



The Health and Safety Impacts of Night Working: The case of TSSA workers.

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October 2024

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1. Introduction

A substantial international body of work has shown the association between night work and shift work and a wide range of both mental and physical health conditions (Torquati et al., 2019; Moreno et al., 2019; Gurubhagavatula et al., 2021), with impacts on their families and communities (Arlinghaus, et al., 2019). A range of organisational psychosocial risks such as high workloads, reduced supervisor support, workplace violence are frequently increased for night workers (Fischer et al., 2019).

However, there is also a tendency to suggest that the impacts of night work on the health of workers can also be explained by lifestyle habits which shifts responsibility from employers and their duty of care onto individual workers. This research aims to look at workers' experience of night work, including in the context of shift work, the impact on their lives and the factors that may shape worker's decision-making about night work, as well as how both organisational and labour market changes impact night work. The overall research covers five unions; CWU, RMT, TSSA, Equity and Community. An overall report will bring the findings together, but this report specifically analyses the data collected on TSSA. It is based on interviews with one TSSA officer and 14 members working rotating nightshifts in London Underground, Network Rail, ScotRail, Transport for Wales, Great Western, British Transport Police, DG Cargo and in a range of job roles.

The research aimed to:

1. Examine the experiences and perceptions of night working, including on-call work, and its impact on the physical and mental health of workers.

2. Explore the impact of changes in work, both organisational psychosocial risks including workloads, supervisor and social support, job cuts and vacancies as well as the labour market level, for example outsourcing, on experiences of night working;
3. Interrogate workers' preferences for night work and the factors that may influence workers' decisions to undertake night work;
4. Develop potential union demands in relation to collective bargaining about shiftwork and night work, including in the context of longer-term demands for a shorter working week.

2. Summary

- Rotating shifts including night work and weekend work is a feature of the work of railways workers. Apart from rostered night work, additional night and weekend work occurs through cover weeks which can be more than three weeks per year.
- There is a large amount of overtime done by railways workers, which can further increase the number of night shifts worked as well as contribute to fatigue.
- Key psychosocial risks identified are excessive work demand related to work intensification i.e. excessive workloads, work extensification through excessive overtime; insufficient managerial support for workers in some areas; and insufficient managerial leadership on workers' health and safety. These contribute to work-related stress and exacerbate fatigue.
- Excessive workloads and overtime are underpinned by insufficient staffing in most companies, although some have recently begun to address this. This exacerbates managers roster inflexibility in response to workers' needs and may also impact on how they conduct and respond to fatigue and occupational health assessments.
- Most workers do some overtime with younger and middle-aged workers more likely to do large amounts, mostly for financial reasons. This is even more salient with the cost-of-living crisis, inflation and below inflation pay rises. Older workers report increasing difficulties coping with night work and limit the overtime worked which is primarily to help colleagues take leave or to support good relationships with managers by helping to fill the rosters.
- In alignment with the academic literature, most night workers suffer from fatigue and sleep deprivation due to poor quality sleep, split sleep and short durations (4-6hrs) and difficulties staying asleep. This is related to circadian rhythm disturbance as well as the external environment (noise, children's school runs). Sleep deprivation is cumulative over the number of nights worked. The more nights worked the longer it takes to resolve sleep deprivation and associated fatigue. Older workers report that poor sleep, fatigue and recovery time have got worse as they have aged (from their 40s onwards) with many in their 50s doubting that their bodies can continue doing night work into the future.
- The length of runs of night shifts worked and the amount of recovery time in rosters was highly variable. Long runs of night shifts such as six or seven in a row are particularly detrimental, especially where not accompanied by sufficient recovery time, and there was evidence of this. Given the cumulative effects of sleep deprivation there should be an assessment of the number of night shifts worked in a row, the total worked and the adequacy of recovery time following a run of night shifts. HSE guidance on this should be a minimum and the impact on older workers considered.

- The extended need for recovery time is an added burden for night shift workers that is not shared by day workers, yet this is not paid for by companies and forms part of the workers 'free time'. During recovery time workers are unable to participate in normal personal, family or social life. Given that recovery time is essential to manage the negative impacts of night work on workers, there is an argument to be made that this should be compensated.
- While often workers prefer compressed shifts of 12 hrs because this allows more time away from work, longer shifts can also be more fatiguing, especially 12 hr night shifts. While HSE guidelines recommend a max of 2-3 x 12 hrs night shifts followed by recovery time, and the Office of Rail and Road (2024) recommends 8-10 hr shifts for night shifts, some workers reported doing 4 x 8hr shifts followed by 2 x 12 hrs shifts which seems excessive.
- Most workers reported frequently not having sufficient time or staff to be able to take meal breaks. This is especially concerning for those on 12 hrs shifts. Meal breaks are important in reducing fatigue. Lack of meal breaks may contribute to poor eating habits, including the consumption of high carbohydrate food.
- In alignment with the academic literature on the multiple impacts of night work on workers' health, this research identified a range of negative impacts on night workers' health and health-related behaviour. Most workers struggled with establishing and maintaining healthy eating and exercises routines, especially in relation to night work. Fatigue associated with night work was a key underpinning driver of difficulties in maintaining health diets. Both fatigue and social asynchrony underpinned difficulties maintaining exercise regimes.
- These negative impacts are likely to have a long-term impact on physical and mental health and to potentially exacerbate existing mental health issues and to diminish the quality of life outside of work. Supportive family and social relationships can ameliorate some of these issues to a degree.
- A key advantage of night work for those with dependent children was that this it helped workers to manage childcare, in particular school-runs, in an environment of limited Government support for free childcare and in a market of limited places and times of availability as well as high costs.
- Night work generally had significant negative impacts on families and social relationships, especially those with dependent children. While night work facilitates managing childcare, it also often limits both the quantity and quality of the time the night working parent has with their children and family, with some reporting negative impacts on partners and children. The impact of night work on workers can strain partner relationships, in some cases leading to relationship breakdown, as well diminishing social relationships. While night shifts enable workers to do schools runs giving them time to talk to their children, this also disrupts the sleep pattern of the workers. Poor and inflexible rosters, social asynchrony, worker fatigue and mood disturbance all contributed to these negative outcomes. These could be partially ameliorated by workers having genuine control of rosters and roster flexibility.
- All the workers over 50 reported that they were concerned about the impact on night work on their health, that their fatigue and recovery time was increasing as they become older, and that they did not think their bodies would 'hold up for much long'. Most were seeking to reduce or to stop night work, by reducing their hours, moving to other roles or

by finding jobs that did not require shift work or to retire early. To the extent that this research can be generalised this represents a significant risk to workforce planning.

3. Participants description

All workers had worked night work for many years, except a Service Construction Manager who had worked 8 years on nightshifts but was now more office-based but still doing some night shifts and a significant amount of on-call work. All were currently working night shifts on rotating rosters.

There was one TSSA union official who had worked for the union for 23 years and who was a key informant on the issues of night work in the industry. The 14 workers were predominately white males (12) over the age of 50yrs (9), with two white males in their 40s and one in his 20s. There were two female workers both in their 50s and working in the London Underground.

The participants worked across a range of companies including: London Underground, Network Rail, ScotRail, Transport for Wales, Great Western, British Transport Police, DG Cargo.

A range of roles were encompassed by the participants with many associated with ensuring the timely running of the trains and intervening in the cases of accidents, breakdowns, emergencies, including arranging repairs etc. or involved in the management of train crews, station staff and customer services. Eight participants also had additional roles with the TSSA union, as union reps, H&S reps etc.

Most (eleven) had or had had partners while doing night work and ten of these also had or had had dependent children over the years of working night work. There were two males and one female who did not have a partner or children over the time of working night work. The description of the participants is in the table below:

Pseudonym	Role and Company	Gender	Age	Yrs of in railway industry	Yrs of doing night work	Partner while doing night work	Dependent children when doing night work
Gary	TSSA Union Official	m	50s	nr	nr	nr	nr
Rob	Train service manager & Union rep; Regional Train Company	m	20s	10	6	Yes	No
Jim	Train crew supervisor; Union Rep; Scotrail	m	50s	22	14	Yes	Yes
Alex	London Underground	f	50s	27	19	No	No
Sam	Resource Manager TFW Rail (Wales); H&S rep plus local union rep	m	40s	24	27	Yes	Yes
Ryan	Incident Response LU	m	60s	6	40	Yes	Yes
Sophie	Customer service manager LU	f	50s	22	20	Yes	Yes
George	Shift station manager & union rep; (hi-speed line)	m	50s	35	32	Yes	Yes
Tony	Service manager; union role; LU	m	50s	36	36	Yes	Yes
Mike	Communications Officer; Union rep; British Transport Police	m	50s	15	15	Yes	Yes
Ted	Operations Supervisor	m	60s	52	50	No	No
Bill	Train Running Controller & H&S rep; Network Rail	m	50s	29	26	No	No
Lloyd	Senior Infrastructure Controller & TSSA rep; DB Cargo	m	50s	27	36	Yes	Yes
Terry	Senior Construction Manager	m	50s	21	22	Yes	Yes
Eric	Train Running Controller; Network Rail	m	40s	27	17	Yes	Yes
	NB: 'nr' = not relevant						

4. Key findings

4.1 Nature of the work

This section describes the nature of the work and general working conditions for these workers.

All the workers are employed as managers in various capacities and a range of roles. Train network controllers control the operation of the railway network to ensure the trains run on time, and intervene in emergencies, accidents, breakdowns to keep the network running. These are supported by mobile operation managers who manage, often on-site, emergency repairs, etc, to fix problems that have arisen, including providing technical advice to maintenance teams. Train service operators work for specific train companies managing trains, train crews and depots to deliver the train service. Train crew operators in ScotRail manage drivers and conductors including informing them of changes, checking fitness to work, organising cover where there is

insufficient staff, etc. Teams can be responsible for up to seven different locations and 400 drivers.

Some managers, such as Train Network Controllers, direct key railway operations (and workers) to keep the networks running but may not have specific line management roles. Others directly line-manage teams and some may do both line management work and also engage in front-line work (e.g. station managers). There was also a senior construction manager who line-managed several large teams with a large number of workers in each team, and who while primarily office-based also provided on-site support for teams (including doing irregular night shifts and working away from home) as well as providing on-call support to teams overnight from home.

4.2 Psycho-social risks and night work

While night working has its own well-documented negative impacts on workers' fatigue, mental and physical health, the nature of the work environment also impacts on workers' fatigue, work-related stress and mental and physical health. Widely recognised psycho-social risks in the literature include excessive job demands, low levels of control of the work, low levels of supervisor and collegial support and poorly managed change programs. These are robustly linked to work-related stress and a range of negative physical and mental health outcomes including fatigue and burnout, as discussed in the literature review in the main combined union report. When night work is combined with psycho-social risks within the work organisation the impact on fatigue and work-related stress, on mental and physical health and on family and social relationships will be exacerbated.

The key psychosocial risk factors identified in the research are excessive work demands (including both work intensification (high workloads) and extensification (high levels of overtime)) which are largely underpinned by insufficient staff and changes related to training needs and climate change as well as problems with managerial support in some locations.

Understanding how specific psychosocial risks shape the context of night work and exacerbate the impact of night work enhances understanding of the impacts of night work on workers in these sectors.

Changes to work: work intensification

The majority of workers, most of whom had many years of experience in their jobs, reported that their workloads had increase of recent years, for some to unmanageable levels and that this was associated with significant work-related stress. This seems to be less of an issue for the senior construction supervisor who had recently entered a work period that was quieter, although previously he had experienced two years of high intensity work.

For example, Rob (a train service manager with a regional train company, aged in his 20s) reported that coming out of the Covid-19 pandemic that there has been significant cost-cutting with the trains now running with minimum trains and crew, so there are daily cancellations due to the lack of trains and crew. This is further complicated where there were faults or fatalities, so trying to keep the system running can at times feel overwhelming. Consequently, workloads have increase significantly over the past two years, due to cost-cutting, as Rob explains:

It's more the fact that we're trying to run a train service that's timetabled 75 units are required for the day's service. Previously we had say 90 units, which gave us 15, kind of that were on maintenance spare having overhauls done, etcetera. But now the government has reduced that. So you're now trying to run a 75 unit service with only 80 units. And you've only got 5 that you can

stop for maintenance now, so they get stopped and put to one side. But then there's not enough spare units or units for overhauls. So whenever something goes off for overhaul, that's train cancellation. So, it's just squeezing the number of available spares and it's the same with the crew you're trying to run a service that you require 100 drivers for and we're trying to run it on 70 drivers. So, you're then trying to work out how you prioritise services, what you cancel. What you're moving around, putting more work into the into each driver to try and maximise the number of trains you can run, which is, which is frustrating for us because it's all, it's a lot of work for us. It's a lot of work for the crews. It's a lot of work for the traction as well, but it's all cost-cutting from the company and the government.

Older workers made comparison between the current situation and what it had been like 30 years ago in the railways when they first started:

Thirty years ago, it was a different railway. It was so much slower paced, I mean, now the railway can be hectic, I mean we have thousands of movements a day in our station and then when you expand that to a network, you really sometimes have got to have your finger in the pulse and so that also adds stress to the situation ... (Jim, Train Crew Supervisor, ScotRail).

Many identified that in recent years staffing numbers had been reduced while job demands and tasks had increased especially for team leaders and lower-level managers. This was an issue across the different networks (ScotRail, Transport for Wales, Network Rail and the London Underground).

In 2017 they did what they called 'Project Charles' where they reduced the workforce by 1,000 people. That was the intention, but they reduced it eventually by about 670 within the workforce over all the sections of the company. But we didn't lose the amount of train services we were running.

So, the work content and workload went up because there was more vacancies, there was more work to do and then with our company they've done some agreements with the drivers to give a better work/life balance. That affected our workload and increased our workload through the agreements they did with the drivers, which meant then we were more stressed and more work to be completed before we could finalise a training plan. ... It can stress you completely out because you're tired and then you know you've got so much work to do and then you find out you've got to do even more work because then there's less staff that are adequate to do the work. So then you've got to work even harder to find the resolution to ensure that train runs. So, yes, it compounds. It really does affect you. (Lloyd, Infrastructure Controller, DB Cargo).

In this case the cuts in staff numbers were accompanied by the impact that some groups of workers (drivers) gaining beneficial changes to their working conditions had on other groups (managers).

Not having sufficient staff also eliminates the buffers needed to enable staff to cope with busier periods:

Weekends very busy. We do have peaks and troughs when it is busy it's very busy, to the point where the number of staff in the room just isn't enough even though you're above minimum staffing. So, we have minimum staffing in the room, but even at minimum staffing or above it can be not enough people in there really for the volume of calls or how busy it gets, especially on a Friday and a Saturday night. ...– I think with the old shift pattern there were more people in on each shift. We used to have six shifts. We're now down to five shifts... (Mike, British Transport Police).

Similarly, Tony (Service Manager, London Underground) reported that

... the staff I manage directly in the control room, we should have 33 and we have 25. It's a lot of staffing issues. We can't get people qualified and get them through the training. That has – 12 years ago we had 32, we had one vacancy. Twelve years on, we've got eight vacancies.

These reduced staff numbers also affect the capacity to train new staff.

The workloads had also increased due to increases in volume which can particularly impact those working solo night shifts. A younger train controller working for a regional company commented on the stress that this can cause:

... with the state of the railways in at the moment, it's really difficult because you're the only one on nights, where on day shifts you get two people, we get two controllers, on nights there's only one, so everything's on you to sort out. So, we've had some fatalities recently that it's really difficult to kind of get your head around. We've had some infrastructure issues where you're amending 60-70 trains in one night shift and that's quite a lot of work for one person. So, you can regularly go home absolutely exhausted from the mental strain of dealing with those incidents. (Rob, Train Service Manager, regional rail company)

Staff reductions at ScotRail had also occurred. Jim at ScotRail described how staff reductions over time had left only five workers to cover the work, which was insufficient to cover annual leave or staff sickness, and now more workers were refusing to come in and cover shifts. In this case, the union was eventually able to negotiate with company to add another two workers. However, even in this case, while the union rep is currently trying to negotiate a new roster based upon the additional staff to that they can improve workers' time off and ensure welfare of staff through a better work/life balance, on the other hand the company is prioritising full coverage in the office.

At Transport for Wales there was also recognition by managers that insufficient staffing had become a problem with the system depending so much upon overtime. There is currently a recruitment campaign in some areas. However, in the short and medium term this has exacerbated workloads for staff in relation to covering shifts for the training needs of the new staff. Sam (Resource Manager at Transport for Wales) reported that workloads and stress had increase over past few years in relation to the new recruitment and training program. This was related to increased work in trying to find shift cover for new staff to undergo training. In addition, the increase in workers is not accompanied by a parallel increase in their managers.

I think we've got 30 per cent more staff than we managed before, without really an increase in us [managers] Then there was training programs

which is having the biggest impact, the amount of training programs we have going on. The amount of time, amount of staff we have to cover for that... It's a lot of new staff, there's a lot of new starters with people leaving, people retiring, people have unfortunately passed away, which is the nature of any business. We've got a very ambitious program put in place by – which I don't necessarily disagree with, it's just they might be a bit too ambitious to do it too quickly more than anything else. I agree with the long-term goals, it's the speed that they want to achieve that is the difficult thing, I think is probably the most appropriate way to describe it. That tied into obviously everyone's workload and they've not kept up with management employment as they have with just regular staff employment. It's far outweighed it, the amount of staff they took on for us to manage and whether it's manageable.

Impact of climate change on workloads

Climate change was also having an impact on the capacity to deliver services, in particular increasing periods and the extent of flooding further disrupts the train networks and adding to the workloads of staff:

We used to get a quiet period from January to March, but that's not in existence anymore. Every period's busy now, and the manic months are really, really busy. The climate has an impact. I've noticed a massive change in the climate impact on our industry. Obviously, everyone used to joke about the leaves on the line, but it's not leaves on the line now. It's water on everywhere. It's flooding causing a massive problem. (Sam, Resource Manager, Transport for Wales).

Overtime - Work extensification

The railways are a 24/7 service. While most city-based trains will stop around 1pm, there are with a few night trains running through some stations, and there is still a reduced intercity service after this time, as well as freight trains.

In more recent years there have been various restructures such as London Underground's 'Fit for the Future' programs and other programs in other companies which have resulted in redundancies, especially of older more experienced workers, leading to increased workloads and the need to more overtime in most areas for those remaining. The workers commonly stated that 'the railways run on overtime', meaning there was insufficient staff to get the work required done so that without workers doing overtime the railways couldn't run. More recently some senior managers in some companies have acknowledged the problem of significant numbers of unfilled vacancies and vacant shifts and are now actively recruiting new staff. In the short term this puts additional workloads onto experienced workers to cover training shifts and to support training places and less experienced staff.

Overall, it was difficult to gain clarity on the shift premiums and overtime penalties and how these had changed over time as many participants were vague or contradictory about this. There need to be further investigation of this issue. These are likely to be significant in relation to incentives to work extra nights and to do overtime.

The nature of the job, the structuring of rosters, lengths of working day and week and the contexts of organisational restructures largely shapes expectations and requirements concerning night work and overtime. Overtime is a form of work extensification by prolonging the working week that saves money for the employer as it can become a means of running the

railways with fewer workers, especially if combined with the erosion of overtime premiums over time. Excessive overtime can exacerbate the fatigue associated with night work, which is particularly risky in safety critical roles which is the case for all of these workers.

There are more opportunities for overtime where there are twelve-hour shifts since this leads to having more days off work which can then be used to work overtime. Where shifts are shorter for example seven or eight hours and include longer runs such as seven nights in a row, there is less opportunity for overtime.

The older workers report having done a lot of overtime when they were younger and are aware of other workers who do work a lot of overtime. There is a regulation specifying an upper limit of 60 hours per week maximum which was put in place following the Clapham Rail Crash. This is still more than the EU working time directive of 48 hours per week. The nominal working week is 35 hours per week, but this is averaged over the year, so actual working weeks vary significantly. There are reports of some workers earning up to £30,000 extra per year through overtime.

The older workers report that they have generally cut back on the amount of overtime they do as their fatigue has got worse as they have aged, however this impact on their bodies began at a relatively young age (in their 40s). In their 50s many are saying the impact is too much and want to reduce nightwork and overtime. Nevertheless, they still do some overtime if required.

Insufficient staffing means that the railway system depends upon workers doing significant amounts of overtime.

The underground over – certainly over the last 15 years, it's all been about trying to reduce costs. What that has meant has been the natural wastage as people retire, their roles are not necessarily filled. From a company's financial perspective, it's much cheaper to get someone to do overtime than it is to recruit someone to fill the role. So as people are leaving they are not necessarily being replaced and the workload is being dispersed between the remaining people. When I started there was almost no overtime, there really wasn't. There was maybe one or two shifts because somebody had gone sick. Now there is so much overtime, sometimes it's just not covered.
(Alex, London Underground)

Despite overtime, managers still have problems covering shifts, which is stressful for managers and negatively impacts on workers and service delivery.

What's happening is the demographics of the room are my age group, so we're all coming to that stage. We're all going, actually, 'I've had enough, I'm going'. Especially with my controllers, it's the pressure and the amount of hours that they do as well. They are doing up to £30,000 a year in overtime, [because of staff shortages]. I've actually suspended the whole Central line because I've only had two members of staff come in out of six, because of sickness. I just did it. I got asked – I got asked to explain why and I said, unsafe, not running the trains. I just put the phone down. It is very, very stressful and causes a lot of workload, it does. (Tony, Service Manager, London Underground)

However, overtime is particularly exhausting for older workers which in some workplaces constitute the majority, with many trying to minimise working overtime and leading some to consider early retirement or shifting into a different role or job.

Similarly, Mike (Communication Officer, British Transport Police) reported that older workers who had been unhappy with the workloads and the lack of work/life balance transferred to another job when the company decided to change rosters to 12 hrs shifts only.

We had a lot of people leave. Apply for those jobs and leave to go to those [new training jobs and working 9-5] because of the work-life balance. They just thought, working from home, not on a shift pattern, was much better for them. So, we had five or six leave, I think, to get, to fill those jobs, even though it was actually less money. So, they lost the shift – that shift allowance. It's a lower grade job, but they still went for it because it provided better work-life balance.

These workers are prepared to take a pay cut to be able to stop shift work and to have a better work-life balance. This loss of experienced staff members further exacerbated workload problems for those remaining and makes it stressful for managers trying to cover vacant shifts.

Problems with managerial support – the politicisation of service delivery

Insufficient trains and staff to cover for accidents, breakdowns and maintenance leaves the rail system vulnerable to increased service delays. With companies accountable for the level of service delivery provided, and with the London Underground publicly owned, this has resulted in service delivery become politicised. For some network controllers, this becomes an additional psychosocial risk and source of work-related stress. Tony (Service Controller for the London Underground) explains:

I've seen major changes in the last fifteen years, and the work – the work has changed and has increased and become more political as well. Okay, so once upon a time we were very much in the belief, is that, we're here to run a train service for the customers, let's give them the best service we can. That's what we wanted to do. Now, there's a lot more politics that we're having to argue with, like on the central line it's absolutely horrendous. We want to tell the customers the truth. That you've got severe delays, the service is shocking, we're only running 60 per cent of trains.

But then you get the pressure from people above saying, I don't want you to do that, we want to show minor delays. You end up getting into a lot more clash and there's a lot more – there's a lot more things they want from us, now that are data-driven, to justify why we've done things as well. Explaining why you've done it.

There's a lot more pressure from the top, but it's all – it's now all data-driven and it's become – for the mayor, for the commissioner to say, this is actually how we're performing, and this is the data. It's become very, very political for us to try and make it look pretty, when it's not. Yeah, but I'm quite a bolshy so-and-so. When I had it the other week where they said to me, 'we want you to show good service'. I said, 'no'. They've gone, 'well we're telling you and we're going to put it out anyway'. I said, feel like – 'do what you like', I said, 'but I control the dot matrix, my staff do here'. 'We're going to change it on the line', and they threatened a senior manager to call me. I said, 'tell them to call me, I really look forward to having that conversation with him'

There is a tension between controllers wanting to provide a safe service with accurate information to the public and senior managers, commissioners and politicians who want service disruptions to appear to be minimised, which becomes an area of contention regarding the professionalism of the controllers and the political needs of senior managers. This has led to senior managers intervening to hold controllers to more intrusive and time-consuming accounting of their decision-making. This is highly stressful for train controllers.

Night work in the railways is embedded in an organisational work environment with significant psychosocial risks, specifically excessive work demands through work intensification and extensification (overtime) related to insufficient staff, some indications of some more senior managers prioritizing the efficiency of the rail system in rosters rather than the work-life balance and health of workers, and at least in some areas such as the London Underground, politically motivated attempts to interfere and micro-manage the work of train and network controllers.

These psychosocial risks are more generally linked to work-related stress and mental and physical health and are likely to exacerbate negative impacts of night work on workers. Excessive work demands and poorly designed rosters are likely to increase fatigue and to exacerbate the fatigue associated with night work.

4.3 Night work and shift rosters

Rosters are supposed to be negotiated between managers and worker union representatives within the parameters set by management. The capacity of workers to achieve preferred rosters depends to an extent on the co-operation of managers which seems to be variable across the participants. For example, one participant, Jim for ScotRail, who was a union representative, had not seen a roster change in 30 years. He was currently trying to improve the roster to enable a better work life balance for the workers, by increasing the number of days off after a block of seven night shifts from one to two days. However, management are adamant that they still require the blocks of seven night shifts in a row, which is in contradiction with the HSE (2006) guidance on shift work.

Rosters

Workers had rotating rosters, most with earlies, lates and nights, but some included middle shifts. Shift lengths were variable across job roles and companies. A few had some 5hrs shifts but most were 7, 7.5, 8, 8.5, 9, or 12, hours long, with 12 hrs shifts predominate on weekends. Some worked all shifts as 12 hr shifts as this gave them more time and weekends off. One worker from the Elizabeth Line (which was a new line and where managers were somewhat keener to follow H&S guidelines) had changed the roster to 2 blocks of night shifts and introduced 12 hr shifts for Fridays so workers could do 3x 12hr night shifts in a row. This enabled them to have an extra weekend off per roster, moving from 2 to 3 weekends off work every seven weeks.

Rosters were highly variable rotating shifts from 4 weeks to 13 weeks with 4, 5, 6, 7 and 10 weeks common. Some, especially those on the London Underground and ScotRail did blocks of seven night shifts in a row. One worker on the London Underground had two of these seven nightshifts as 12 hr shifts.

While most were contracted for a 35hr week, this was averaged over the year so the length of the working week varied considerably, and could be 48hrs, or more if overtime was required. Most also had blocks of time off within the roster, such as 5 or 7 days in a row. For some (with London Underground and ScotRail) these longer rest day blocks occurred before a block of

night shifts, but with only 1 day off (i.e. the day of finishing night shift in the morning) after night shifts before changing to an early shift pattern. Again this is very concerning as it is contravening HSE (2006) guidelines on shift and night work which recommends a maximum of 2-3 night shifts in a row followed by 2-3 recovery days.

Night shifts

Several workers were doing seven nights in a row, including for one worker doing 2 x 12 hr night shifts within this block. This was occurring in three cases (LU and ScotRail). These were part of slow rotation rosters, which again contravenes HSE (2026) guidelines recommending fast rotation shifts. There was also a case of working seven shifts in a row as a combination of 3 earlies and 4 nights shifts which could also include 2 x 12 hrs night shifts over the weekend (Controller for regional train company). Most workers had nights shifts in two blocks of 3, 4 or 5 nights in a row, including 12hrs shifts on the weekends, with one worker reporting that Friday nights had recently also become a 12hr shift.

The number of night shifts in a roster varied with length of roster. For example, 2 weeks of night shifts in a 10-week roster, nine nights in a five-week roster, nine nights in a six-week roster, seven nights in a four-week roster, etc.

There were no permanent night shift workers in the sample.

Rest days after night shifts

Rest days here are defined by the companies as including the day of the morning that the night shift ends and the day when the next shift change begins if this a late shift or night shift.

The time off after finishing a run of night shifts varies considerably between different workplace rosters as well as within specific rosters. The worst (Alex, London Underground and Jim on ScotRail) was seven nights in a row, finishing in the morning, then starting an afternoon shift the next day. For Alex this include having 5 days off before commencing night shifts. Sam at Transport for Wales had three night shifts then seven days off then four night shifts, finishing in the morning and starting back the next day on a middle shift at 13:15. Several had up to seven days off before commencing night shifts. Others had 1, 2, 3, 4, 5, days off following a run of night shifts. Some had significantly more days off before commencing night shifts than they have off following a block of night shifts.

The HSE (2006) guide on shift work recommends that the fast rotation of shifts, i.e. two or three nights, earlies, lates is recommended, 'as the internal body clock does not adapt and sleep loss can be quickly recovered, reducing the risk of fatigue and ill health'. The use of slow rotation such as a week of nights, a week of earlies, a week of lates shifts or similar 'are the most disruptive schedule as the internal body clock starts to adapt and then must reset itself as the shift changes' and recommends that these types of slow rotation rosters these should be avoided, where possible.

Weekends off

The number of weekends not spent working also varied across the different roles and departments. In this research we counted a weekend off as covering all day Saturday and Sunday, i.e. not those days when the shift ends on a Saturday morning or starts on a Sunday night. (The companies count a weekend off as beginning from when a night shift ends at Saturday 7am in the morning). The number of weekends off was highly variable with the most

weekends off being five weekend off out of every seven (e.g. Tony on London Underground) which was gained by agreeing to work all shifts as 12 hr shifts. A controller for a regional company had six out of 10 weekends off and a station manager for a high-speed train company had four out of six weekends off. However most had much less than half their weekends off, with the worst being two weekends out of 12 weeks and another 3 weekends out of 13 weeks, with others having, for example, three out of seven weekends off, or two out of five weekends off.

There was one worker doing on-call for one week out of three, including 24hrs on a Saturday which was often busy.

Cover shifts and extended night shifts

Most workplaces had some form of 'cover shift' weeks which involves picking up various shifts to cover people on leave. Vacant shifts may also be covered by extending the working day from 8hrs to 12 hrs for a worker already on a shift and then getting another worker from the next shift to come in 4 hrs early. Cover weeks often extend the number of nights worked in a roster and with extended hours this can lengthen weekday night shifts to 12 hours. Both are common practices in relation to filling vacancies caused by not having insufficient staff, so that often workers can end up working up to ten night shifts in a row.

Including the day of the morning when the run of night shifts ends as a rest day is a contentious issue for workers since they finish night shifts exhausted, and that day is generally spent just recovering and preparing for shift transitions. To manage shift transitions workers often will get a few hours' sleep when they get home from work, then will try to stay awake as long as they can in the hope of sleeping properly that night to try to readjust their circadian rhythms back to day shifts. This is certainly a day in which the worker is too exhausted to do much at all.

Many workers claimed that they preferred, or would prefer to work, longer twelve hours shifts as it meant they had more days off which allowed for both recovery from night work and some time to engage in personal, family and social life. Working seven or eight hour shifts on rotating rosters including weekends meant they felt like they were always at work. However, on 12-hour shifts staying awake after 03:00 to 04:00 was often when they 'hit a wall', so this was a particularly difficult period on nightshifts and puts them at risk of fatigue on the job, especially since many report that they too busy to take breaks while working or are solo workers and can't get a break because there is no relief. Lack of breaks increases the risk of fatigue and should be avoided according to HSE (2006) guidance of shift work.

Commuting

Commuting times were also very variable from 30 to 60 minutes each way. Long commutes are significant in relation to finishing a night shift and driving home afterwards, with those on long shifts of 12 hours especially vulnerable to the effect of fatigue on driving. There is a rule that the time from leaving work to returning home should be no longer than 14hrs, however, many workers, especially in London, can't afford to live close to work so have longer commutes that puts their working day over 14 hours.

Several of the workers reported accidents, near misses or significant concern about their capacity to drive home due to excessive fatigue.

... but twice I've had problems driving home after a night shift. Once I drove straight in the back of somebody, because I was just so tired. It just didn't

register in my brain the fact that it stopped and I just, bang, straight in the back of him. ... Once, which really shook me, really shook me, I hit the central reservation on a dual carriageway at 70 miles an hour on the way home. I think they now call it micro-sleeps. But I just nodded like that and had hit the central reservation. (Then, for a period I stopped using a car and started using a motorbike. It's very difficult to fall asleep on a motorbike [laughs]. I now just rely on the train and if I can't get in, I can't get in, it's tough. (Sam, Resource Manager, London Underground)

So, you end up on the first night shift, being awake for nearly 24 hours.' And you drive home. You know, sometimes I drive home and I'm thinking, oh, you know, should I be doing this? Should I be driving home? [George, Shift Station Manager, high speed line].

Yeah, [after a night shift feeling] very spaced out. Sometimes when the – you sometimes drive home and you're not even sure – you get home and you think you can't kind of remember the journey, if you know what I mean. It's as though you're on autopilot getting home, which sometimes I think is quite dangerous. (Mike, Communication Officer, British Transport Police).

These risks associated with commuting when excessively fatigued put both the worker, their family and the general public at risk of adverse physical and mental health outcomes.

Sleep deprivation is dose dependant and accumulates with the more nights that are worked resulting in excessive fatigue which can be exacerbated by multiple 12hrs shifts and putting night shift workers at considerable risk. Workers are generally keen to get home as quickly as possible after finishing work with some having childcare responsibilities when they get home. There is a case to be made for following HSE guidelines concerning workers having a nap during the shift (40-minute break for a 20-minute nap plus recovery time to overcome sleep inertia), particularly in the context that many of these workers are too busy or working solo so don't have an opportunity for meal breaks. This would need to be during working time as a health and safety measure.

4.4 Motivations for nightwork and overtime

Workers choose to work for the railways in roles which demand significant night and weekend work. Most of the older workers considered that the demands of the job had increased significantly, whereas when they were younger the job was more tolerable and less demanding. They described their younger selves as getting used to shift work including some night work and being able to work significant overtime without excessive tiredness. They put this down to being younger and the work being less demanding at that time.

One worker reported that he was required by the company to work a 44-hr week (his contract is for 35hrs per week) with the roster structured in this way, even though he finds it very tiring working what is in fact overtime. For the other participants doing overtime is a choice for the individual worker.

A key advantage of night work is for those who have dependent children since night work enables workers to prepare and take children to school and pick them up in the afternoon, negating the need to find child-care which is expensive and difficult to find in the UK.

This was easier in the past when night shifts were only six hours so workers could get more sleep. One worker describes finishing at 5am and getting home for a few hours of sleep before taking the kids to school. Night shifts are now longer, generally 8-12 hrs, so workers may stay up until they have dropped their children off to school.

However, having young children can also be a dis-incentive to work overtime for some as it reduces the time available to spend with children:

In 15 years, I've never, ever volunteered for overtime. I've always said I think I'm here too much as it is. I'm tired. I don't understand how people do it. Some people do a lot of overtime. Then, I would say some of those people tend to get sick more often than me. Yeah, I've always been – like I've just explained with my kids. If I did a couple of days overtime, that's a couple of days where I'm not seeing them, taking them to school, or seeing them after school. So, I've always been very strict on doing that. (Mike, Communications Officer, British Transport Police).

Older workers described doing overtime when they were younger to save money for holidays, to support families and children and to pay mortgages.

One of the older workers described other workers as currently doing overtime because of the current cost-of living crisis and high mortgages, with high inflation and below inflation pay increases negotiated with management over recent years exacerbating financial stress for younger workers.

Some also report that some workers will work as much overtime as they can, but others want a better work-life balance. This desire for a better work-life balance occurs in both younger and older workers.

One of the younger workers, Rob, a train controller for a regional train company, prefers night shifts even though it can be very busy at times, because nights is period when he can do more strategic development work which he finds interesting. He does not have children, or a partner, so wants to work nights and overtime for the moment while he has the energy, realising that this might change once he has children.

Alex noticed that people are more likely to work overtime in winter when there is nothing else on and it is cold, and they might be saving for a holiday. They are less inclined in the summer, so more shifts go uncovered.

For others night work can enable them to have some time during the day to be outdoors or sit in the park or do shopping when it is not busy. For example,

Healthy wise, I'm an outdoor person, really. So, I be night shift outdoor and then being able to be outdoor during the day as well quite a bit was great. I don't do so much of it now. I'm old now. Can't do the things I used to do. [He is 52yrs]. (Terry, Senior Construction Manager)

I could go and sit - I can go and sit in a park and there would be - there's no one about and you can just - you can chill. You can go to the heritage centres and it's not over packed or you want to go shopping, it's not full of people. It's not that I'm not a people person. I just feel it's more comfortable and more laid back. It's more relaxed. Like I say, I feel the shift work has been a bigger advantage to me. But as I'm getting older I feel like it's [night work] now

becoming a disadvantage because it's now starting to wear me down. (Lloyd, Senior Infrastructure Controller, DB Cargo).

There were advantages to night work when they were younger, but as they get into their 40s and 50s these advantages are no longer relevant because they are too fatigued from night work to be able to engage in these activities.

Most of the older workers reported doing much less overtime now than in the past primarily due to the excessive fatigue created by their rostered night work had become worse as they have aged. They no longer have the energy to do a lot of overtime. Night work and overtime is now having a more pronounced negative impact on their bodies and how they feel as they have got older. These older workers continue to do some limited amount of overtime, some for personal reason such as a good holiday:

Yeah, I do as well sometimes, depending on how much money I need. If I've got a holiday coming up or something, then yeah, I'm inclined to do a bit of overtime just to sort of, you know, fund the holidays. I'm not consistent overtime worker. I just do it for my own personal needs. So, so I don't do it for the loyalty to the company, 'cause, they're desperate for me to work.... Yeah, yeah, I got my car insurance coming up next month. So I've just done three days overtime. (George, Station Shift Manager, High speed line).

Most often the motivation to work overtime for older workers is more about either helping colleagues so they can take sick days or annual leave or their dedication to providing services to the public or to support their local work team, not due to loyalty to the company.

I tend not to do overtime, but recently I have been doing overtime. The reason I selected to do the overtime was just mainly to keep the stations open. We've had that pressure from everywhere, whereby – we're all picking up extra shifts that we don't necessarily need to pick up. Or I don't know whether we should – because I'm torn between closing a station or not closing a station. ... That's the reason why I have had to jump in, to do a few shifts to keep our stations open, but I don't readily want to do overtime. If I'm on a rest day they know that. You're not going to get me in. If I'm coming in anyway and I have to do extra four hours, I'm happy to come in earlier to support in that sense. (Sophie, Customer Service Manager, London Underground).

While service delivery is very important to Sophie, there are limits on what she is willing to do and she will not go into work on her days off to keep the station open, despite pressure from the company.

Maintaining services to the public is also important to Jim (Train Crew Supervisor, ScotRail):

.. if somebody's in holiday and somebody needs time off, they you're basically you're going to have to work 12 hours to allow your colleague to time off. Or if the railway's broken or if you're members of staff off, as I say, the company then expects you to give up your time off to come in and make sure that their office runs.

And we are such a dedicated group that we don't like to know see trains not running, that the majority of the time we'll just go in and we'll do it in order because it keeps the service going. (Jim,

However, in Jim's area in ScotRail, this dedication has begun to unravel with more shifts not being covered because more workers are refusing overtime,

more and more people in the grade, have turned around and said, 'No, I'm not coming in'. So what then happened is that people have turned around have said 'well we're not coming in, so that just swinging'. So, the way the company's looked at it is well, 'we can't have such a key role unmanned', so in order to do that, that's why they've extended the positions to 7 is to ensure that there would be cover in the event that people say no.

Workers both young and old wanted a better work-life balance so they had begun to refuse overtime. As a consequence, in this workplace in ScotRail the company subsequently agreed to employ an extra two workers, which would ensure that more shifts could be covered, and this would reduce the amount of overtime. Jim as union rep is endeavouring to gain a better work-life balance in a new roster.

Nevertheless, by doing significant amounts of overtime workers say they could significantly increase their wages, sometimes nearly doubling their normal pay. This is significant in the current cost of living crisis with high inflation and below inflation pay increases negotiated with management over recent years.

4.5 Experiences of night work

Sleep and fatigue

All the workers reported suffering from excessive fatigue which was much worse on night shifts. Most were aware of issues related to their body clock which they used to explain their difficulties in sleeping when doing night shifts. The majority reported only getting about four to six hours of poor-quality sleep split across two periods during the day when on night shifts. Most report sleeping for a few hours after they get home or after they have taken children to school, then waking in the middle of the day and getting up (often because they can't sleep) and then trying to have another couple of hours of sleep in the late afternoon before they leave in the evening to start night shifts. This leads to sleep deprivation which builds up the longer the runs of night shifts that workers do.

I think you never get your sleep back. Like I say, if you do three night shifts and you only manage to get four or five hours in between, it's a real – and those four and five hours are not great quality of sleep either. It's in the day. It really does impact, and you find you're a bit slower brain-wise, thinking of things that are normally quite quick. So, it definitely does affect you and you can really tell. You have to be strict to try and rest. (Mike, Communications Officer, British Transport Police).

They described the resulting fatigue associated with doing night shifts as feeling 'completely wiped-out', 'shattered', 'spaced-out' 'punch-drunk' and 'like a zombie'. These metaphors express such an extreme level of exhaustion where they are unable to function in any sense of normal. This compromises the capacity to think clearly or to have the energy for other activities, including for some, exercise and preparing healthy food.

It is largely when they finished a night shift that the fatigue and feelings associated with that would start to overwhelm them. On the job the demands of the job often keep them awake, although those on 12hr night shifts (as well as some on shorter shifts) reported 'hitting a wall' about 3-4am and struggling to stay awake.

I can feel tired. I think the worst time on a night shift for me is around about four o'clock in the morning is when I feel the most tiredness [inaudible]. But around about four o'clock in the morning that's when I start feeling, 'God, I just want to get in bed'. So it does make you tired but more towards the back end of finishing your night shift. (Lloyd, Senior Infrastructure Controller, DB Cargo).

Consequently, during the day they have very little energy left for anything else apart from work and doing the basic necessities (e.g. childcare) during night shift working.

Exhaustion is even worse after working longer runs of seven nights in a row resulting in extreme exhaustion at the end of a run of seven-night shifts, especially where occurs in a shift pattern of slow rotations.

so I've already done two nights and I'm already – I'm ragged. I'm already ragged. I've only done two. I've still got another five to go ... (Alex, London Underground).

Many of these workers often also have very limited rest (only the day of finishing a night shift in the early morning) before starting a new shift pattern the following day. This further diminishes any opportunity for recovery from sleep deprivation since it requires a very rapid transition so workers try to stay up as long as they can during the day in the hope of sleeping that night.

Transitioning from night shift to other shifts is very demanding,

Get out of the punch-drunkenness. I only try to get maybe two to three hours sleep when I get home [after end of run of nights], because I want to try to kick my body back into a normal sleep pattern. But that normally takes me a good two – at least a good two days, until I start to feel back to normal. (George, Station Manager, high speed line).

This is even more demanding for those on rosters requiring seven nights in a row with minimal rest days before a new 7-day shift pattern.

It takes 3 or 4 days to readjust sleep and recover from a run of 7 nights, so fatigued after night shifts. Often [after a run of nights] can't get to sleep until 2am ... I finish 7am Tues and have to start again 3pm Wed, so have to force yourself to stake awake Tuesday so you can sleep Tues night in preparation for working Wed. So, you are not getting proper rest on the 'rest day'! ... Your one day off you too tired and don't feel like doing anything and the Wednesday you are still in recovery and don't want to do anything. (Jim, Train Crew Supervisor, ScotRail).

This short time between shift rotations means that the one 'rest day' is not for recovery but to try and shift the workers' circadian rhythm into a new shift pattern through even more exhaustion in an effort to get some sleep that the night.

Alex (London Underground) finishes a run of seven nights on a Monday morning then starts Tuesday at 5pm. She describes this shift pattern as:

It's pretty brutal, ... the impact is devastating.

When doing longer runs of nights (more than 3 in a row), the body begins to adapt its circadian rhythm to night shifts, which then makes it harder for the body to re-adapt to a shift change. Hence the difficulties in getting to sleep at night again when shifting to early or afternoon shifts. One rest day is clearly insufficient to enable workers to recover, especially following seven nights or more in a row.

HSE (2006) advises against long rotations of seven nights, recommending instead fast rotations of a maximum of three nights in a row followed by two to three recovery days and at least 2 nights of sleep before a shift pattern change. It is concerning that these recommendations are not being followed in some companies.

Most workers, including those doing shorter runs of three or four night shifts, report that it takes several days to recover from the sleep deprivation associated with night shifts, with some reporting that they use annual leave days to increase the runs of rest days so they can recover. This included the case of a worker in his 20s who reported taking four of five days to recover properly from a long run of nights (he sometimes does ten night shifts in a row with overtime).

Going from night shifts into early shifts is also problematic since the day before commencing earlies requires workers to go to bed very early in the evening to get up often between 04:30 and 05:30, or earlier in some cases. The workers reported feeling that they were constantly having to manage shifting their circadian rhythms, which is also exhausting.

I think I had four days off after the last night shift. So, I sleep in on the first one. The second one, you're very, very tired. You get back to normal on the third and fourth. Then you're in very early. So, I've got to try and go to bed early to get up at – so, I get up at 5:30 to start work at 7:00. So, it is difficult to flip your body around and keep flipping your body around. (Mike, Communication Officer, British Transport Police)

Recovery from night shifts and preparing for early shift significantly reduces the workers' actual time for normal living. Even where there are several rest days following a run of night shifts, there are days when many workers are still too fatigued to engage in activities such as socialising or driving long distances.

And then after say I'll do my five nights, it can take me like 3 days just to recover just to get back to the norm. And I find myself on my days off, I just wanted to sleep all the time during the day. ...when I finish nights, I'm very lethargic. Very,... so, those days I get off after my nights, I really don't feel like going out and socialising and doing anything. I tend to just get on with my chores here at home. (Mike, Communication Officer, British Transport Police)

All the workers (except for one 20yr old) reported that their fatigue associated with night work had got worse as they got older, with difficulties starting in their 40s and with most of those in their 50s doubtful about whether their bodies could keep going, so were considering either early retirement, or shifting to other roles or jobs. They described changes in their sleep, with increased difficulties staying asleep during the day on nightshifts, which reduces the hours of sleep and exacerbates sleep deprivation. All workers contrasted their current struggles with

fatigue associated with night work to their younger selves, which they remember as being more resilient and as having more energy to do other things during the day and evening before night shifts and then recovering much more quickly after a run of night shifts, and to have better, more refreshing, sleep.

[When she was younger] I would do a night shift, I would go home, I would have four, five hours sleep, I'd get up, I'd go shopping, I'd do all sorts of things and then I'd go to work. That was my MO and there was no issues, but what's happened is over time, I can't do that now. It's really, really – it's really hard, where I struggle to sleep and then I get up and notionally I'm awake but I'm not functional. (Alex, London Underground, in her 50s).

Some recall being able to get a good quality eight hours of sleep during the day when they were younger.

I'm finding now, in the last three to four years, specifically doing night shifts, I'm finding it a lot, lot harder. A lot harder. My recovery period is a lot longer, but I'm sleeping less, so I do get quite jaded with it all. I'm also struggling with doing the early shifts because that means I'm up at 04:30 in the morning, to go into work. But I do find – and I have actually said this to my wife, I struggle to sleep. (Tony, Service Manager, London Underground).

I used to find it easy. I think maybe the last four, five years I tend to struggle a bit more now, more so with sleep. You finish in the morning, where I used to get - I don't know - eight hours sleep, maybe it's about six hours sleep now. My body is changing I gather as I'm getting older. So it's less rest than what I used to have when I used to do nights. ... I just seem to wake up and then I just can't get back to sleep either because it's - I mean, I have blackout curtains, but it just seems to be 12.00 - finish at 06:00 - 12:00, half 12, one o'clock I'm up and about. I just don't tend to sleep like I used to anymore at night.... But, like I say, where I used to do eight, possibly the odd nine hours sleep, now it's six and at a push seven. ... I mean, when I first start the nights it's not too much of a problem. But then as you're getting into them the less of sleep the more tiredness I guess because obviously you're doing 48 hours, but you could end up doing 70 hours that week on nights depending on the General Purpose. So, your body just doesn't adjust. It just gets tired. (Lloyd, Senior Infrastructure Controller, DB Cargo).

Some workers are using annual leave days and holidays to recover from the accumulated sleep debt. One worker reported she was permanently tired, and that she had to use much of her holiday time with her family just recovering from sleep deprivation.

Really with my husband, I keep saying to him, when we go on holiday I just want to be left alone to recuperate. I don't want to leave the holiday villa, or whatever. – I just feel tired. I don't know how else to express it more than, I'm just constantly tired. I'm trying to do vitamins, trying to take natural supplements, I buy my own plain grape juice, or whatever (Sophie, Customer Service Manager, London Underground).

Poor quality sleep and insufficient sleep leads to accumulating sleep deprivation and a sleep debt the greater the number of night shifts. The current regime of rest days after nights shift are

often not sufficient to reverse sleep deprivation and fatigue in those older workers (40-60 years of age) so they accumulate a sleep debt which some then attempt to compensate by using annual leave (during holidays, or for some by taking some annual leave days to gain extra rest days). This then has impacts on their family and their capacity to enjoy annual leave and holidays.

Fatigue management:

Several workers criticised the system of fatigue management. One reported that his occupational health assessment indicated that the new medications that he was taking were causing him to urinate frequently and leading to significant sleep disruption. The assessor recommended that he be put onto early or late shifts until his body adjusted to the new medication. His manager refused to do so, and he had to continue with night shifts. The refusal was because there were insufficient staff to cover his shifts and the manager claimed that occupational health advice was a recommendation only, not a requirement for managers to accept.

Another worker reported that even though he was involved in fatigue management, he did not think that the system was adequate, as it did not consider individual differences, such as a workers' personal circumstances, or how much sleep they had been getting. He gave an example of being put up in a hotel so that he didn't have to travel long distances while providing technical support to a team. This ticked the fatigue management system box as sufficient but did not consider that he sleeps very poorly when staying in hotels compared to being at home.

Summary and discussion

All the workers reported suffering from excessive fatigue which was much worse on night shifts compared to daytime or evening shifts. Most were aware of issues related to their body clock which they used to explain their difficulties in sleeping when doing night shifts. The majority reported only getting about four to six hours of poor-quality sleep split across two periods during the day when on night shifts, with difficulties sleeping during the day. This leads to sleep deprivation which builds up the longer the runs of night shifts that workers do.

These findings on sleep quality and duration are in alignment with the literature on circadian rhythm and night work which identifies problems with poor quality sleep of short duration (four to six hours, and insomnia (Moreno et al., 2019; Wyse et al., 2017; Yong, Li and Calvert, 2017; Kecklund and Axelsson, 2016; Åkerstedt and Wright, 2009)

This exhaustion means they often have little energy during the day following a night shift for anything except some basic household tasks or childcare. Many reported that they suffer from difficulties in clear thinking after night shifts and during recovery.

Sleepiness, impaired cognition and performance are widely reported for shift workers in a range of industries, with performance declining further with extended working hours and shorter sleep duration, and with the first night shift usually the worst. Cognitive function may either improve or deteriorate depending on a range of other factors (Boivin, Boudreau and Kosmadopoulos, 2022).

The effects of exhaustion were severe for those doing long runs of seven or more nights in a row, on rotating 7-day shift patterns which was the standard roster in several places, notably ScotRail and London Underground. These are slow rotating shift patterns and are not

recommended in guidance by the HSE (2006) as they push the body to undergo continuous circadian rhythm re-alignment with each change of shift pattern and lead to excessive fatigue.

The capacity to recover from sleep deprivation and an accumulated sleep debt is further compromised where there are insufficient recovery days following a run of night shifts. This is most detrimental in the cases from ScotRail and the London Underground where workers will regularly start work on a new shift pattern the day after they finish a run of seven night shifts. Nevertheless, these rosters do allow 5 days off *before* commencing night shift which does not then enable these days to be used to recover from sleep deprivation and to realign their circadian rhythm following night shifts. Having the run of 5 recovery days after a long run of nights would be an improvement.

Even workers on shorter 4 or 5 day runs of night shifts followed by several days off afterwards reported that it takes two or more days to feel like they have recovered from the fatigue of nightshift, during which time they have little energy to socialise, drive long distances or to enjoy regular activities. One worker reported sometimes taking annual leave to have an extra recovery day while another reported that she the first few days when on holidays with her family to sleep and rest to recover from an accumulated sleep debt.

These findings are aligned with the literature on recovery from sleep deprivation, which may take one or two nights following one night of total sleep deprivation (Balkin et al., 2008) and longer than seven days to recover after five days of 4 hours of sleep (Axelsson et al., 2008).

This recovery time from fatigue and sleep deprivation is a result of working night shifts and is a penalty that normal day shift workers do not usually experience. Yet these workers do not get extra holidays and any runs of rest days are in their own time since they continue to average a 35hrs week across the year.

During a night shift, many workers report worsening of fatigue from 03:00 to 04:00 with difficulty staying awake, especially those on 12-hour shifts. Several reported concerns about driving home after a night shift with some reporting accidents or near misses. Several sources including the Working Time Society and the HSE UK recommend having regular breaks during work and a nap for 20 minutes (as part of a 40-minute break that includes time for the worker to refresh and overcome sleep inertia) to combat fatigue. However, unless this is in the employer's time and with proper facilities provided, workers are unlikely to do this in their own time. Most workers reported that they had no time for meal breaks which are also key to managing fatigue.

The participants in this research were all (except one 20 years old) over 40 years of age with most in their 50s. These older workers all reported that ageing was having a significant effect on their capacity to do night work since they were finding that on night shifts they were getting less sleep, poorer quality sleep, being more exhausted, and taking longer to recover from the fatigue associated with night work as they got older. This was to the extent that most of those in their 50s and 60s were considering ways to stop doing night work, through either early retirement or shifting to roles or to jobs that don't require night work.

Many studies of the impact of age, sleep and shiftwork indicate that younger workers are more tolerant of shift work, with those between 42 and 52 years having the lowest tolerance (Ritonja et al., 2019). However, this research does not mean that those over 52 years are not similarly affected since at least in Tucker et al.'s (2011) study there were significantly few workers over the age of 52 yrs in the study since many retired, so comparisons with this older group were not significant. Blok and de Looze's (2011) review found strong evidence that older workers have

more sleep problems with night shifts than younger workers, with Flo et al. (2012) indicating that there is an increase in sleep difficulties for shift workers once they reach 40-50 years. Research also indicates that aging is related to an increased sensitivity to circadian phase misalignment and an increase propensity in older people to awaken from sleep, as well as issues of getting to sleep during the day and with sleep tending to be less restorative with age (Dijk et al., 1999).

There needs to be much more accommodation in rosters and in fatigue management to the needs of older shift workers to retain these workers who have considerable knowledge and experience in the industry. For older workers this would require minimising the number of night shifts and ensuring sufficient recovery time to eliminate the sleep debt and associated fatigue and to enable circadian rhythm re-alignment.

Diet and eating:

Shift work disturbs the timing of eating which may have affect metabolism. Night shift workers are reported to have a greater calorie intake at night which may increase body fat and weight loss effectiveness independently of total daily consumption (Boivin, Boudreau and Kosmadopoulos, 2022).

The majority of participants struggled with poor eating habits associated with night shift work, despite having significant self-awareness about diet and health and they often made repeated attempts to have a healthy diet, however, for many, this was difficult to maintain during night shift working, or for some, over longer time periods. Most ended up eating ‘rubbish’ food when on nightshifts. Those who could sit down before the night shift and have a cooked meal with their family fared somewhat better. However, others were not hungry after getting up from sleeping a few hours as their body eating clocks was not synchronised. During the night shifts some found that their body rhythms related to eating were disrupted, so they were not feeling hungry when they would normally when they were not on night shifts.

Some workers reported that they eat more when they are on night shifts because of the way the shift changes to night shifts operate and that they are awake for more hours (since many only get 4-6hrs sleep when on night shifts). Extra snacking at work also contributes to having extra calories which is exacerbated for those who can’t get proper meal breaks. Sam (ScotRail) describes having lunch when he get up about 11am after waking from a few hours of sleep following a night shift, then an early evening meal at home, and then sometimes having a snack before he goes to work late at night to start a night shift, then lunch in the middle of the night at work, with snacks from vending machines a temptation in the early morning although he does take his own food in, then breakfast when he gets home.

With companies, in most cases, only providing vending machines with chocolates, sweets and crisps for night shift workers, they struggle to resist the temptation for a ‘sugar hit’ especially when they ‘hit a wall’ of fatigue about 03:00.

Eating unhealthy is – night shifts do cause issues because you think, I'll just have a snack before I go in. You get there, I'll just have something else or I'll just have – it's very easy to overindulge in snacks more than anything else There were vending machines outside our office, which can be very tempting, but I'd always try to take my own food in food to try and avoid the temptations (Sam, Train Crew Manager, ScotRail).

I keep bars of chocolate in there. I know [unclear], but sometimes you just think, I just need a sugar boost, just to keep me going. I will do that.

Ordinarily, if I wasn't doing shift work and I wasn't doing something like this, you could easily say, 'Well, do you know what, I'll have an apple and a bowl of homemade coleslaw or something like that. Have something a bit healthier'. But you do get that craving for a bit of chocolate. Because you just need an instant sugar boost. (Ryan, Incident Response, London Underground).

All the workers reported that fatigue following night shifts is also a significant factor in poor diets, since they are often too tired to organise food and prepare healthy meals despite knowing healthy diets are important especially for shift workers, and most describe this as a difficult struggle:

It's like now I've got my shopping delivery last night. A lot of it's ready meals, purely because you know you're just too tired. You don't have time to prepare a proper meal. ... I generally, I generally eat at home. I don't tend to eat at work because my job is so reactive [so is too busy to eat at work] (George, Station Shift Manager, high speed line).

For George, it is both the fatigue associated with shift work and the lack of rest breaks when on night shifts that prevents him having healthy eating habits.

Sophie (Customer Service Manager, London Underground) also struggles with fatigue and goes through cycles of trying to organise food and prepare meals ahead, but this is an effort she cannot maintain because of the fatigue associated with night shifts,

I tried to eat properly, but I find that I can't eat properly because I need time to get stuff. If I do it, if I put my head down and I say, 'Okay this week I'm going to get my shopping done, do my preps, put my meals in the fridge', it will work. I will find myself eating properly and all that. ... But that goes through the window very quickly because you get tired and you can't just keep up. I said to my daughter, I wish I had a personal chef and I can say, 'do this for me, do that for me'. It would help, I don't know.

Tony (Service Manager, London Underground) has started to get help by ordering Hello Fresh deliveries which provide recipes and ingredients for healthy meals and encourages his sons to learn to cook, making this a family issue. However, on night shifts this is impossible:

My diet is absolutely horrendous on nights, and I will admit this. I end up eating more rubbish than what I really should be doing. It's just one of... I think I just need sugar. It's – you just need that sugar. I've tried to change the amount of coffee I drink on nights, drink a bit more decaf, a bit more water, peppermint teas, to try and help that – see if that – helps me to sleep more, but it hasn't changed anything also we have a tuck shop at work which is full of all the stuff that you know you shouldn't be eating.... When I had a period of time where I was working 09:00 to 05:00 on a project, for about six months, I noticed that I wasn't eating as much. My weight was a lot more stable, but doing the nights, it's just – doing shift work.

Again, the effort to eat healthy is represented as a difficult struggle of trying to change but the fatigue on night shifts creates a desire for rubbish food, sugar and caffeine to get through it. He compares his eating and weight as being much better when, for a short period, he was not doing night shifts.

This theme is taken up again by another worker with stomach problems who now mostly eats a healthy diet, with either himself or his partner cooking meals and eating main meals at home, then taking sandwiches and fruit to work. Still when fatigue hits at 03:00 it triggers his need for a 'sugar rush':

Definitely on night shifts I'll have things like sweets just for a bit of a sugar rush to try and keep you up. Also, I try and eat – snack wise I try and pick healthier snacks. So, I'll have fruit. I also do have chocolate and crisps. It does tend to get you through about 03:00 in the morning when you're crashing, something like a chocolate bar and a bag of crisps does help.

Time compression due to a series of 12 hours shifts also negatively affects workers' capacity to prepare healthy food. Bill (Train Running Controller, Network Rail) describes working 12hrs plus a 1.5 hr commute and 8 hours sleep adds up to 21.5 hours, leaving 2.5 hours per day for all other activities including showering, eating and relaxing. This time compression and fatigue from long shifts means there is not enough time to prepare healthy food or to exercise and on recovery days following 12 hr night shifts he is also too fatigued to do so.

Practices such as staying up late to realign the circadian rhythm after a run of nights is another source of poor diets and eating habits:

[After a run of nights] ... then we'll get to the point in the evening when I start to wake up and that's when the wife says, 'Well, I'm tired now. I'm going to bed'. So, now I've got everybody in the house has all gone to bed, because they're all on standard hours and I'm sitting there thinking, 'Well, I'm wide awake now, because I've just come off nights'. So, what do you do? You sit there, get a bag of crisps and a tinny and you watch a film. So, it increases the unhealthy activities. Because you can't go down to the shops at 11, 12 o'clock at night. You can't go out and ring your mates and say, fancy going for a walk with the dog, or whatever. You tend to just sit there and have a bag of crisps, have a can of beer and eventually you'll start thinking, yeah, I feel tired enough to go to bed now. Then you won't get a proper night's sleep, because you're all out of kilter (Ryan, Incident Response, London Underground).

The poor dietary habits of colleagues also play a role, even for those who normally eat a healthy diet and take healthy food into work

So, on a night shift you're eating - I do take healthy stuff in, but you end up snacking and wanting rubbish, to be honest. [poor eating is mainly on night shifts]. No, it is majority night work. You work in a team, and someone will say, we'll have a takeaway, and you think, I've got a cheese and ham butty there. I would rather have a takeaway. You don't have to, but I would say 90 per cent of the time on nights it's junk food, to be honest. (Lloyd, Senior Infrastructure Controller, DB Cargo).

The only food supplied to night shift workers by employers were, in some cases, automatic vending machines with chocolate bars, crisps, etc.

Fatigue plays a significant role in unhealthy eating patterns. Workers were often too tired with little energy to prepare a proper meal to take to work. In addition, one way to cope with the increasing fatigue as a night shift went on was to eat junk food especially sugary or fatty food (crisps, chocolate bars) which some reported as 'craving' especially in the early hours of the

morning. Eating sugary food and drinking drink coffee is a way to try to push through the rising fatigue to keep awake.

What strongly came through these interviews is the conflict and struggle for most workers between knowing that fatty high carbohydrate foods such as chocolate and crisps jeopardises their health in the medium and long term, and their ongoing struggles to change and to maintain a healthier diets within a regime of night shifts and its associated fatigue. This could lead to feelings of frustration, guilt and becoming self-critical.

What needs to be appreciated is how the structure of night work and associated fatigue both during shifts and between night shifts, the lack of meal breaks, availability of high carbohydrate food in vending machines and the organisation of work including compressed hours and long commutes, as well as the dietary habits of colleagues all collude to shape workers' conflicts and struggles over diets yet give the appearance of individual choices. Simple admonishments about needing to have healthy diets ignores the context that is shaping workers' diets and their struggles to establish and maintain healthy diets, and then constitutes the problem as just an issue about individuals (poor) choices.

Exercise:

There is a relationship between reduced physical activity and shift work identified in the literature which describes several mechanisms including desynchronisation with the availability of leisure facilities and team-mates, conflict with other responsibilities (domestic and family) and fatigue (Atkinson et al., 2008; Arlinghaus et al., 2019).

These issues were also found to play a role in the case of the rail workers in this research. Many (but not all) workers reported diminished physical activity when not at work. For some this was most of the time and for others occurred during night shifts. Fatigue was the most prominent cause of diminished physical activity, and this was exacerbated as they become older.

Healthy wise, I'm an outdoor person, really. So [when he was younger] I'd be on night shift and then being able to be outdoor during the day as well quite a bit, which was great. I don't do so much of it now. I'm old now. Can't do the things I used to do. (Terry, Senior Construction Manager, in his 50s).

... I might go to the gym. I'm finding that more and more difficult, because I always used to go between 04:00 and 05:00, and I'm now finding I don't have the energy to go to it. I've found it's getting more and more harder the older I am. When I was younger, I could breeze through it, but oh god, it is getting harder and harder. ... I always try to go at least three times a week, but when I'm on nights I find that goes down to one. I just don't have the energy. I'm planning now to retire now, next year. (Tony, Service Manager, London Underground, in his 50s).

We do a lot of walking on days off and that. But during the nights I'm just too lethargic, to be honest. (Lloyd, Senior Infrastructure Controller, DB Cargo in his 50s).

Most were aware of the importance of having a good diet and needing to exercise regularly. However, as with the case of eating above, most workers found it difficult to do much exercise when on night shifts due to fatigue and time constraints. The irregularity of rotating shifts could also be a limit on doing team sports. Some reported going through cycles of going to the gym or

other forms of exercise, but this required significant discipline to maintain, which is a struggle so they often dropped exercising.

I've not been able to steadily keep into an exercise routine. I paid a gym membership, but it just carries on and I don't find that energy to pull myself into it, to go do it. I did try to see if I could do some exercise virtually. I joined a [unclear] group in Grantham and to be honest, it hasn't worked for me. Nothing in that [realm] it's working, so far so good.

[The problem is] it's the [shift] pattern, because with the pattern I have, it doesn't help. All it creates, it's that tiredness, its fatigue, to be honest, because you're constantly – your body is constantly on the go and you're not able to rest. Because if I'm on holiday, what I tend to do is try to take things to aid sleep, just to be able to get that rest for the body. Sometimes maybe I'm getting into that wave of, 'Yes, I'm getting some results', then I'm back again into the vicious cycle of the shift, and all that. It kind of takes all the hard work away. (Sophie, Customer Service Manager, London Underground; in her 50s).

Those doing twelve-hour shifts and having significant commutes do not have much time or energy left to exercise during the working week, especially if they also have young children.

I make sure I go to the gym. I try and keep as active as I can. Yeah, I do feel like I'm tired a lot of the time. A lot more tired than I should be. When I do go to the gym, I do find my energy levels drop quite quickly. If I'm running on the treadmill or on a bike or whatever, quite quickly your energy dips compared to what I think it would be if I didn't work shifts.

Yeah, on my rest days, yeah. I make sure I force myself to go pretty much every day on my rest days, or the majority of them. Reading stuff about shift work and your heart and health and that sort of thing, I do think it's really important to. I used to cycle to work when we didn't do 12-hour shifts, but now we're doing 12 hour shifts I find it too much to cycle in and cycle home afterwards, because it adds another hour or so onto your shift. You're already out of the house for 12 hours. I don't really want to be out and have to try and eat when I get home. So, that was a way I kept fit, cycling, but I've had to stop that. So, that's when I joined the gym. (Mike, Communications Officer British Transport Police; in his 50s).

Mike is aware of the negative impacts of shift work on health, and 'forces himself' to go to gym since new compressed hours has stopped him from being able to cycle to work which was his previous routine and which easily fitted into his schedule. Now he has exercising at gym as an additional discipline which despite doing it only on his rest days, he now finds also tiring.

Ryan (Incident Response; London Underground, 60yrs) is also concerned about the negative impacts of night shifts on his health so also tries to engage with exercise. He contrasts how much healthier and fitter he was when he was younger. However, irregular work patterns of shift work increase the difficulties in establishing a regular pattern of exercise and in making regular commitments such as playing sport with others.

[When he was younger] *So, I got regular exercise, regular eating and I felt really good. I felt really good then. I was a lot younger, I was a lot fitter, but that's the best I've ever had.*

So, I'm trying to be a little bit better, because as I've got older I've realised that it is starting to affect my health quite a bit. I'm also now trying to get more exercise as well. Injuries prevented me for a number of years doing stuff. But I went out, for example, and cycled 14 miles this morning. I got up early and went out on the pushbike. So, I'm getting more exercise. But because you're on a constant change of shift, you have no pattern, you have no regularity. When I say no pattern, it's over seven weeks, you can't get into a regular pattern for something. Because it's constantly changing.

So, you can't go and join the local club for whatever and meet every Wednesday night, because I've – there's a club that I go to on a Friday. I haven't been for a month, because of my shifts. The next time I can physically go is April.

While many workers were concerned about the negative impact of night work on their health, they often reported that excessive fatigue and time limitations result in them giving up on doing significant exercise, especially while doing night shifts. For many, having an exercise routine was more difficult because they are feeling more fatigue as they have aged. While most report that they try do some exercise at least on days off, this may be limited and irregular. A few were doing gym when not on night shifts.

In addition to fatigue, other issues related to the working time regime limited their capacity for establishing an ongoing exercise routine. Time compression of multiple 12 hr shifts prevent many workers from commuting to work via walking or partly walking or by cycling. The irregularity of shift work patterns and long rosters that exacerbate the irregularity of hours also limits workers' capacity to establish and maintain an exercise routine or being able to engage in team sports often provides an incentive to maintain an exercise routine. As in the case of night workers' diets and eating habits discussed above, the regime of working time and the demands and impact of night work that shape the conditions of possibility for these workers to establish an exercise routine.

4.6 Impact on health

Physical health

A wide range of physical illness are associated with shift work and night work as discussed in the literature review (in the combined union report), with particularly strong associations with cardiovascular diseases, metabolic disorders such as diabetes, and some forms of cancer.

Many of the workers were overweight or struggled to maintain a healthy weight, with several reporting a range physical ailment such as high blood pressure or various heart problems, high cholesterol and triglycerides, diabetes or pre-diabetes (five reports), prostate cancer, colitis, Crohn's disease, sleep apnoea associated with being overweight, all of which have been associated with shift and night work in the academic literature.

Many of the workers thought these conditions were at least partly related to decades of doing night work. Many were in there 40s when they started to notice reduced resilience to the adverse effects of night work.

In the academic literature these health dysfunctions are linked to metabolic dysfunction in relation to circadian rhythm misalignment as well as to the association between night work, poor diet and limited physical exercise as discussed above. While some workers reported having issues with cardiovascular problems, others were aware of the link between shift and night work and cardio-vascular disease which worried them as they get older, and as they start to see colleagues dying before or shortly after retiring.

Most older workers considered that their bodies are no longer resilient to the negative impacts of night shifts in particular, that they were becoming more exhausted and were taking longer to recovery from the effects of night work on their bodies. Some are actively planning various forms of exit strategies because of this.

I reckon around about 48, 49, I'm just thinking, it's starting to wear me down a bit. Like I say, I've done 36 years of shifts. I've always worked a shift worker. I've always done nights and days and I think I'm at the stage now where I'm thinking it's starting to affect me health-wise, as well, I suppose, because obviously I think my health has started to deteriorate a little bit from it because my body isn't getting its rest period. (Lloyd, Senior Infrastructure Controller, DB Cargo, in his 50s).

Alex (London Underground, in her 50s) intends to reduce her working hours

No. I'm – I've already got an exit strategy. My body will not tolerate this for much longer. I know that, I know that. I'm on – I'm on borrowed time. So, I've got an exit strategy and sort of like within the next 12, 18 months I will not be working full time, because my body literally cannot tolerate it.

Ryan (Incident Response, London Underground, in his 60s) realised the negative impact of night shifts on his body when he compared his health and lifestyle during a period of working compressed day shifts only:

So, for two years I was off shift, I had regular hours. I worked compressed hours, so I went in and did 10-hour days. I got up early and I got in and I went in the gym, shower, change, breakfast, start work. Because there was a big canteen there. Then I would work through and then come home late at night. I bumped into somebody I hadn't seen for a few years, and she went, 'Oh, hi, how are you? Oh!'; she said, 'You look so well. You always used to have these big bags under your eyes!' [laughs]. So, six months of being off shift and she said I looked so much healthier.

Mental health

Epidemiological studies suggest that night shift workers are at a 25–30% higher risk for mental illnesses, including depression and anxiety. There are potential cause pathways between shift work, night work and mental health through the effects on circadian rhythm misalignment and chrono-biology, sleep deprivation and impacts on family and social life. The academic research on the association between shift work and diagnosable mental illnesses is currently inconclusive (Moreno et al., 2019). Nevertheless, there is evidence that night work affects the mood of workers (Lowson et al., 2013; Chellappa, Morris and Scheer, 2020) with proposed biological pathways via circadian rhythm disturbance and via the brain-gut axis (Chellappa, 2020).

The findings of the research below indicate at least short-term impacts of night work on mood disturbances and with interactions between night work, fatigue, and social desynchronisation with mood disturbance and family relationships which could have medium term consequences for mental health or exacerbate existing mental health issues.

Two workers indicated that night work was negatively impacting on their mental health to a significant degree but did not want to discuss this further during the interview.

All the workers spoke about how nightwork and fatigue caused changes in their emotional status or mood, how they were more 'short-tempered', 'snappy', 'grumpy' and more emotionally reactive when doing night shifts, which then which took a day or two before they recovered and returned a more normal way of relating.

They reported getting short-tempered after working night shifts with partners and children due to excessive fatigue and related stress, which may be worsening for some as they get older and more tired:

I think there's a stress because the lack of rest it does tire you out. You do get restless, you do get stressful, you do get - I think from the tiredness you get a bit argumentative because it just makes you feel I can't be bothered, just leave me alone. I just want to try and get this rest period into me. But it just tires you out and I think it does make you feel a bit unwell with it sometimes, more so now (Lloyd, Senior Infrastructure Controller, DB Cargo).

I basically don't talk to anyone when I'm on nights. I'm short tempered, I'm snappy, I have no patience, I have no filter. Actually, sometimes comprehension is really, really difficult. So, the easiest way to preserve relationships and the easiest way for me to not make a mess of my life, is to just kind of like step back and do very little for that week that I'm on nights. ... So, my MO now is to do very, very little, interact with people very little, because I will probably do or say something that I would have to apologise for. It does make it really, really difficult. ... I find now that even – even after I'm rested, my tolerance for people is quite low, sort of like internally so. I mean I don't – I don't suffer from anxiety. I've always known how to manage my stress. I'm quite intentional about doing all of that, but I'm also aware that if I don't do that, in terms of my mental health, it will slide very, very quickly down the pan (Alex, London Underground).

Alex copes with her poor mood while on night shift by withdrawing from interacting with people when she is on night shifts, but which she also admits puts her at risk of social isolation with potentially more significant impacts on her mental health. She must be disciplined and actively manage her mental health, but being intentional and disciplined is also exhausting and sometimes doesn't work:

I've been taught how to spot the signs of stress in other people, so I've used that on myself to be able to spot, 'Ooh, okay, you're not going down a good route', and put things in place. But other people don't have that background, they don't necessarily have that skill, but even that is exhausting because then I have to be intentional about everything and energy's not a limitless resource, so sometimes it just doesn't work and – yeah, yeah.

Many of the workers reported experiencing psychosocial risks in relation to high or unmanageable workloads and time pressure on tasks accompanied by work-related stress, which can also lead to increased fatigue and a vulnerability to mental health problems including burn-out.

While these workers attribute their poor mood following nightshift to fatigue, which undoubtedly is an important factor, as is excessive work demands, there are also theorised biological pathways and emerging evidence for a causal basis in circadian rhythm misalignment and the brain-gut axis which govern mood.

While aging itself is associated with increased physical health issues, shiftwork and night work have direct negative impacts on physical health, with emerging evidence of negative impacts on mental health (mood disorders, anxiety and depression). This is evident in the interviews with the workers in this research. Age and psychosocial risks further exacerbate these risks. Night shift is particularly problematic and is dose dependant. Critical factors in this include the specific regimes of shiftwork and night work, the number of night shifts in a row and in total, the length of shifts, the number of rest days and their positioning in relation to night shifts. These can exacerbate or reduce the negative impacts of night work on workers' physical and mental health, and they can also be adjusted to affect the resilience of aging workers to night shift work. There needs to be roster adaptability to individual needs and particularly for older workers (40 years plus) to retain their knowledge and skills within the industry and enable them to work through to a healthy retirement in the industry they have trained for and to which they have been committed.

4.7 Impact on family life and social

Sustaining social and family relationships is critical for workers' mental health and overall well-being. Evenings and weekends are the most valued times for meaningfully engaging in these relationships. However, night work and weekend work desynchronise shift workers social lives from that of their family and social networks. Furthermore, fatigue and circadian rhythm misalignment can also negatively affect workers' mood and mental health and the quality of their engagement in social relationships.

There is significant literature supporting an association between night and weekend work and poor work-life balance. This can have negative impacts on the worker and their family, with a higher risk for partners to separate, and for poorer emotional and developmental outcomes for children and riskier behaviour in adolescents. These risks are also shaped by family circumstance e.g. number of young children, extent of quality childcare support outside the immediate family, work schedules of both parents, geographical proximity of extended family and social networks, aspects of the organisation of work and the work environment (Arlinghaus et al., 2019).

Some of the negative consequences of shiftwork and night and weekend work on social life can be ameliorated by roster flexibility and workers having control over their rosters (Arlinghaus et al., 2019), so they can time their work, at least to some extent, to enable participation in important family and social events.

This section investigates the impact of night work and weekend work on workers' family and social relationships for railways workers participating in the project.

Partners:

The majority of participants were or had been in relationships while working shift and night work as well as having dependent children. Most reported a significant impact of shift and night work their relationships with partners, with several attributing night shifts to relationship breakdown to a significant extent. Both fatigue and mood disturbance related to working night shifts and the social asynchrony of shift work contributed to strained relationships and with the non-shiftwork partner often taking most of the responsibility for organising the household. For some, this could produce a sense of disconnection from their family:

I was an angry dad, because I was always angry, because they were always noisy, and I never had any rest, and I was always tired and grumpy. So, it causes a domestic strain. Because the wife has never done shift work and can't understand. She just – I think until someone's actually done it, they really don't understand the level of fatigue. They don't understand how tired you get. You get very short; you get very snappy. Your tolerance to buffoonery like that is very, very low. Because I just think, you noisy bastards, shut up [laughs]. ... The way it impacts is she is quite an independent person, and she'll go off and do stuff. Because otherwise she's sitting at home waiting for me to come home. Then by the time I get home she's too tired, she goes to bed. So, she'll just get on with life and I'm just a part-timer in the house. I pitch up and I'm, 'Ooh, I got a day off today'. She's had no choice. She's had no choice. She just had to get on with it. (Ryan, Incident Response, London Underground).

Ryan reflects the impact of shift work and of night shifts on his mood and relationships with his children and wife, and his physical and emotional unavailability at times. In the early years of his relationship and young family he thinks that his partner had little understanding of the level of fatigue he was experiencing, and which underpinned his unavailability. She had to take on much of the domestic organisation and being quite independent would be to go to bed when she got tired rather than wait for him to get home. This left him feeling like he is 'a part-timer in the house', somewhat disconnected from the family and the related responsibilities, but helping out when he was available.

Fatigue and disconnection from family could extend into holiday periods as well, and be a source of strain in relationships

... because even if we go on holidays, it seems to be an issue. Really with my husband, I keep saying to him, when we go on holiday I just want to be left alone to recuperate. I don't want to leave the holiday villa, or whatever. I just want to stay indoors and for them to enjoy themselves, well that is still the separation. He says to me, 'Can you see what you're doing?'

But he is not seeing what I'm saying as in, I feel exhausted, I think my holiday should be – I [unclear]. I've offered for him to go with the girls, and I just stay back. I found every excuse to say, listen – because I don't want to create that friction. We've gone on holiday and I'm just trying to rest. (Sophie, Customer Service Manager, London Underground)

For several workers fatigue, mood disturbances, and irregular shift patterns contributed to breakdown of their relationships with their partners:

I'm on my second wife now. Without a doubt, it probably had an impact on my first marriage. On my second marriage it was – I knew the impact it would have, and I think – I know it sounds horrible, but I could say to my current wife, this is what to expect, I'm a shift-worker. It's – I was able to lay down the foundations straight away. ... [With the first wife] I think there was things that she wanted us to do, we couldn't do together. Things with the kids, and – bits and pieces. I think also, being younger as well, you are – you're also a bit more enthusiastic to get your career going as well. Knowing there were times I had to go into work to do overtime, to stay on, which as I've got older, I just go, 'I'm not doing it, I'm going home'. (Tony, Service Manager, London Underground).

The added pressures on younger workers in relation to working overtime to support families and to establish their careers exacerbated the impact of shift and night work on fatigue, reduced availability and consequently the relationship with his first partner. In his new partnership he has been much clearer with his new partner from the beginning about the life of a shift and night worker and has clarified expectations. Now that he is older, he refuses overtimes so he can spend more time with his family.

The first wife would struggle with understanding the shift work and fitting life in around it. [With his current wife] we've tried to work around when we do things, and make sure that when we've got rest days and we're all off together that we do stuff together. It hasn't been an issue. It definitely is straining sometimes, especially when I'm on a run of five and my wife is having to do everything on those five days. It does become – I can imagine it's a nightmare for her, especially running kids to clubs and stuff like that. ... I think she's very tolerant of the shifts, really. I think that's – she has to be really, ... (Mike, Communications Officer, British Transport Police)

With his second partner Mike tries to do things with his family when he has rest days and acknowledges that at times his partner has a significant workload in relation to domestic work and childcare.

Most reported that the success of their current relationships were grounded in having a partner who had some understanding and acceptance of the impact of shift and night work on the worker and their relationships, including accepting that they were often not physically available due to shift patterns, and when even when physically present, were not as emotionally available on and after night shifts.

Having partners who also worked shift work or work flexibly can help develop mutual understanding and expectations.

I think we've just naturally adapted. It's not something we've consciously done. We've just – it's an acceptance. I think. I think we're both quite level-headed, quite balanced sort of people.... There's weddings I've not gone to, there's events I've not missed out on. Same for my wife as she's been working and not been able to go to things. But on our relationship, I don't think it makes an impact on our relationship. It's just always been a situation we've had to deal with. [Sam, Resource Manager, Transport for Wales – partner is a nurse working shift work).

My partner is self-employed ... So, she doesn't do night shifts, but she understands flexible working because sometimes she has deadlines to meet, and then she's up really late working. So, she does a little bit of that as well. So, she does understand it. They've got to do what you need to do, and that might involve funny hours. So, she does get it in a way. (Terry, Senior Construction Manager).

Children

The workers' relationships with their children were particularly complex as for younger workers children were often a key motivation to work night shifts in the first place, both in relation to the practicalities of childcare arrangements as well as in being able to financially and materially provide the best they could for them. Workers with younger children would make significant efforts to spend time with them, taking them to school and picking them up after as well as on recovery days. However, the contingencies of recovery days often mean they are unable to do as much with children as they might want to.

She did nights and days, and we quite often had to balance childcare. We'd quite often hand over our oldest one in the car park of the hospital. as I was going home, I'd take him to nursery, go to bed for a few hours and go pick him up from nursery. Then obviously be with him, feed him, be with him in the evening until my wife would come home. It was pretty much as she came home, I would go to work

But over a weekend if I finish night, it's on a Sunday and she's working on a Sunday, it can be that I'll be – I don't technically go to bed, I go home and have a catnap on the sofa for an hour or so when I finish and get up and do things with the children because you want to spend time with your kids. You don't want to spend the whole time in bed

When they were younger, if I was to finish on a Sunday morning and I'd be off on a Sunday, I'd be at home, I'd be present, but there wouldn't be much socialising for them because I wouldn't be safe to drive. I wouldn't drive a car if I've only had an hour of sleep because it's dangerous. They do miss out on potentially where if I was someone that works on the Friday and had every Saturday, Sunday off, they potentially miss out on going out and doing things. It doesn't mean we wouldn't do things by going for a walk or going to the park or walking somewhere, or somewhere where I wouldn't have to actually drive a car somewhere dangerously. (Sam, Resource Manager, Transport for Wales).

Sam describes a highly disciplined childcare regime with his wife who also worked shift work, including exchanging young children in car parks between their shift changes. Childcare when on night shift further limited the time available for sleep.

This discipline around childcare includes make good use of the time spent taking children to school to talk to them and planning ahead to do things with children on days off when both the shift worker and children are free. Nevertheless, children often miss out on having their shift-working parent round for key events which disappoints them:

I still make sure I take them to school. Just get that time to talk to them. So, I have to plan a lot around them when I'm off. I make sure I do. I think they probably wish I didn't work shifts if I'm honest. There will be stuff like tonight, my son plays for a football team. It's a fundraising night. ... I can't go. My son is a bit upset that I can't go, sort of thing. So, you do have to miss some things, unfortunately, like that. (Mike, Communications Officer, British Transport Police.

Having younger children can also affect the capacity of night shift workers to get sleep during the day especially with children being home on weekends, which would exacerbate their mood disturbance and potentially affect children who then need to be quiet because their father is trying to sleep. Ryan reports that both himself and his children remember him as 'an angry dad' when they were younger:

I was an angry dad, because I was always angry, because they were always noisy and I never had any rest and I was always tired and grumpy. So, it causes a domestic strain. ... I think the trouble is the disturbance to sleep, my children say they just remember me being an angry dad when they were young. Because I was always shouting out for being noisy. (Ryan, Incident Response, London Underground.

The difficulties with being not being emotionally and physically available enough due to fatigue and shift work irregularity is perhaps heightened for female shift workers, given social norms about women and motherhood and can leave some feeling very disconnected from their families when primary relationships become more developed with the non-shift-working parent

I think now what I see mainly, it's like the family is getting on without me. That's the reality dawning on me more. ... However, I still try to wriggle myself into whatever is happening at home, but I find it's not that I'm – it doesn't bother me in a negative sense, but I find that there is a connection there with the girls and their dad. ... but it's like, there's a relationship that I'm kind of outside the circle of because I'm not there most of the time. What I do, I make my connection mainly by phone. I'm not going to be there until they go to bed, and he is there with them and they can relate to it. Oh, we watched this movie, and if I have to join the conversation it's like trying to explain the movie to me first [laughs]. Oh dear, it's hard. (Sophie, Customer Service Manager, London Underground).

Sophie contrasts this situation with a short six-month period when she was seconded to another role and just did day shifts giving her the energy and time to develop a more fulfilling family life and social network as well as time to develop her own personal interests.

I think the best bit of it for me was that I was able to sit at home and have dinner with the girls, with the family. Able to have a conversation, able to plan things, hear some of the – careless gossips that I have missed, things like that. I was happy to be a part of that. Also, it improved my relationship with my husband quite a lot, because we could spend the evenings together alone, we could drink together and do things together. ... That was a nice feeling. ... I was able to be there for my girls because it's like you own your

time. If they needed me to be somewhere with them, was off school, I was able to do that....

We even invited a few people over, that possibly we could build relationships with, because we have people waiting to be invited, and things like that. I have to sometimes turn invitations down because I can't reciprocate. I don't want to start something and I'm on the receiving end, I just keep taking, taking. That makes me feel very, very uncomfortable as well. I was able to do that. I started a patch in my garden, I really liked that. I grew something.

Extended family and friends

Shift work and night work that includes weekend work negatively impacts on the capacity of workers to regularly engage in social life with extended family and friends. Unlike day worker who can socialise in the evenings after work, nightshift workers are out of sync with normal life as well as too fatigued to be able to engage with people, with excessive weekend working further isolating workers from their social networks.

My circle of friends are very small because there's only so many times you can turn down an invitation before people stop inviting you. (Alex, London Underground).

That, across the years, affects friendships, it affects marriages. Your friends get fed-up, keeping changing all their arrangements to work around your shift pattern. So, they just go out and they say, 'Well, if you can make it, you can make it. If you can't, you can't'. So, you end up missing out a huge amount of a period of time. I'm lucky that I've got some good friends left who still accommodate the fact that I'm on shift. They keep telling me I should just hang it up and retire [laughs]. But, yeah, it is an enormous impact on your life. It's an enormous impact on your health. (Ryan, Incident Response, London Underground).

Maintaining a supportive social network depends upon finding friends who understand the difficulties for shift workers and who are willing to accommodate the needs of shift worker over the long term and to plan well ahead of time. This is more likely to be found amongst work colleagues or other people who also do shiftwork.

I have a big, big circle of friends on the railway. You know, railway families are very extensive, and we become very close, and we have a very good social network within my team. We arrange periodically always to meet up for a drink, normally traditionally Friday, and we go out for coffees, and we go out for lunch (Terry, Senior Construction Manager).

Nevertheless, with the very limited social time available to shift workers there can be tensions between wanting to spend as much time with family as well as trying to see friends

It can be difficult. I've got a few friends that work with me, so it makes it a bit easier. We have close friends, but he's a lorry driver so he does shift work. So, getting to meet him and going out and playing snooker or going to see him we have to plan things and then make sure that - so you plan more I think. Because I don't get a lot - I only get two out of five weekends off then that's when I want to be around my partner and family. But then we also want to be with our friends. So we'll do a compromise and we try to - you can't do it

without planning it. You have to plan it. (Lloyd, Senior Infrastructure Controller, DB Cargo)

Friendship networks often depend upon forms of reciprocity, and the women seem particularly sensitive to this. One reason for having small social networks, which are often more centred on extended family, is the problem of not being able to reciprocate if invited to social events.

I have to sometimes turn invitations down because I can't reciprocate. I don't want to start something and I'm on the receiving end, I just keep taking, taking. That makes me feel very, very uncomfortable as well (Sophie, Customer Service Manager, London Underground).

For many of these older workers, fatigue is a major problem limiting the opportunities to maintain friendships, with several commenting that they were too tired to be able to engage with family and friends for a few days following a run of night shifts.

Summary

All workers reported that fatigue coupled with shift scheduling of night work and weekend work desynchronised their lives in relation to valued social time with family and friends limiting their opportunities to engage meaningfully with family and friends. This could be a significant factor in the breakdown of some relationships and contribute to strain at times in many relationships. Those older workers in long-term relationships with partners who had some understanding and acceptance of the impact of night work on workers fared better.

For both male and female workers there was significant conflict around parenting and work since night work enabled the practicalities of childcare as well as enabling the financial and material provision of families, yet the shift scheduling also reduced the amount of social time available on weekends and their fatigue diminished the quality of their relationships with partners and children when on night shifts and during recovery rest days. This often resulted in workers with young families feeling conflicted about work and family, with young children at times beginning disappointed with the lack of availability of the shift working parent.

Workers wider social network of friends and extended family was also negatively impacted by shift scheduling and fatigue when on night shifts. While some had friends who would try to schedule events around their rosters, most still ended up missing out on significant gatherings unless they could book annual leave (which may or may not occur) These limitations could diminish their sense of connection to partners, extended families and friends. This could potentially affect worker mental health in the medium and long term or exacerbate existing mental health problems.

4.8 Future plans and night work

The majority of workers in their 50s knew about the negative long-term impact of night work and shift work on health. Many describe older colleagues who retired only to die of heart diseases soon after. They were very worried about the negative impact that nightshifts were having on their bodies with an increased possibility of serious diseases if they continue. This was often expressed as *'my body just can't keep going doing night shifts'*. Most felt they could not keep working nightshifts until retirement.

However, for many with specialised skill sets, moving to an alternative industry seemed difficult. Some were exploring ways to move into another role or to move into other areas of the industry

that don't require shift work, with others aiming to reduce their working hours. Some older workers were considering early retirement.

5. Conclusion

Night work and weekend work is a requirement for most rail workers. Rostered 'cover' weeks and overtime can significantly increase the amount of night work. Most TSSA workers do significant amounts of nightshifts and weekend work.

All workers found night work to be particularly fatiguing compared to other shifts, with those on long runs of seven nights and then starting an early or later shift the following day the worst affected by excessive fatigue. The majority reported only getting about four to six hours of poor-quality sleep split across two periods during the day when on night shifts, with difficulties sleeping during the day. This leads to sleep deprivation which builds up the longer the runs of night shifts that workers do. Older workers reported that their sleep problems, fatigue and recovery time related to night shifts had become worse as they had aged with many concerned that their bodies could not continue for much longer.

These findings of sleep quality and duration are in alignment with the literature on circadian rhythm and night work which identifies problems with poor quality sleep of short duration (four to six hours, and insomnia (Moreno et al., 2019; Wyse et al., 2017; Yong, Li and Calvert, 2017; Kecklund and Axelsson, 2016; Åkerstedt and Wright, 2009)

Excessive fatigue means they often have little energy during the day of a night shift for anything except some basic household tasks or childcare. Many reported that they suffer from difficulties in clear thinking after night shifts and during recovery.

Sleepiness, impaired cognition and performance are widely reported for shift workers in a range of industries, with performance declining further with extended working hours and shorter sleep duration, with the first night shift usually the worst. Cognitive function may either improve or deteriorate depending on a range of other factors (Boivin, Boudreau and Kosmadopoulos, 2022).

Fatigue and circadian rhythm misalignment can affect their ability to be awake and alert during the latter part of a night shift, with many resorting to eating high carb and sugary food and drinking caffeine to stay awake after 03:00 to 04:00.

The problems with sleep (short duration, problems staying asleep, poor-quality sleep) and associated fatigue related to night work had become worse as they got older, starting in the 40s. As workers age their recovery time has also become longer. This reflects the academic literature on shift work, night work and aging indicating that older workers have less tolerance for shift work and more sleep problems than younger workers. However, it is the specific regimes of rosters, the numbers of night shifts in a row and in total and the recovery time following nights shifts, length of shifts, etc that are critical. There needs to be much more accommodation in rosters and in fatigue management to the needs of older shift workers to retain these workers considerable knowledge and experience in the industry. This could be achieved by minimising the amount of night shifts, ensuring sufficient time for recovery from fatigue and accumulated sleep debt and by following or exceeding the minimum guidelines from the HSE and other advisory bodies such as the ORR, regarding these issues.

Recovery from the fatigue associated with night shifts and re-adjusting their body to another change of shift generally takes at least two days (or longer depending upon how the number of night shifts worked in a row), for most workers. This corresponds to HSE guidelines

recommending a minimum 2 nights of sleep between shift changes and 2-3 recovery days following 2-3 night shifts. During recovery time the workers report being exhausted and unable to function normally limiting their capacity to be available for activities, families or social life or to participate in normal activities. Rostered recovery time allocations varied across job areas and within rosters and could be 1 to 7 days. Rest days are on the workers' own time.

Long runs of night shifts (seven in a row) were reported to be the most exhausting probably as a result of the accumulative effects of sleep deprivation and the re-alignment of circadian rhythm. The demand for working long runs of night shifts in rosters should be re-assessed, along with the adequacy of recovery time following longer runs. It is concerning that in some cases (examples were found at Scot Rail and London Underground) the HSE guidelines concerning the rostering of night work and rest days seem not to be followed.

Circadian misalignment is likely to remain an issue especially where runs of night shifts are short, for example runs of three, four or five nights were common amongst the workers. These are fast rotating shifts. Circadian rhythm re-alignment generally takes longer than this, although some related biological processes (e.g. cortisol levels, etc) do not seem to re-align at all. Fast rotation of shifts (about three nights) do minimise disruption of the internal body clock since there is little to no adaptation. On slow rotating shifts, e.g. five or more, circadian re-alignment is more likely. Individual chronotypes are likely to be significant as some people re-align more quickly, while others many fail to align at all. Slow rotations of shifts are not recommended as the body remains in a constant state of trying to re-align to different shift patterns (HSE, 2006).

The TSSA workers were doing 35 per week average over the year. However, night work, especially in relation to rotating shifts, demands much more recovery time compared to those workers who work a regular day work. This recovery time needed is related to biological processes connected to circadian rhythm and sleep deprivation that do not occur in day workers. Recovery time from work for night workers is much longer than that of day workers. It is also likely to be exacerbated by the prevalent psychosocial risks (especially excessive work demands) and the needs for overtime in the face of insufficient staff to keep the railways running. Recovery time is not available for enriching personal, family or social life. Yet the worker is not compensated for this. This puts night workers at considerable disadvantage compared to day worker who don't bear this burden.

Large amount of overtime is also worked in the railways with workers identifying that 'the railways run on overtime', largely due to reductions in staffing over recent years. Motivation for doing overtime for younger workers were largely related to extra money for holidays, to buy houses and for supporting families, with a key advantage of working night shifts being the capacity to managed childcare.

This changed for older workers with common reasons being to support colleagues getting time off and to support managers having difficulties finding shift cover. However, all older workers had reduced or eliminated working overtime as it was too exhausting on top of their normal roster. The maximum length of the working week permitted in the railways is 60hrs per week, which gives significant scope for working overtime, with night shifts likely to be those most available. When overtime is combined with the increased demand for night work, this can further exacerbate fatigue.

The most reported and significant negative effect of night work on workers was fatigue. This become worse as they aged. Excessive fatigue then has negative feedback loops on diet and

exercise for most workers, with social and appetite misalignment also impacting on diet and exercise. Some workers reported being overweight or struggling to maintain a healthy weight and had struggles to establishing and maintaining a regular exercise routine, despite having some understanding of the importance of a healthy diet and exercise. Workers reported a range of physical health issues including cardio-vascular problems, diabetes and pre-diabetes and prostate cancer and insomnia. They were very concerned about the impact of night work on their health in the medium and long term.

Managerial recommendations for workers to try harder to have a good diet and to exercise fail to acknowledge that the fatigue and unsocial hours associated with regimes of nightwork was a key driver of poor diet and insufficient exercise.

While a few workers reported significant negative impacts on their mental health, more generally fatigue produced mood disturbance during night shifts and recovery time, with short-temperedness universally reported. For some this can have negative impacts on family and work relations, as well as potentially affecting self-esteem and is a potential vulnerability for exacerbating existing mental health issues. Negative impacts on family and social life were also associated with social desynchronisation. Since supportive families and social networks are central to workers' well-being, it is important to ameliorate these potential negative impacts of nightwork on these relationships, such as providing workers with genuine control over their rosters and ability to book time off work.

Night shifts facilitated childcare arrangements for those with dependent children, and was especially important where they had few alternatives, such as not having extended family or close friends nearby. This was a key motivation to do night shifts for these workers, in the context of limited affordable childcare with poor availability for shift workers in the UK. However, night work and weekend work could also reduce the amount of time workers could spend with children and affected the quality of these relationships. In some situations, this could have a negative impact on children as well as the night shift worker. These risks are well-established in the academic literature and include higher risks for partner separation, impacts on children, and reduce sense of connection to social and community life (Arlinghaus et al., 2019).

Several psychosocial risks within the railway work environment were identified – in particular work intensification and extensification (overtime), as well as problems with managerial support in some areas, including at times attitudes to worker health and safety, all of which can contribute to work-related stress, mental and physical health and to fatigue. High levels of overtime and work-intensification were widely reported by workers, and largely due to insufficient staff, and experienced staff in particular, due to restructures, redundancies, recruitment freezes and recruitment difficulties. This is likely to contribute significantly to fatigue and work-related stress experienced by workers. Insufficient staff reduces managers' flexibility in relation to roster changes and booking leave. Psychosocial risks are covered under UK health and safety legislation which requires organisations to assess and prevent or minimise them and are within the remit of the railway companies and managers to address.

Management approaches to roster flexibility can have a significant impact on workers' wellbeing by ameliorating some of the negative impacts of night work and shift work on workers and their families (Arlinghaus et al., 2019). Reports in this research that managers in some areas were prioritising business needs over workers' well-being and pressuring workers to do overtime are very concerning. To the extent that this is accompanied by poor managerial attitudes and

actions concerning worker fatigue and fatigue assessment, together with workers limited knowledge and confidence to raise issues about fatigue, this poses a considerable risk to workers in relation to ameliorating the negative impacts of nightwork.

6. Recommendations

5.1 *Rosters, recovery time, and annual leave*

Fatigue from sleep deprivation and circadian rhythm disturbances are strongly associated with night work. Unions need to continue to be able to negotiate rosters, with input from workers locally. Long runs of night shifts of seven nights, ie long rotation shifts, are particularly exhausting for workers and these need to be reduced to shorter runs of night work, as well as ensuring that the number of recovery days are sufficient. HSE guidelines should be a starting point.

The recovery time following night shifts should be reviewed. It is concerning that recovery days include the day of the morning that a run of night shifts finishes, when the worker is exhausted. There were concerning reports of workers finishing seven nights in a row then starting back at work the following day on a different shift, commonly earlies. This is in contravention of HSE guidance. Workers reported needing a minimum of two days after finishing night shifts before they feel somewhat recovered and since the effects of sleep deprivation and circadian rhythm misalignment are cumulative, the recovery time should align with the number of days in runs of night shifts and be sufficient to ensure recovery before shift changes.

There is a case to argue that employers should be making some contribution to recovery time given that this significantly disadvantages the night workers time for personal, family and social life compared to normal day workers. Since night shift workers who are doing a lot of night shifts and weekends, with some using annual leave for recovery time or to book doctors and related appointments, additional annual leave needs to be considered for these workers.

5.2 *Older workers*

Older workers (from 40 onwards) report they are increasingly struggling with night work with the impacts of fatigue as they have aged. There is academic literature indicating that older workers have reduced tolerance for shift work and experience increased problems with sleep as they age. There needs to be more recognition of the impact of various regimes of shift and night work on older workers and adjustments made to minimise these effects to enable older workers who have many years of accumulated knowledge and experience to remain in the workforce until retirement. Increased recovery time, more flexibility in enabling individual rosters, additional annual leave for recovery and to be able to book medical appointments, etc., options to temporarily reduce night work, and attending to their occupational health needs might enable these workers to continue to work until retirement and remain healthy.

5.3 *Managing fatigue on the job: meal breaks and naps*

Many workers reported not being able to take meal breaks during shifts which is likely to increase their fatigue. Work breaks are particularly important in safety critical and demanding work as they reduce the risks of accidents (Folkard and Tucker, 2003) and are particularly important in reducing fatigue for those doing 12-hour shifts. There needs to be a review of staffing to ensure that workers can take their permitted meal breaks. Furthermore, given the safety critical nature of their work and the risks of excessive fatigue to the commute home there

needs to be consideration of HSE (2006) guidelines recommending workers on night shifts, especially on 12 hr shifts, to have a 40-minute break during working hours to include a 20 minute nap plus time for recovery from sleep inertia. This would need to be in suitable facilities, be carefully monitored and remain the choice of workers. This may be especially beneficial to older workers.

5.4 Overtime

Significant amounts of overtime are being worked in the rail industry which frequently increases the number of night shifts worked as well. Together these will increase worker fatigue and potential adverse effects on workers' health and their family and social support. While younger workers often want overtime for financial reasons, there is evidence of a negative cumulative effect of night work on worker health, so overtime involving night work should be minimised and workers educated about the risks to health. Ensuring sufficient staff would minimise overtime and this requires workforce planning. The issue of financial incentives for doing overtime could be partly addressed by inflation- or above inflation- pay rises.

5.5 12-hour shifts lengths

Workers generally report preferring to work 12-hour shifts compared to shorter shifts as this give them more consolidated time away from work for a better work-life balance. Nevertheless, some of this time is still used as recovery time.

However, the impact of 12-hour shifts impact on recovery time is uncertain. Furthermore, how 12-hour shifts affect fatigue at the end of a shift is likely to be shaped by the nature of the job, work environment including the demands of the job and breaks, and the number of shifts worked. There is good evidence that the risks of accidents increase substantially with 12-hour shifts compared to 8 hr shifts (Folkard and Tucker, 2003) with emerging evidence based upon objective measures of performance that fatigue increase across three days of 12 hr shifts (Thompson, 2019). HSE (2006) recommends avoiding 12-hour shifts especially in safety critical or demanding work, recommending no more than two to three night shifts of 12hrs, followed by 2-3 days for recovery and avoiding overtime (Health and Safety Executive (HSE, 2006). The ORR (2024) recommends limiting night shifts to 8-10 hours. Twelve-hour shifts may put workers with long commutes at further risk of fatigue-associated accidents.

5.6 Ameliorating the impacts of night work and shift work on workers, their family and communities

There are generally significant negative impacts of night work and weekend work on workers personal, family and social life and their sense of connection. Both fatigue and social desynchronisation play a role in this. Fatigue is also reported by these workers to result in mood disturbances especially being short-tempered and irritable which can compound the negative impacts of night work on both their relationships and workers' self-esteem. This could exacerbate existing mental health issues. The negative consequences of social desynchronisation for these workers can be ameliorated by workers having more flexibility and genuine control over their individual rosters to accommodate their need for some work-life balance. This is particularly important for those with young children. With some workers reporting taking annual leave as recovery days there is a case for night workers to have additional leave days. Managers in general need to be more supportive of workers' roster needs. Nightwork and weekend work needs to be minimised more generally, through additional recovery days, annual leave and ensuring sufficient workforce to enable this.

5.7 *Fatigue assessments*

Fatigue assessment by managers was reported by some workers to be superficial and then not necessarily acted upon in a reasonable manner. Workers are not necessarily knowledgeable about fatigue assessment processes nor confident in reporting fatigue. TSSA could support education of workers concerning fatigue and fatigue assessment and seek additional ways to ensure that fatigue assessment is more robust.

5.8 *Psychosocial risks*

Significant psychosocial risks in the railways were work intensification and extensification (overtime), poor managerial support in some areas and instance of poor managerial attitudes to worker health and safety. These are likely to lead to work-related stress and to further exacerbate worker fatigue. Key recommendations related to psychosocial risk are:

- That TSSA conduct a H&S risk assessment of psychosocial risks for TSSA rail workers and work with management to prevent or control the identified risks, as required under H&S legislation, with particular attention to the HSE Management Standards (Health and Safety Executive (HSE), 2017). Currently psychosocial risks are a priority area for the UK HSE.
- Work intensification and extensification due to insufficient staff needs to be addressed through working with management on workforce planning to improve the situation. Where this is related to other factors in the work environment these need to be addressed by managers appropriately.
- Poor managerial support with roster changes can be addressed by policies that provide greater genuine worker control over rosters and requiring managers negotiate with workers locally concerning their rosters, including the use of individual rosters, and for managers to be flexible in granting leave in ways that prioritise workers' health and family and social relationships. This would be facilitated by less overtime and sufficient staff to fill rosters and to cover leave.
- Poor managerial attitudes to health and safety - senior managers are primarily responsible for the priorities of middle and lower-level managers in relation to balancing business operations with health and safety concerns and the overall safety culture. Workers' perceptions of managerial attitudes to health and safety should be part of a psycho-social health and safety risk assessment and may help to enlist senior managers in ensuring a strong safety culture is developed concerning psychosocial risks and worker fatigue.

7. References

- Åkerstedt, T. and Wright, K. P. (2009) Sleep Loss and Fatigue in Shift Work and Shift Work Disorder, *Sleep Medicine Clinics*, Elsevier, 4(2), pp. 257–271.
- Arlinghaus, A., Bohle, P., Iskra-Golec, I., Jansen, N., Jay, S. and Rotenberg, L. (2019) Working Time Society consensus statements: Evidence-based effects of shift work and non-standard working hours on workers, family and community, *Industrial Health*, 57(2), pp. 184–200.
- Atkinson, G., Fullick, S., Grindley, C. and Maclaren, D. (2008) Exercise, Energy Balance and the Shift Worker, *Sports Medicine*, 38(8), pp. 671–685.
- Axelsson, J., Kecklund, G., Åkerstedt, T., Donofrio, P., Lekander, M. and Ingre, M. (2008) Sleepiness and Performance in Response to Repeated Sleep Restriction and Subsequent Recovery during Semi-Laboratory Conditions, *Chronobiology International*, 25(2–3), pp. 297–308.
- Balkin, T. J., Rupp, T., Picchioni, D. and Wesensten, N. J. (2008) Sleep loss and sleepiness: current issues, *Chest*, Elsevier, 134(3), pp. 653–660.
- Blok, M. and De Looze, M. (2011) What is the evidence for less shift work tolerance in older workers?, *Ergonomics*, Taylor & Francis, 54(3), pp. 221–232.
- Boivin, D. B., Boudreau, P. and Kosmadopoulos, A. (2022) Disturbance of the Circadian System in Shift Work and Its Health Impact, *Journal of Biological Rhythms*, SAGE Publications Inc, 37(1), pp. 3–28.
- Chellappa, S. L. (2020) Circadian misalignment: A biological basis for mood vulnerability in shift work, *European Journal of Neuroscience*, 52(8), pp. 3846–3850.
- Chellappa, S. L., Morris, C. J. and Scheer, F. A. J. L. (2020) Circadian misalignment increases mood vulnerability in simulated shift work, *Scientific Reports*, Nature Publishing Group, 10(1), p. 18614.
- Dijk, D.-J., Duffy, J. F., Riel, E., Shanahan, T. L. and Czeisler, C. A. (1999) Ageing and the circadian and homeostatic regulation of human sleep during forced desynchrony of rest, melatonin and temperature rhythms, *The Journal of Physiology*, Wiley, 516(Pt 2), p. 611.
- Fischer, F. M., Silva-Costa, A., Griep, R. H., Smolensky, M. H., Bohle, P. and Rotenberg, L. (2019) Working Time Society consensus statements: Psychosocial stressors relevant to the health and wellbeing of night and shift workers, *Industrial Health*, 57(2, SI), pp. 175–183.
- Flo, E., Pallesen, S., Magerøy, N., Moen, B. E., Grønli, J., Hilde Nordhus, I. and Bjorvatn, B. (2012) Shift work disorder in nurses—Assessment, prevalence and related health problems, *PloS One*, Public Library of Science San Francisco, USA, 7(4), p. e33981.
- Folkard, S. and Tucker, P. (2003) Shift work, safety and productivity, *Occupational Medicine*, 53(2), pp. 95–101.
- Gurubhagavatula, I., Barger, L. K., Barnes, C. M., Basner, M., Boivin, D. B., Dawson, D., Drake, C. L., Flynn-Evans, E. E., Mysliwiec, V., Patterson, P. D., Reid, K. J., Samuels, C., Shattuck, N. L., Kazmi, U., Carandang, G., Heald, J. L. and Van Dongen, H. P. A. (2021) Guiding principles for determining work shift duration and addressing the effects of work shift duration on

performance, safety, and health: guidance from the American Academy of Sleep Medicine and the Sleep Research Society, *Journal of Clinical Sleep Medicine*, 17(11), pp. 2283–2306.

Health and Safety Executive (HSE) (2006) *Managing shiftwork: Health and safety guidance*, Publisher with assets.publishing.service.gov.uk, [online] Available at: <https://www.hse.gov.uk/pubns/books/hsg256.htm> (Accessed 3 June 2024).

Health and Safety Executive (HSE) (2017) *Tackling work-related stress using the Management Standards approach. A step-by-step workbook.*, UK, The Stationery Office., [online] Available at: <https://www.hse.gov.uk/pubns/wbk01.htm> (Accessed 3 June 2024).

Kecklund, G. and Axelsson, J. (2016) Health consequences of shift work and insufficient sleep, *BMJ*, British Medical Journal Publishing Group, 355, p. i5210.

Lowson, E., Middleton, B., Arber, S. and Skene, D. J. (2013) Effects of night work on sleep, cortisol and mood of female nurses, their husbands and children, *Sleep and Biological Rhythms*, 11(1), pp. 7–13.

Moreno, C. R. C., Marqueze, E. C., Sargent, C., WRIGHT Jr, K. P., Ferguson, S. A. and Tucker, P. (2019) Working Time Society consensus statements: Evidence-based effects of shift work on physical and mental health, *Industrial Health*, 57(2), pp. 139–157.

Office of Rail and Road, (2024). *Managing rail staff fatigue*. Available at <https://www.orr.gov.uk/managing-rail-staff-fatigue> . Accessed 15th August, 2024.

Ritonja, J., Aronson, K. J., Matthews, R. W., Boivin, D. B. and Kantermann, T. (2019) Working Time Society consensus statements: Individual differences in shift work tolerance and recommendations for research and practice, *Industrial Health*, 57(2), pp. 201–212.

Thompson, B. J. (2019) Does work-induced fatigue accumulate across three compressed 12 hour shifts in hospital nurses and aides?, *PLOS ONE*, Public Library of Science, 14(2), p. e0211715.

Torquati, L., Mielke, G. I., Brown, W. J., Burton, N. W. and Kolbe-Alexander, T. L. (2019) Shift Work and Poor Mental Health: A Meta-Analysis of Longitudinal Studies, *AMERICAN JOURNAL OF PUBLIC HEALTH*, 109(11), pp. E13–E20.

Tucker, P., Folkard, S., Ansiau, D. and Marquié, J. (2011) The effects of age and shiftwork on perceived sleep problems: results from the VISAT combined longitudinal and cross-sectional study, *Journal of Occupational and Environmental Medicine*, LWW, 53(7), pp. 794–798.

Wyse, C. A., Celis Morales, C. A., Graham, N., Fan, Y., Ward, J., Curtis, A. M., Mackay, D., Smith, D. J., Bailey, M. E. S., Biello, S., Gill, J. M. R. and Pell, J. P. (2017) Adverse metabolic and mental health outcomes associated with shiftwork in a population-based study of 277,168 workers in UK biobank*, *Annals of Medicine*, Taylor & Francis, 49(5), pp. 411–420.

Yong, L. C., Li, J. and Calvert, G. M. (2017) Sleep-related problems in the US working population: prevalence and association with shiftwork status, *Occupational and Environmental Medicine*, BMJ Publishing Group Ltd, 74(2), pp. 93–104.