DISRUPTIVE SCHEDULES

appropriate FRM to night/late arrivals duties

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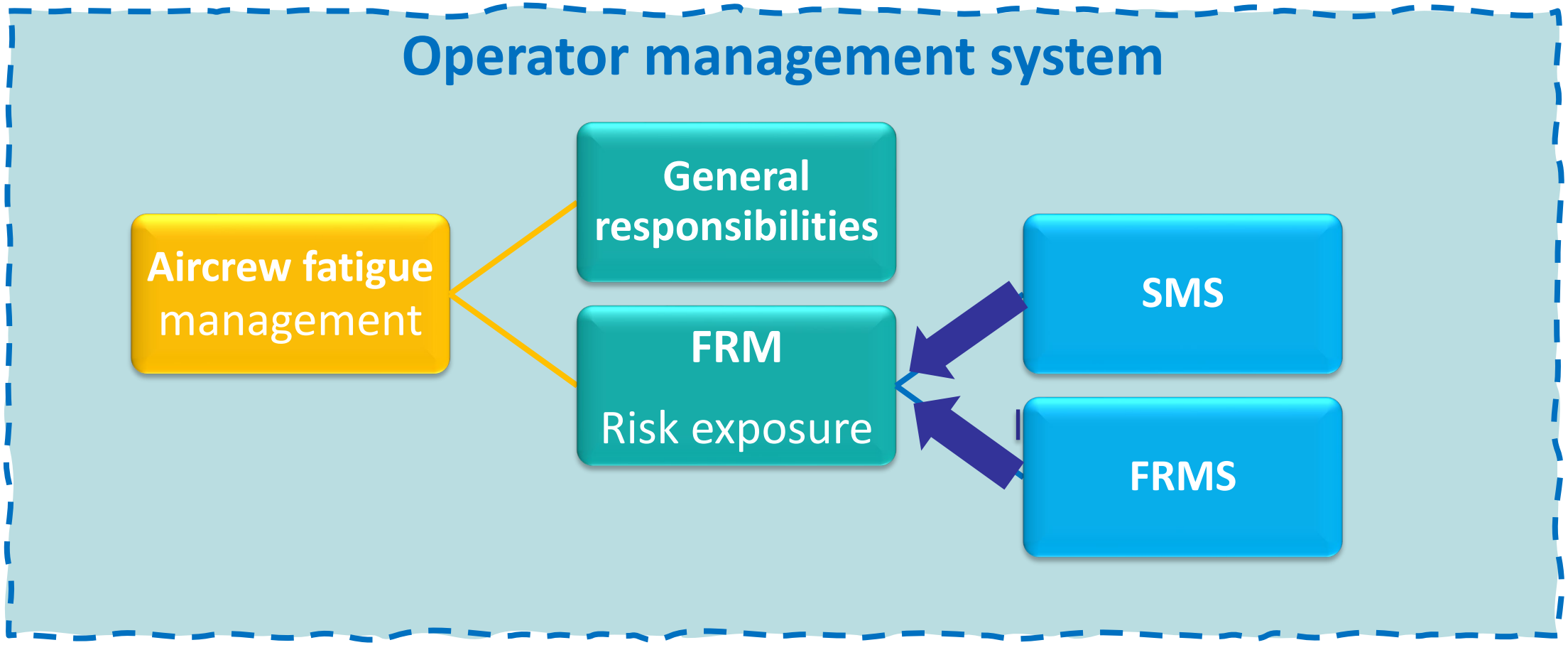
Fatigue management under Regulation (EU) 965/2012



General responsibilities for fatigue management

- Include (among other things):
  - pairing and rostering activities
  - management of non-roster induced fatigue
  - fatigue management training of personnel
  - operators responsibilities as per ORO.FTL.110
- Based on:
  - scientific principles
  - the principle of shared responsibility for fatigue management

Fatigue Risk Management (FRM)

- Fatigue Risk Management (FRM)
  - adds fatigue risks as an additional dimension to fatigue management
  - accounts for operator's specific operational environment and risk exposure
  - involves two systemic approaches:
    - SMS – prescriptive
    - FRMS – performance-based

Safety Management System (SMS)

- Safety Management System (SMS)
  - mandatory; defined in ORO.GEN.200
  - may be used to deal with fatigue risks that do not require FRMS (fatigue is one of the possible safety hazards)
  - collect data-driven evidence only if a fatigue issue has been identified
  - uses reactive tools to identify fatigue hazards: fatigue reports, ASR, MOR, CSR made via existing channels for reporting safety concerns

Fatigue Risk Management System (FRMS)

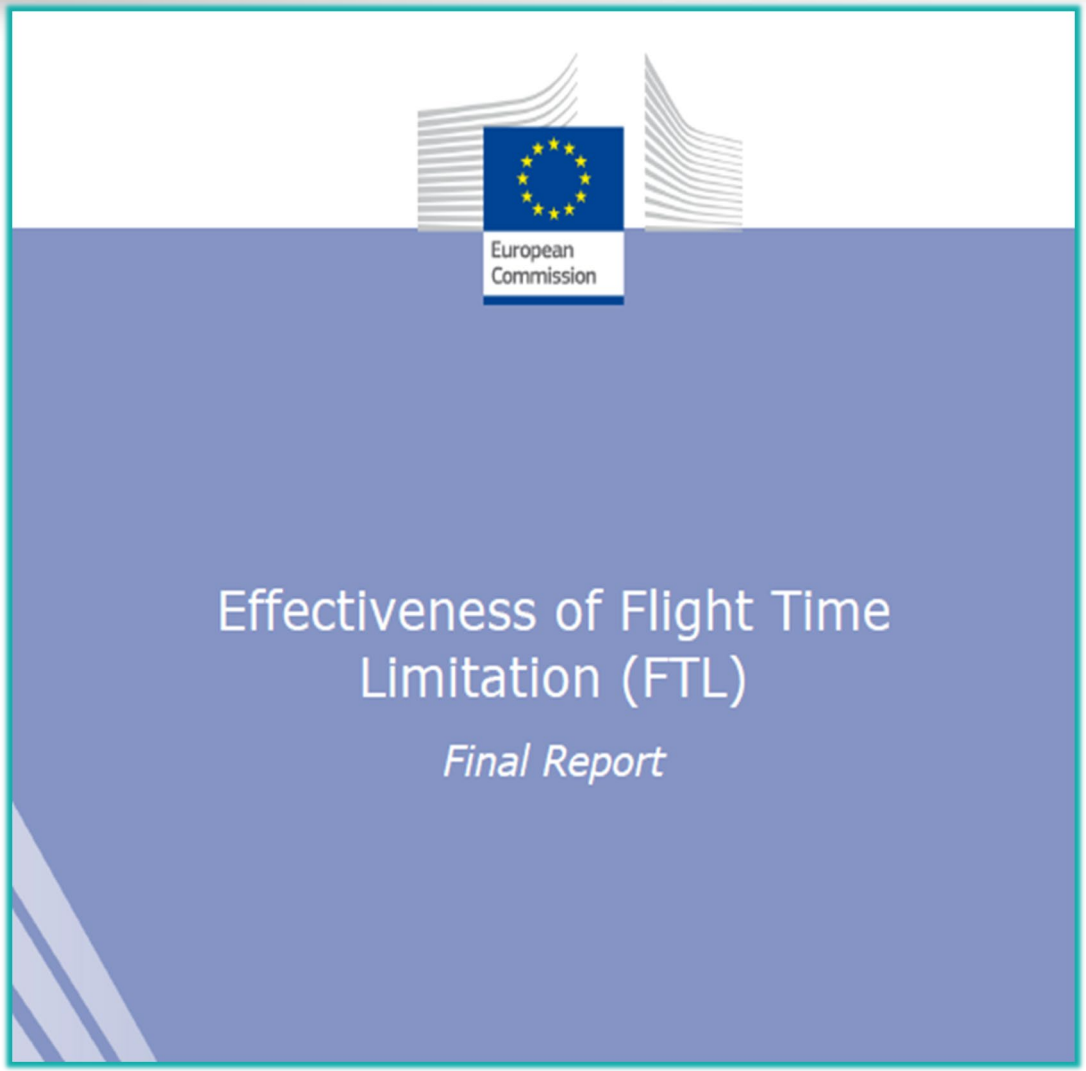
- Fatigue Risk Management System (FRMS)
  - defined in ORO.FTL.120
  - is a separate system from an SMS
  - uses the entire toolbox of reactive, proactive and predictive tools, prior to conducting operations outside of the prescriptive limits
  - mandatory in two cases: crew in X-state of acclimatisation on long duties and planned reduced rest; otherwise - optional
  - makes sense when dealing with deviations/variations from prescriptive requirements or where there are legal gaps

appropriate FRM: the concept

Not new

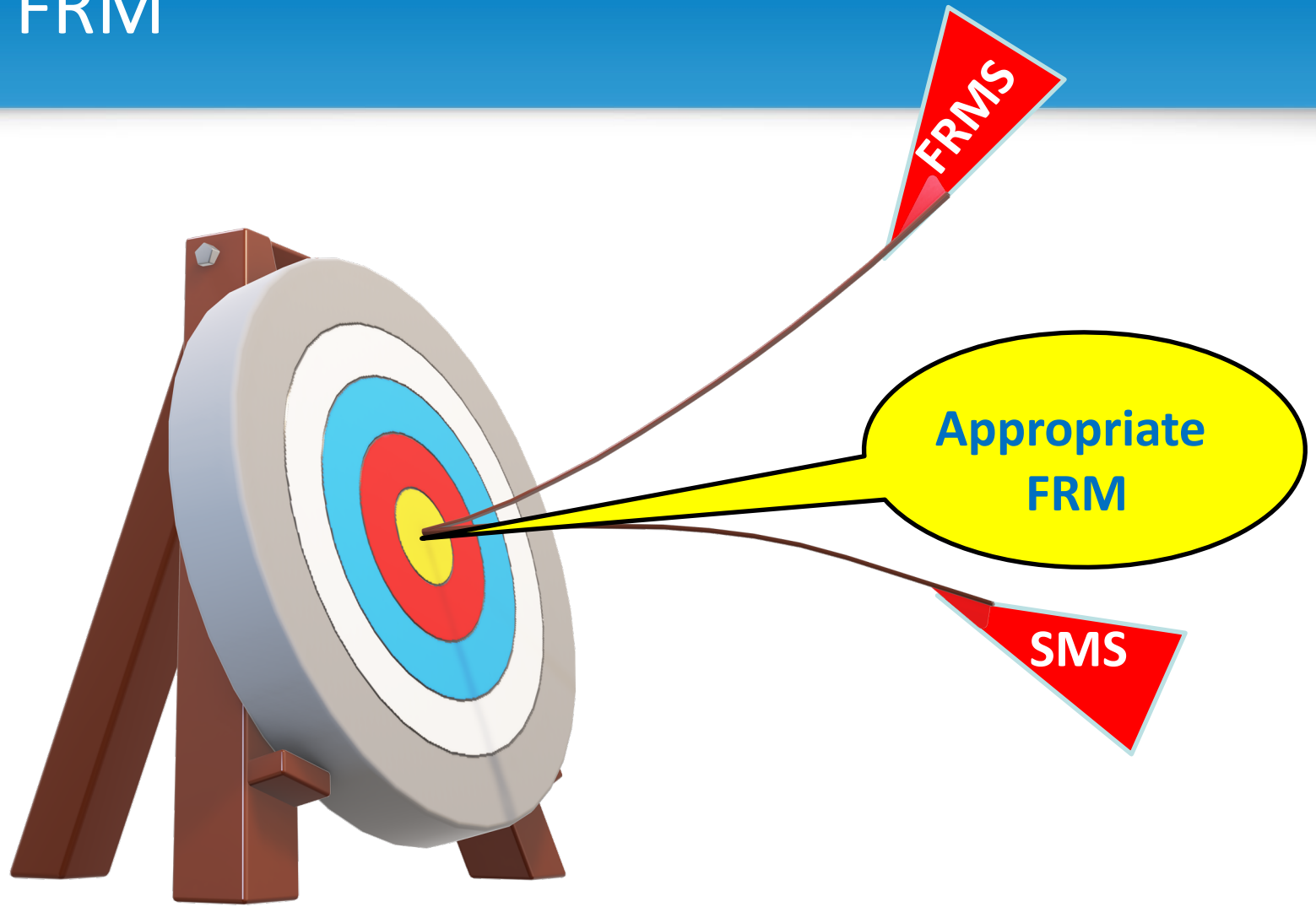
- already existed in CS FTL.1.205 for night duties > 10h
- now, expanded to include all night /late arrival duties

appropriate FRM: the Decision



- Decision 2023/023/R follows up on the scientific evaluation of FTL effectiveness, 2018 & 2019 (FTL#1)
- CS FTL.1.205 differentiates three subtypes of night FDPs:
  - start time between 02:00 and 04:59
  - end time between 02:00 and 05:59 and start time at 01:59 or earlier
  - end time at 06:00 or later and a start time at 01:59 or earlier

appropriate FRM



appropriate FRM: hazard identification (operator)

- Using the hazard ID process of their SMS or FRMS, the operator starts by analyzing its roster, including night duties and late arrivals, as well as combinations involving such duties
- Using reactive, proactive and predictive tools, night duties are ranked based on start/end times and probability of occurrence of high levels of fatigue at TOD
- Any tool assesses fatigue from a different perspective
- The more data the better

appropriate FRM: hazard identification (aircrew)

- Aircrew can use the *Prior Sleep Wake Model (PSWM)*
- It is a basic predictive fatigue hazard identification tool
- It needs:
  - min and max thresholds for sleep and time awake, respectively
  - clear procedures for reporting when outside thresholds
- PSWM is not the only tool in appropriate FRM

appropriate FRM: risk assessment (operator)

- Once the hazard is identified, the *severity* and *likelihood* of risks it poses are assessed and a decision is made as to whether or not those risks need to be mitigated
- Operators can use ICAO *risk matrix*, but need to customize it according to their particular operations environment

Fatigue Level (KSS)	ICAO Risk Severity Category
1–3 (Very alert)	Negligible
4–5 (Alert but relaxed)	Minor
6–7 (Sleepy but awake)	Moderate
8 (Very sleepy)	Critical
9 (Extremely sleepy)	Catastrophic

SP Rating	Description	ICAO Risk Severity Category
1–2 (Fully alert)	Minimal fatigue	Negligible
3 (Okay)	Mild fatigue	Minor
4 (A little tired)	Moderate fatigue	Moderate
5 (Moderately tired)	Significant fatigue	Critical
6 (Extremely tired)	Severe fatigue	Critical
7 (Completely exhausted)	Unsafe fatigue levels	Catastrophic

appropriate FRM: three subtype-based scenarios

Factor	Pilot wakes up and begins duty during the WOCL 02:00–04:59	Pilot is already working through the WOCL Duty starts <01:59, ends 02:00–05:59	pilot is awake for the entire WOCL and beyond Duty starts <01:59, ends ≥06:00
Fatigue Level	High	Very High	Extreme
Circadian Disruption	Moderate	Severe	Maximum
Alertness at Start	Low (sleep inertia)	Moderate to low	Moderate to low
Alertness at End	Moderate to high (depending on the duty length)	Low	Very Low (critical impairment)
Risk of Microsleeps	Moderate	High	Very High
Recovery Sleep Quality	Best of the three	Moderate	Worst (fragmented daytime sleep)

All three scenarios lead to significant fatigue, but Scenario # 3 consisting of longer duties that extend past 06:00 cause the most extreme impairment

appropriate FRM: risk assessment

SIRA methodology: using a standard *risk matrix* (5x5) based on likelihood and severity, assess the risk levels for Scenario 3

Overall risk level: HIGH to EXTREME

To reduce the extreme fatigue risk, appropriate FRM measures should be applied

Hazard	Likelihood (1-5)	Severity (1-5)	Risk Level (L x S)	Risk Category
Microsleeps & loss of alertness	4 – Likely	5 – Catastrophic (if undetected)	20	Extreme
Cognitive impairment (decision errors)	4 – Likely	4 – Major	16	High
Navigation or communication errors	3 – Possible	4 – Major	12	High
Increased stress & health impact	4 – Likely	3 – Moderate	12	High

appropriate FRM: risk assessment

- *Fatigue Factor Assessment and Mitigation table* – can be tailored to fatigue risks in particular ops environment

Type of Shift/Specific Duty: CGN-TFS-CGN: Check in 1600LT, Checkout 0300LT; FDT: 11:00h				
	Fatigue Factor:	Worst Case:	Mitigated	Comments:
Sleep debt	Previous night sleep ** reduced < 4h (night: 22-08LT)	1**	1**	Not relevant if 1st duty day
	Previous night sleep ** reduced > 4h	1**	0	Avoid previous day checkout after midnight
	Reduced night sleep > 4h before previous night ***	1***	0	Avoid any previous day checkout after midnight
	Previous "night duty"** (day sleep only)**	1**	0	Avoid any previous day checkout after midnight
Wakefulness	Time since awake > 2h prior C/I*	1	1	
	Time since awake > 6h prior C/I*	1	(1)	Recommend nap before duty
	Time on task > 10h (FDT)	1	1	FDT > 10h at night (!)
	Time on task > 12h < 14h (FDT)	--	--	
Circadian Factors	Circadian disruption > 4h **	1	0	Previous duties shall be late duties
	Flight after 2300LT or last landing during darkness	1	1	
	Flight time <2h during WOCL	1	1	
	Flight time > 2 h during WOCL	--	--	
Workload	3 or 4 consecutive flights/sectors	--	--	
	5 or 6 flights / or 3 flights during night	--	--	
	Known hassles	--	--	
	Training flights	1	0	Avoid training on this duty

Sum of fatigue factors	
Assessment of fatigue factors:	
0-3 relevant factors:	accept
4-6 relevant factors:	check
7-9 relevant factors:	mitigate
>10 relevant factors:	not acceptable
Note. Factors are not fully weighted! Most important f order.	

Assessment of Fatigue Factors under Existing Conditions (Step 1):		
Relevant factors	Acceptability	Action
0-3	Accept	No mitigation required
4-6	Check	Identify mitigations to reduce relevant fatigue factors
7-9	Mitigate	Identify mitigations to reduce the remaining fatigue factors to the minimum
> 9	Not Acceptable	Identify mitigations to reduce the remaining fatigue factors to an acceptable minimum. If not possible this duty is not permissible

appropriate FRM: risk assessment

Let's compare a single night duty surrounded by sufficient rest periods and a combination of duties with minimum sleep opportunities between them

Aspect	Single night duty with sufficient rest	Combination of duties with minimum sleep
Fatigue accumulation	Low to moderate, with full recovery possible	High, cumulative fatigue grows with each shift
Sleep quality	Generally adequate with extended rest periods	Poor, fragmented, and insufficient
Performance	Stable with occasional lapses during circadian lows	Declines steadily over time
Health impact	Minimal long-term risks	Increased long-term risks (mental, physical health)
Incident risk	Lower risk with adequate recovery	Significantly higher risk of fatigue-related errors

appropriate FRM: avoidance barriers

- when rostering *a single night duty*, the operator can:
  - allow sufficient time for rest before night duty
  - avoid placing it after an early start
  - avoid placing it after an extended recovery rest period

- when rostering *combinations involving disruptive schedules* the operator can:
  - avoid blocks of mixed duties
  - start a block of duties with a shorter FDP
  - avoid more than one transition between two types of disruptive duties in 168 hours

appropriate FRM: mitigation strategies

The operator can:

- ❑ communicate on the use of available rest facilities at the main base
- ❑ promote the optimum use of sleep opportunities
- ❑ where possible, provide suitable accommodation at or near the crew reporting point
- ❑ establish procedures for aircrew to report insufficient prior sleep
- ❑ provide training to aircrew on how to determine their actual level of fatigue and on fatigue-mitigation strategies
- ❑ provide advice regarding exposure to daylight, sleep, physical activity, and nutrition
- ❑ use a relief pilot for long-haul flights to allow for rest rotations

appropriate FRM: individual strategies

Here are some individual fatigue mitigation strategies aircrew can use:

- ❑ Optimize pre-duty sleep the day before
- ❑ Take a strategic nap in the afternoon
- ❑ Avoid caffeine, alcohol, or heavy meals before sleep
- ❑ Gradually adjust prior bedtime and wake time
- ❑ Manage alertness with caffeine and exercise during the shift
- ❑ Plan recovery sleep post-shift

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