



## Waking up to the call: fighting grogginess after sleep

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### Tired of waking up tired?

Do you ever feel more tired when you wake up than you did before you went to sleep? This grogginess after waking is called *sleep inertia*.<sup>1</sup> Luckily, this feeling doesn't typically last very long. Most people try to cope with this grogginess by hitting the snooze button or drinking coffee.

Unfortunately, some people don't have the luxury of slowly easing their way into wakefulness. For example, think about emergency service workers and doctors. They are often "on call" around the clock. Some work such long hours that they nap while on shift. When responding to a call, these workers may have to make important decisions, perform safety-critical tasks, and/or drive within minutes after waking up. To make things worse, often these calls come in the middle of the night.<sup>2</sup> Essentially, these individuals are expected to perform potentially life-saving work before they are fully awake! However, it isn't just emergency service workers and doctors who are expected to work shortly after waking. Did you know that almost half of the workforce works hours outside the normal "9 to 5"?<sup>3</sup>

### Waking up on the right side of the bed

*What causes sleep inertia?*

Sleep inertia occurs when the brain transitions from sleep to wake.<sup>4,5</sup> During sleep inertia, you may feel sleepy. Also, you may not be able to think clearly or perform tasks at your best. Typically, these symptoms fade within 20 minutes after waking.<sup>6,7</sup>

However, there are a few things that can cause sleep inertia to last longer or be more severe:

- Waking up during your normal sleep time (e.g., at night)<sup>8</sup>
- Waking up from deep sleep<sup>9</sup>
- Waking up from a nap after being awake for a long time before<sup>9</sup>
- Not getting enough sleep in the prior day or week<sup>10,11</sup>





*Sleep inertia can occur after ANY sleep period, even if you avoid the factors listed above.*

*What are the consequences of sleep inertia?*

Sleep inertia can have severe consequences – even worse than after losing a whole night of sleep!<sup>7</sup> Sleep inertia can impair:

- Reaction time<sup>12,13</sup>
- Decision-making<sup>14</sup>
- Ability to solve math problems<sup>12,13</sup>
- Ability to detect errors<sup>13</sup>

The average person isn't challenged with math problems as soon as they wake up, so why is this important? Imagine if a doctor needs to calculate a medicine dose. What if an airline worker needs to calculate the amount of fuel required for a flight? An error in these calculations could have detrimental consequences in the real world! In fact, sleep inertia has played a role in aviation, maritime, and military accidents.<sup>15-20</sup>

*How can you counteract sleep inertia?*

There are a few things you can do to reduce sleep inertia *before* going to sleep:

- Plan sleep to avoid waking up during the night
- Take shorter (<30 minutes) or longer (~90 minutes) naps to reduce the risk of waking up from deep sleep
- If you know you will be awake for a long time, take naps earlier rather than later (e.g., nap within 18 hours of waking on a 24-hour shift)
- Avoid prior sleep loss
- Consume caffeine before a ~20-minute nap<sup>21,22</sup>
  - Consuming caffeine *after* waking up is less effective because there is a delay in action of ~20 minutes (at which time sleep inertia is usually low)

There are also things you can do to reduce sleep inertia *after* waking up:<sup>23</sup>

- Seek bright light when you wake up, especially at night<sup>1</sup>
- Engage in a short bout of exercise<sup>24</sup>
  - This may only improve how alert you feel, not how well you perform

There are a few things to consider about the proposed strategies to counteract sleep inertia:





- These strategies have primarily been studied in the laboratory; it is unknown if they are effective at home or in the work place
- It is important to consider how these strategies to improve wakefulness may impact the ability to fall asleep after work, especially if it's a brief work activity<sup>25</sup>
- More research is needed to determine the most effective strategy or combination of strategies

*The most effective strategy is to delay safety-critical tasks whenever possible.*

## To sleep or not to sleep...?

Some nurses<sup>26</sup>, emergency service workers<sup>27</sup>, and helicopter pilots<sup>28</sup> avoid sleeping in order to avoid sleep inertia. This approach can backfire. After all, sleep is critical for optimal alertness, performance, and well-being. After you wake up, wait at least 20 minutes before you make an important decision or perform a safety-critical activity. This includes driving a car! If you can't wait that long:

- Try to plan your sleep using pre-sleep strategies (e.g., avoid waking at night)
- Use alertness promoting strategies after waking (e.g., bright light)
- Use fatigue management strategies to reduce the risk of errors turning into accidents (e.g., cross-checking work with a rested co-worker)

*Sleep is the best solution to sleep loss, but it is important to manage sleep inertia after waking.*



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## Infographic

### WAKE UP!

#### HOW TO MANAGE SLEEP INERTIA

##### ALLOW RECOVERY TIME

Try to wait at least 20 minutes before engaging in tasks that require attention, decision-making, or are safety-critical.

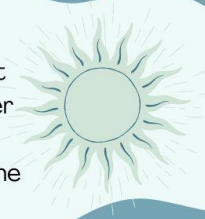


##### PRE-PLAN IF YOU CAN

Getting adequate sleep, planning naps for daytime hours, keeping naps short (<30min) can help to minimize sleep inertia symptoms.

##### RISE AND SHINE

Research suggests that bright light can help to promote alertness after waking at night. More research is needed to see if this is feasible in the workplace!



##### RISK MANAGEMENT

Even with pre-sleep and post-sleep strategies, sleep inertia may still impair performance, so it's best to cross-check your work with a rested co-worker!

##### WATCH THIS SPACE!

Research is ongoing to better understand the causes of, and countermeasures to, sleep inertia!



#### WAKE UP! HOW TO MANAGE SLEEP INERTIA

Hilditch & Vincent (2023) Waking up to the call: fighting grogginess after sleep  
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### Suggested reading

For a deeper dive into the state of the science on sleep inertia:

Hilditch, C. J., & McHill, A. W. (2019). Sleep inertia: current insights. *Nature and Science of Sleep*, 11, 155-165. doi: 10.2147/NSS.S188911

For insight into the challenges in managing sleep inertia faced by on-call workers:

Kovac, K., Vincent, G.E., Paterson, J. L., & Ferguson, S. A. (2022). "I want to be safe and not still half asleep": Exploring practical countermeasures to manage the risk of sleep inertia for emergency service personnel using a mixed methods approach. *Nature and Science of Sleep*, 14, 1493-1510. doi:<https://doi.org/10.2147/NSS.S370488>





## References

1. Hilditch CJ, Wong LR, Bathurst NG, et al. Rise and shine: The use of polychromatic short-wavelength-enriched light to mitigate sleep inertia at night following awakening from slow-wave sleep. *Journal of Sleep Research*. 2022:e13558.
2. Dawson D, Ferguson SA, Vincent GE. Safety implications of fatigue and sleep inertia for emergency services personnel. *Sleep Medicine Reviews*. 2021;55:101386.
3. Sprajcer M, Appleton SL, Adams RJ, et al. Who is 'on-call' in Australia? A new classification approach for on-call employment in future population-level studies. *PloS One*. 2021;16(11):e0259035.
4. Balkin TJ, Braun AR, Wesensten NJ, et al. The process of awakening: a PET study of regional brain activity patterns mediating the re-establishment of alertness and consciousness. *Brain : a Journal of Neurology*. 2002;125(10):2308-2319.
5. Vallat R, Meunier D, Nicolas A, Ruby P. Hard to wake up? The cerebral correlates of sleep inertia assessed using combined behavioral, EEG and fMRI measures. *NeuroImage*. 2019;184:266-278.
6. Signal TL, van den Berg MJ, Mulrine HM, Gander PH. Duration of sleep inertia after napping during simulated night work and in extended operations. *Chronobiology International*. 2012;29(6):769-779.
7. Wertz AT, Ronda JM, Czeisler CA, Wright KP, Jr. Effects of sleep inertia on cognition. *JAMA : the Journal of the American Medical Association*. 2006;295(2):163-164.
8. Scheer FA, Shea TJ, Hilton MF, Shea SA. An endogenous circadian rhythm in sleep inertia results in greatest cognitive impairment upon awakening during the biological night. *Journal of Biological Rhythms*. 2008;23(4):353-361.
9. Dinges D, Orne M, Orne E. Assessing performance upon abrupt awakening from naps during quasi-continuous operations. *Behavior Research Methods*. 1985;17(1):37-45.
10. Tassi P, Bonnefond A, Engasser O, Hoeft A, Eschenlauer R, Muzet A. EEG spectral power and cognitive performance during sleep inertia: the effect of normal sleep duration and partial sleep deprivation. *Physiology & Behavior*. 2006;87(1):177-184.
11. McHill AW, Hull JT, Cohen DA, Wang W, Czeisler CA, Klerman EB. Chronic sleep restriction greatly magnifies performance decrements immediately after awakening. *Sleep*. 2019;42(5):zsz032.





12. Santhi N, Groeger JA, Archer SN, Giménez M, Schlangen LJ, Dijk DJ. Morning sleep inertia in alertness and performance: effect of cognitive domain and white light conditions. *PloS One*. 2013;8(11):e79688.
13. Burke TM, Scheer FA, Ronda JM, Czeisler CA, Wright KP. Sleep inertia, sleep homeostatic and circadian influences on higher-order cognitive functions. *Journal of Sleep Research*. 2015;24(4):364-371.
14. Horne J, Moseley R. Sudden early-morning awakening impairs immediate tactical planning in a changing 'emergency' scenario. *Journal of Sleep Research*. 2011;20(2):275-278.
15. Transportation Safety Board of Canada. Pitch Excursion: Air Canada, Boeing 767-333, C-GHLQ, North Atlantic Ocean, 55°00'N 029°00'W, 14 January 2011. Aviation Investigation Report No. A11F0012. Gatineau: Government of Canada, 2011.
16. Government of India Ministry of Civil Aviation. Report on accident to Air India Express Boeing 737-800 aircraft VT-AXV on 22nd May 2010 at Mangalore. New Delhi: Government of India, 2010.
17. Marine Accident Investigation Branch. Heavy contact by Skandi Foula with OMS Resolution, Aberdeen Harbour 29 May 2010. Accident Report No. 15/2011. London: UK Department for Transport, 2011.
18. National Transportation Safety Board. Contact of Ava Claire Tow with Leland Bowman Lock Gate. Report No. MIR-22/09. Washington, DC: National Transportation Safety Board, 2022.
19. Ribak J, Ashkenazi IE, Klepfish A, et al. Diurnal rhythmicity and Air Force flight accidents due to pilot error. *Aviation, Space, and Environmental Medicine*. 1983;54(12 Pt 1):1096-1099.
20. Armentrout JJ, Holland DA, O'Toole KJ, Ercoline WR. Fatigue and related human factors in the near crash of a large military aircraft. *Aviation, Space, and Environmental Medicine*. 2006;77(9):963-970.
21. Centofanti S, Banks S, Coussens S, et al. A pilot study investigating the impact of a caffeine-nap on alertness during a simulated night shift. *Chronobiology International*. 2020;37(9-10):1469-1473.







22. Dornbierer DA, Yerlikaya F, Wespi R, et al. A novel bedtime pulsatile-release caffeine formula ameliorates sleep inertia symptoms immediately upon awakening. *Scientific Reports*. 2021;11(1):1-12.
23. Hilditch CJ, Dorrian J, Banks S. Time to wake up: reactive countermeasures to sleep inertia. *Industrial Health*. 2016;54:1-14.
24. Kovac K, Vincent GE, Paterson JL, et al. The impact of a short burst of exercise on sleep inertia. *Physiology & Behavior*. 2021;242:e113617.
25. Gupta CC, Dominiak M, Kovac K, et al. On-call work and sleep: the importance of switching on during a callout and switching off after a call. *Industrial Health*. 2021;60(2):91-96.
26. Fallis WM, McMillan DE, Edwards MP. Napping during night shift: practices, preferences, and perceptions of critical care and emergency department nurses. *Critical Care Nurse*. 2011;31(2):e1-e11.
27. Kovac K, Vincent GE, Paterson JL, Ferguson SA. "I want to be safe and not still half asleep": exploring practical countermeasures to manage the risk of sleep inertia for emergency service personnel using a mixed methods approach. *Nature and Science of Sleep*. 2022;14:1493-1510.
28. Gregory KB, Winn W, Johnson K, Rosekind MR. Pilot fatigue survey: exploring fatigue factors in air medical operations. *Air Medical Journal*. 2010;29(6):309-319.

