010), at one drink = 80mg caffeine, which is at the lower range for espresso, and the higher end of the range for brewed/instant coffee (as a comparison, cola = 50mg/375ml can, as done in Dorrian et al., (2011).

**Table 3.**

Correlation (r) between number of cups of caffeinated coffee, tea or cola per day and measures of psychological disturbance, sleep disturbance, abdomen pain and weight gain since starting shiftwork. \*p<0.05, \*\*p<0.01

Cups of caffeinated coffee/tea/cola per day correlated with	r
Psychological Disturbance (GHQ)	0.4**
Sleep Disturbance	0.2*
Abdomen Pain	0.3*
Putting on too much weight	0.3*





**Figure 18.**

Decision Tree to help in decision making about caffeine use as a potential countermeasure. The diagram shows a series of questions about caffeine sensitivity and method of delivery of caffeine. Following this, the individual can be shown targeted suggestions about how caffeine may be used, in the context of the potential associated hazards.

## Changing Timing of Eating

We found evidence of several different eating strategies on night shift. Consistent with previous studies [128, 129], we found changes in worker meal timing:

“So I basically try to flip the day over into night. So I’ll have dinner, which I’ll then count as breakfast, and then I’ll have like a morning tea, lunch – a second lunch, second dinner, whatever you want to call it – at about midnight/1:00 o’clock.” #3103CO

“I always eat, I guess it’s breakfast, I usually have Weet Bix or porridge or something, like a breakfast food. I usually have it between 2.00 and 4.00, sometime in there, and then I’ll usually bring nuts or something to snack on as well, and I always buy chocolate.” #3207ST

Snacking reports were common, which is in line with a number of studies suggesting that shiftwork is associated with an increase in snacking behaviour (reviewed in [129]).

## Avoiding/Reducing Food

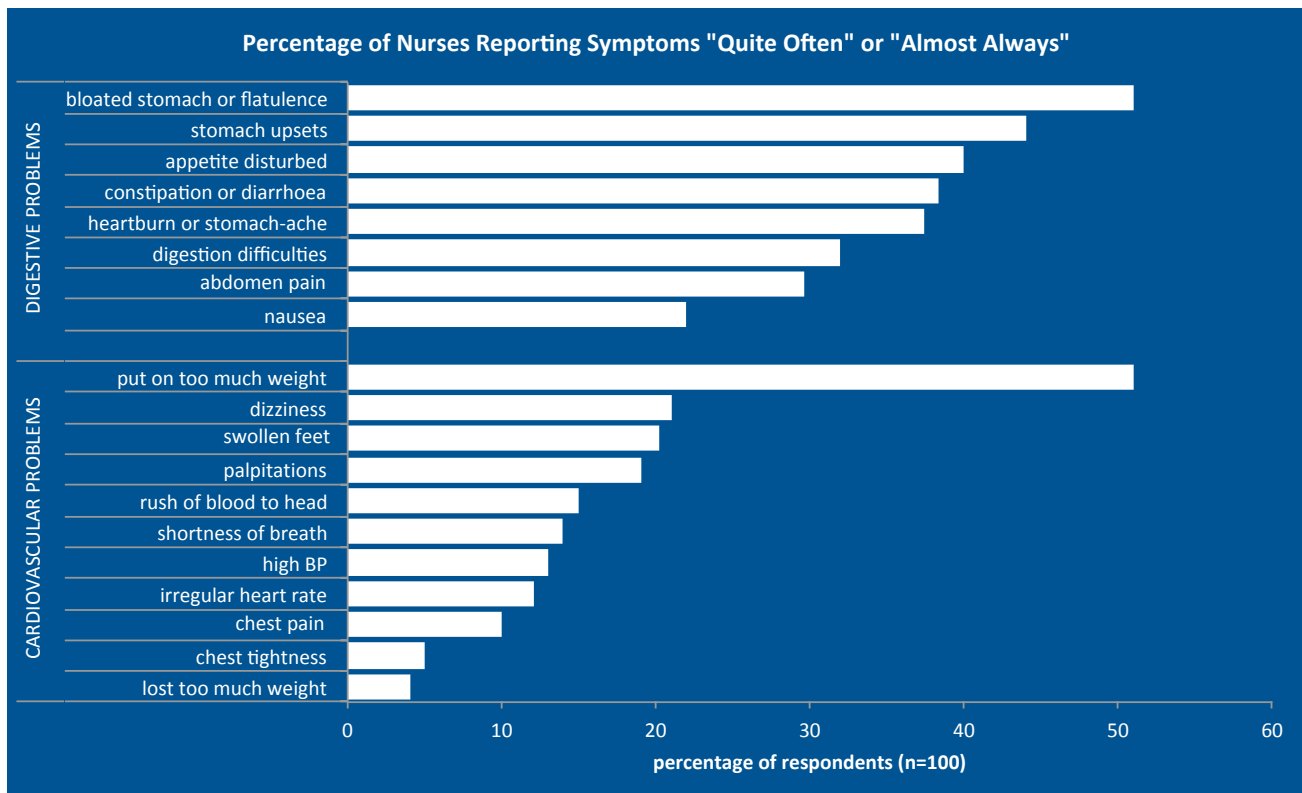
Some participants reported that they avoided food during their nightshift, or tried to “eat light”:

“Usually what I eat normally, something light, so I try not to eat when I’m at work... Sometimes I do but things like fruit or nuts, just little snacky things, not a full meal.” #4206RA

Studies have suggested that compared to those on day shift, evening and night workers reduce the number of full meals they have per day [128]. Indeed, since we are designed to eat during the day, and be asleep at night, we typically feel less hungry during the night hours. Eating during this time can make us feel unwell [129].

Eating large amounts, especially late at night, has been associated with gastrointestinal (GI) upset and metabolic disturbance [129]. In this study, as in other shiftwork cohorts, reports of GI upset were common (Figure 19).

In a 2010 discussion paper [129], Lowden and colleagues made a series of recommendations for timing of meals, which included:



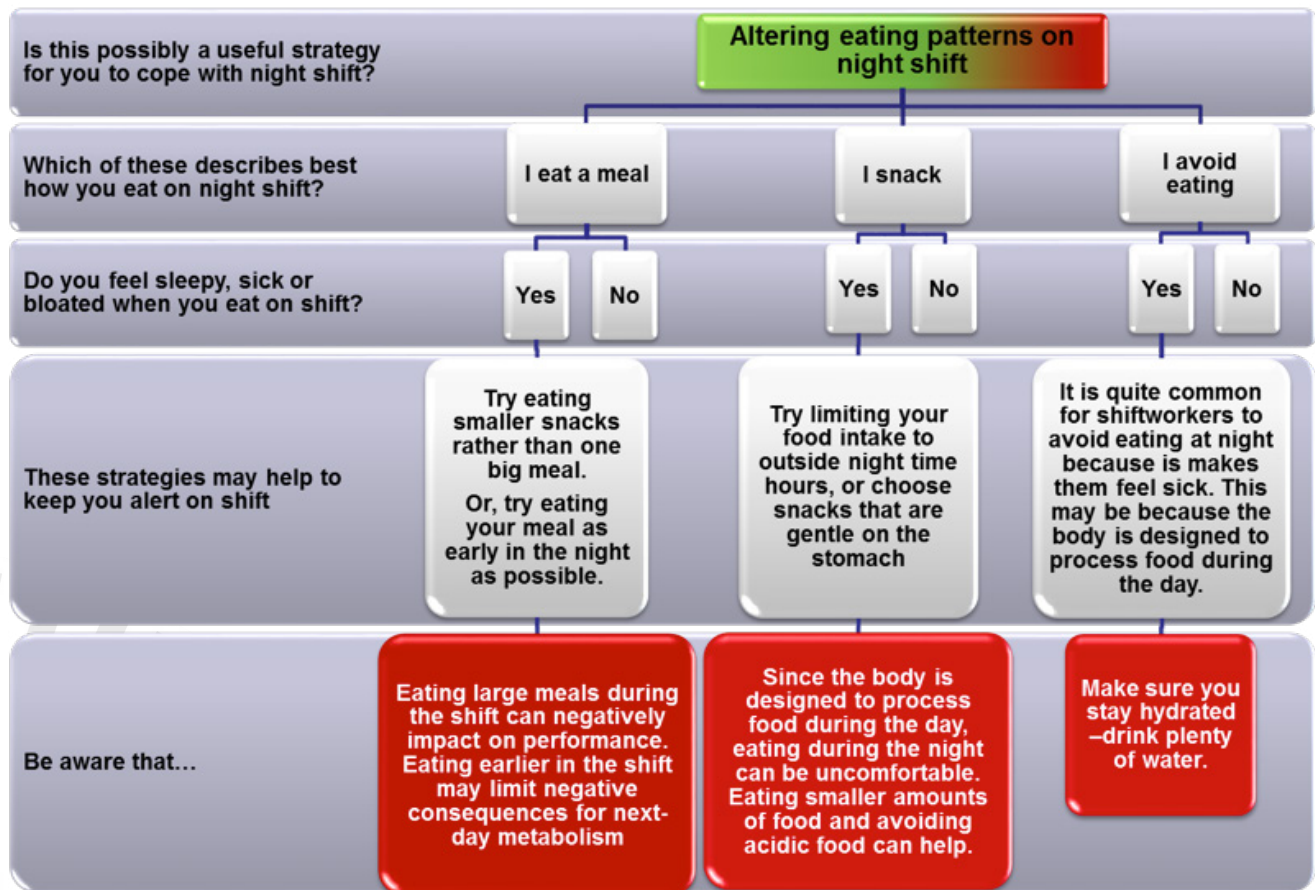
**Figure 19.**

*The percentage of respondents who reported digestive (upper) and cardiovascular (lower) symptoms "quite often" or "almost always".*

- Limiting energy intake between 12pm and 6am
- Avoiding large meals within 2h of sleep
- Eating "breakfast" before daytime sleep to avoid disturbed sleep as a result of hunger
- Consuming three main meals ("eating events") per 24h, each of 20-35% of total energy intake

In light of this, a Decision-Tree (Figure 20) was developed in order to assist with individual decision-making about nightshift meal timing. To assist with this, workers could be asked about their typical strategy for eating on nightshift (eating a meal, snacking, avoiding food), and whether they experience gastrointestinal upset when they eat at night.

This information could be used to target recommendations such as avoiding large meals, eating meals earlier (to avoid the period from 12pm to 6am), or limiting food intake. Options could be presented in the context of the potential hazards relating to eating at night when the body is not designed to process food. In addition, normalising (i.e. letting people know that it is not unusual to adopt) different eating patterns on night shift could be important to provide reassurance that feeling sick after eating at night is perfectly understandable.



**Figure 20.**

Decision Tree to help in decision making about food timing as a potential strategy to cope with nightshift. The diagram shows a series of questions about timing of food on nightshift, and corresponding gastrointestinal symptoms. Following this, the individual can be shown targeted suggestions about consumption patterns, in the context of the potential associated hazards.

### Food as a Reward

One very interesting finding was in relation to motivations for eating on nightshift. While some reported a regular schedule (often driven by workload and/or break timing), or eating what and when they felt like it, others reported using food as a reward for the difficulties of working nights.

“I’ll go down to the vending machine and get a chocolate bar, like if it’s been a hard night.” #3103CO

“My compensation for being awake all night is I eat lots of junk.” #4206RA

Research shows that food activates reward centres in the brain [130], and that sleep restriction, such as is common in shiftworkers, may cause increased activation of brain systems that are most sensitive to food [131].

Therefore, it is perhaps not surprising that food is employed as a reward in this context.

### Food as a Sociocultural Factor

A commonly reported motivation for eating was shared food on the ward, which often consisted of cakes, biscuits, chips and chocolate. Strategies were described regarding involvement in (or avoidance of) the “buffet.”

“You have to have some sort of a reward so people bring in cheese and dips and chocolates and biscuits.” #4206RA

“If there was pizza or if someone brought in lollies and stuff, I’d probably be stuffing my face.” #3207ST

Food sharing may perform an important morale function for night shift workers. However, our data showed that consumption of “indulgence”

foods, such as chips, cakes and chocolate, was frequent (6% had chocolate at least once per day, and nearly half had chocolate more than twice per week) (Figure 21).

**“The CCC of nightshift: Chips, Coke and Chocolate” #4001NA**

Consistent with this increased intake of “indulgence” foods, participants consumed more than the recommended maximum level of saturated fat in their diet (as a proportion of total energy intake).

Figure 22 shows results from the Food Frequency Questionnaire – macronutrient intake (fat, protein and carbohydrate) as a percentage of total energy intake. Of the sample, 96% reported saturated fat intake higher than national guidelines.

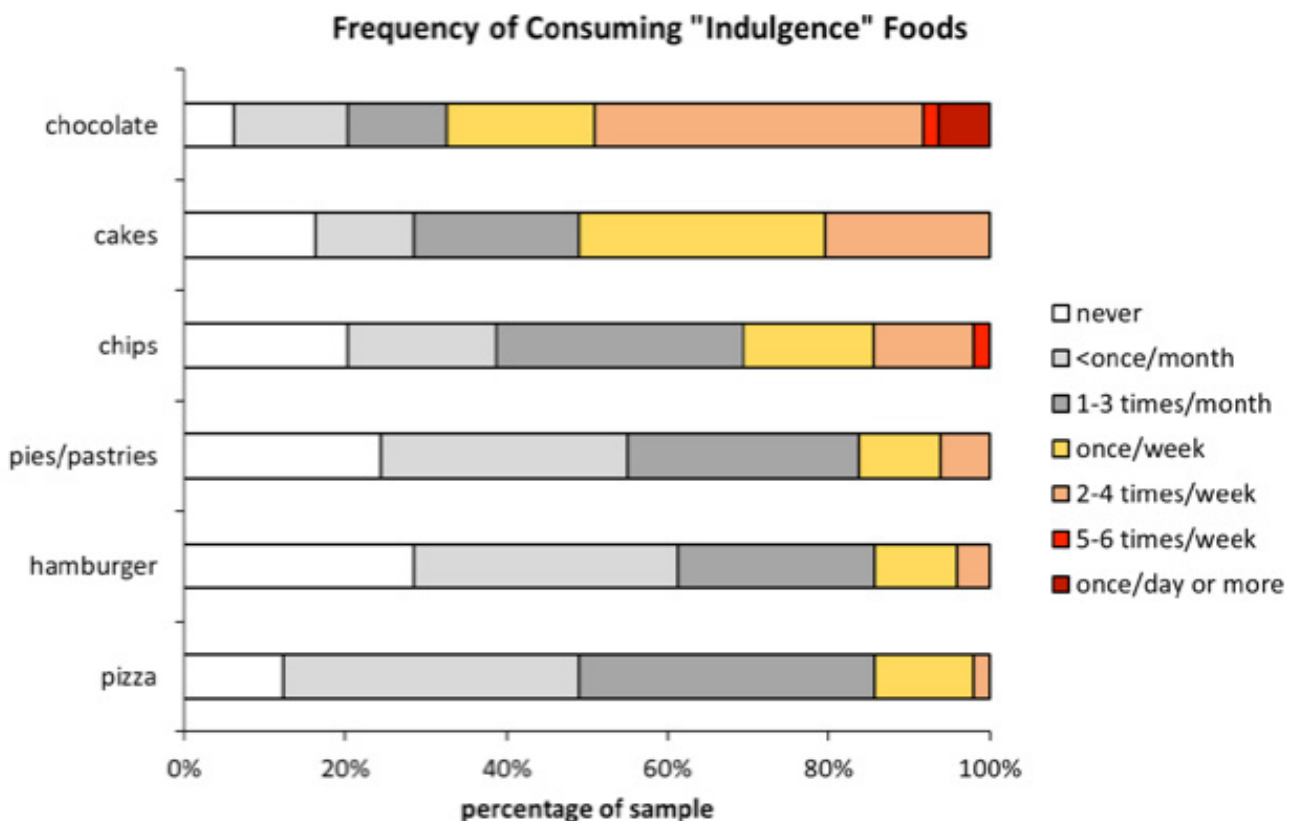
Other studies of shiftworkers have shown elevated levels of saturated fat intake [132, 133]. This may also, at least in part, explain the finding

that approximately half of the sample felt that they had put on too much weight since starting shiftwork (Figure 19).

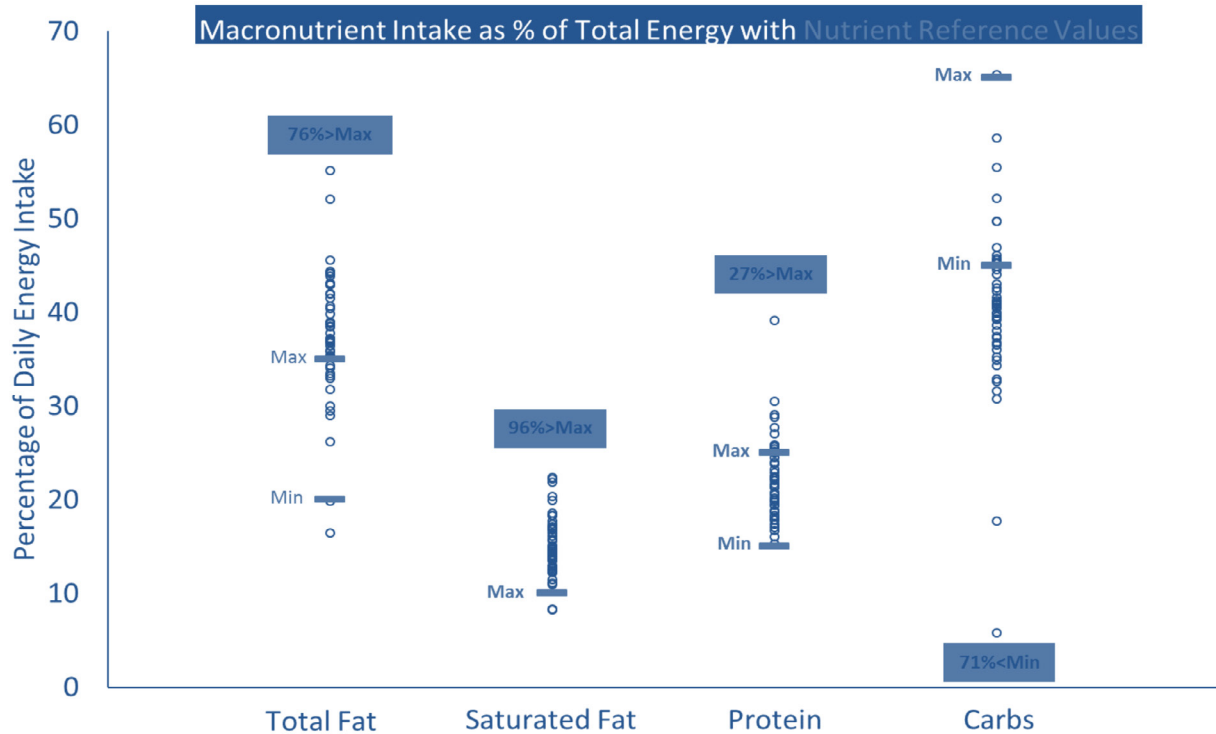
In their 2010 discussion paper [129], Lowden and colleagues also made recommendations regarding meal content, which included:

- Providing variety and avoiding food and drink that would be considered low in dietary quality
- Avoiding energy-dense convenience foods, food and drink that is sugar-rich, and foods with a high glycemic load
- Choosing foods such as vegetable soup, salad, fruit, wholegrain sandwiches, boiled egg and nuts.

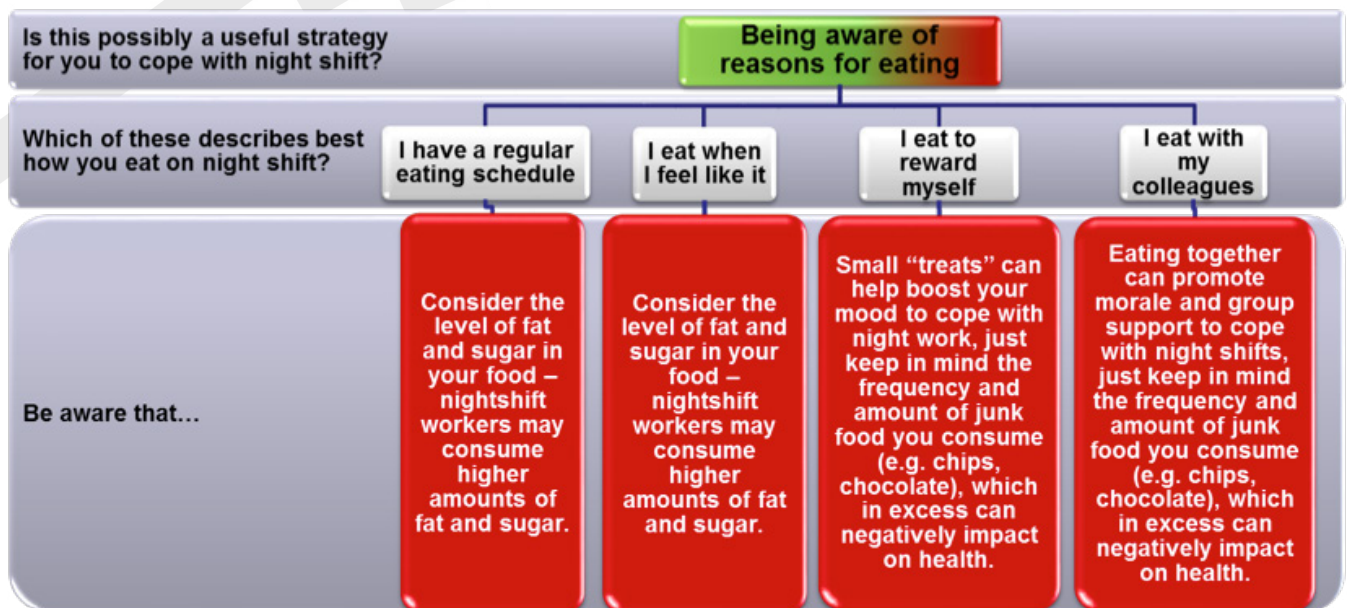
A Decision Tree (Figure 23) was developed based on study findings and these recommendations. This encourages people to reflect on their motivations for eating on night shift, and in this context, consideration of frequency and amount of “indulgence” food consumption is highlighted.



**Figure 21.** Stacked bar chart showing the frequency of indulgence food consumption (chocolate, cakes, chips, pies/pastries, hamburger and pizza).



**Figure 22.** Macronutrient (Fat, Saturated Fat, Protein, and Carbs=Carbohydrate) intake as a percentage of total energy intake. Nutrient Reference Values are shown: <https://www.nrv.gov.au/chronic-disease/summary>



**Figure 23.** Decision Tree to help in decision making in relation to food consumption in the context of motivations for eating on nightshift. The diagram asks workers to consider whether some of these typical motivations for eating may apply to them. Following this, the individual can be provided with some important considerations surrounding food choice on shift.

## Exercise Strategies

There were a variety of strategies regarding exercise that were identified in our sample. Some nurses reported incorporating regular exercise into their routines regardless of what shifts they were working, while others avoided exercise when working night shifts.

### Avoiding Exercise Before Night Shift

A theme of avoiding exercise or strenuous activities in order to preserve energy for the night shift was found:

"Today I've just been to yoga, I'm always doing something but I don't go out of my way just because it's a night shift, in fact I probably would avoid it if anything." 5107PA

"I try not to exercise when I do nights, because I just figure I need all my energy to..." #3103CO

Some participants chose to delay exercise until after the night shift:

"If I exercise I exercise at the end of the night shift." #3611WE

There is little evidence to suggest that avoiding exercise or strenuous activities before a night shift is beneficial to performance. In fact, moderate physical activity has been found to reduce fatigue during night shifts in female shift workers [134]. Therefore moderate intensity physical activity is advisable to shift workers as part of their overall weekly routine. However there is insufficient evidence available to make recommendations about avoiding or promoting exercise specifically before night shifts.

## Maintaining Physical Fitness

Reports of routine exercise were found in the interviews:

"I walk my dogs every evening and I run four nights a week." #4611JA

Approximately 40% of interviewees reported that they exercise before night shifts:

"I've been trialling it (exercising before night shift). I did it last night and then I had the best sleep when I got home. I was like "I'll just lie down for a minute", thinking I'll get up and go get a drink, because I just walked in through the door and I hadn't felt tired and my run was really nice. Then I got home and I was like "I'll just lay down for a minute", read something on the phone and then I just fell asleep... I had the best sleep." #3412CA

This theme of exercise improving sleep is consistent with literature showing that exercise can increase sleep length and decrease sleepiness [135]. While physical fitness does not appear to change circadian adjustment to night shift work, the literature suggests that maintaining an overall good level of fitness can assist in tolerance to shift work [134, 136]. This may be partially due to the fact that engaging in exercise helps to reduce some of the physical symptoms commonly reported in our sample, such as weight gain and cardiovascular problems [137]. Physical activity can also be useful in improving psychological symptoms such as depression and anxiety which are common in shift workers [137, 138].

Therefore, engaging in regular exercise is a coping strategy that is advisable for overall wellbeing and tolerance to shift work. Some nurses may find that they have time to exercise prior to a night shift; it is also important to ensure that sufficient time for rest and sleep is allowed for.

## Aim 3: Summary Points

Analysis of strategies used to cope with nightshift revealed:

- Workers use many strategies to cope with shiftwork across sleep, workplace, psychosocial, driving, diet and exercise domains
- These strategies vary in efficacy (with different levels of evidence from the literature as well as data collected in this study)
- There is no “one size fits all” strategy, and therefore, individualised strategies where guidance is provided to assist in strategy selection are important
- Strategies are also not universally effective, and may be harmful, depending on the circumstances. Suggested strategies should be presented in the context of their potential associated hazards

A number of sleep-related strategies were used to manage shiftwork-related sleep loss and sleepiness:

- Participants reported using sleeping in, prophylactic (preparatory) and on-shift napping to manage sleep loss and sleepiness associated with night shift
- Those who napped scored more highly on sleep flexibility
- Those who used naps had lower time awake by the end of their night shift
- Those who napped on-shift had less sleep on their days off, suggesting that their home environment/domestic or social responsibilities may not be conducive to sleeping at home
- Napping can be associated with sleep inertia, which is a potential hazard that needs to be managed
- A safe space to nap is also required

Workplace strategies were used to manage health and safety at work:

- The importance of teamwork was a central concept, and participants described examples of Teamwork Leadership, Mutual Performance Monitoring, Backup Behaviour, and development of Mutual Trust
- Sleeping in on days off was used to catch up on lost sleep
- Memory aids were used to avoid forgetting tasks or procedures
- People “kept busy” to stay engaged at work
- Having an element of schedule flexibility was considered important, with the ability to call in sick if they were too tired to safely work

Psychosocial strategies were used that were consistent with classic coping styles:

- Engaged coping styles including cognitive reappraisal and expressing emotions were commonly reported
- However, some also reported problem avoidance and social withdrawal, which are aspects of disengaged coping approaches
- Several participants reported using their pets for comfort
- Assessment and reflection on personal coping styles for managing shiftwork may be beneficial, as well as the possibility of interventions to help people adopt more engaged coping.

A number of strategies were used to manage commute sleepiness:

- Participants reported winding down windows for cool air, playing loud music and drinking water/eating ice chips. The literature provides no evidence that such strategies are beneficial for alertness
- Drinking caffeine prior to or during the commute was also reported. It is important to consider the potential hazards of caffeine consumption including negative effects on sleep if consumed too near the sleep period and side effects of consumption in very large doses
- Some participants reported pulling the car over to rest if they felt drowsy while driving home, and others reported that they drove more cautiously.

Dietary strategies were also used to manage alertness but also gastrointestinal disturbance and mood.

- Caffeine was used in coffee, tea, cola and chocolate to promote alertness on shift
- Higher caffeine consumption was associated with increased reported psychological disturbance, sleep disturbance, abdomen pain and weight gain
- Decisions relating to use of caffeine on night shift may be guided by consideration of caffeine sensitivity and the way in which caffeine is consumed (i.e. in coffee, tea, cola, energy drinks or chocolate)
- Caffeine should be used strategically (i.e. not too frequently to avoid tolerance, and not too close to the sleep period to avoid sleep disturbance)
- Caffeine may be used in combination with a nap. This may help minimise sleep inertia
- Consideration should be given to the way in which caffeine is ingested as some caffeinated products (e.g. energy drinks, chocolate) are high in sugar and/or fat
- Nightshift workers change the timing of their food. We are not designed to eat during the night and so limiting food during

night hours (perhaps between 12am and 6am) may minimise gastrointestinal upset and metabolic disturbance

- Food is frequently used on nightshift as a reward by individuals and also in groups
- There is evidence of frequent consumption of “indulgence foods” including chocolate and cake
- There is also evidence of higher than recommended levels of consumption of saturated fats
- Reflection on motivations for eating on nightshift is likely to be helpful. A focus on reasons for consuming “indulgence” foods and possible substitution for more nutritious snack options may be of benefit
- It is important to keep in mind though, that eating together on nightshifts may be an important part of workplace culture, facilitating higher morale and further development of the mutual trust that is so critical for teamwork

Exercise strategies were also reported:

- In particular, participants recognised the importance of maintaining good physical fitness

Overall, findings suggest that there are a group of experienced workers who cope really well with night shifts. They use many coping strategies. Understanding these strategies enables us to go beyond generic fatigue management to develop a list of work type-specific strategies. Findings also suggest that strategies may not work universally, and that individualised recommendations to help people (or even workplaces) to identify the strategies most likely to work for them may be the best approach. Further, strategies that are effective under one set of circumstances may be harmful in another, so information about strategies should be provided in the context of potential associated hazards.



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