The Impact of Controlled Rest On Neurobehavioral Outcomes At Top-Of-Descent

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Learning Objectives

Upon completion of this activity, participants should be able to:

1. Understand how controlled rest may impact neurobehavioral outcomes at a critical phase of flight.
2. Appreciate the need for further research on controlled rest to understand how the policy is implemented in practice and its impact on objective performance measures.

SLEEP 2024

ORIGINAL RESEARCH article

Front. Environ. Health
Sec. Occupational Safety and Health Interventions
Volume 3 - 2024 | doi: 10.3389/fenvh.2024.1368628

This article is part of the Research Topic

Maintaining Health, Safety and Cognitive Function Under Challenging Environmental and Working Conditions

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Investigating the causes and consequences of controlled rest on the flight deck

Provisionally Accepted

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Background

Two pilots fall asleep mid-flight with more than 150 on board 36,000 feet in the air

'More than half' of pilots have slept while flying

NTSB: Both Pilots Asleep on Hawaii Flight

ITA pilots fall asleep on transatlantic flight

Survey Reveals 60% Of Commercial Pilots Guilty Of Scary, Hazardous Habit

Background

Controlled rest (CR)

- A short sleep opportunity on the flight deck
- An effective mitigation strategy to be used as needed in response to unanticipated fatigue experienced during flight operations
- Not to be used as a scheduling tool or in lieu of other fatigue management strategies
- Taken within a clearly defined policy

ICAO, 2015

But...

- Unintentional sleep still occurs even when CR is legal
- Non-compliance with SOP has led to real-world accidents

Background

Air India pilot's 'sleep inertia' caused crash

Updated 11/18/2010 1:12 PM | Comments 57 | Recommend 5 E-mail | Print |

Enlarge AFP/Getty Images

Crews work amid the smoldering wreckage of an Air India Boeing 737-800 that crashed on landing in Mangalore, India.

By Alan Levin, USA TODAY

The senior pilot of an Air India jet that crashed in May was asleep for most of the flight and then made critical errors because he was disoriented after waking up, according to Indian news reports.

The crash on May 22 in Mangalore, India, killed 158 people after the jet overran the runway and plunged off a cliff.

Capt. Zlatko Glusica was captured loudly snoring on a cockpit recorder, the accident investigation found, according to the *Hindustan Times*. The Associated Press confirmed the account from a government official who spoke on condition of anonymity because the report had not been presented to the Indian Parliament.

After waking, Glusica did not respond when his co-pilot H.S. Ahluwalia repeatedly urged him to abort the landing.

Indian investigators said that Glusica was suffering from "sleep inertia," a condition that can be deeply disorienting when someone is awoken suddenly from deep sleep, according to the reports.

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Air Canada pilot suffering from 'sleep inertia' put the whole flight in trouble: TSB

Toronto : Canada | Apr 17, 2012 at 6:17 PM PDT
BY madn3wz
2 0
VIEWS: 86

BACK 1 of 5 NEXT

Baines Simmons, 2023; Safety Matters Foundation, 2022

Objectives

Aim to determine:

1) The relative influence of pre-flight sleep-wake history and time of day on the likelihood to take CR

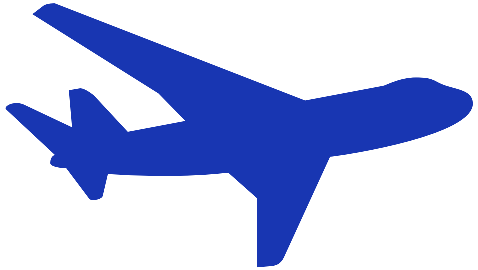
2) Whether neurobehavioral measures taken pre-flight are predictive of CR use in-flight

3) The impact of CR on neurobehavioral measures at top-of-descent (TOD)

Methods

Participants

- *n* = 120 long-haul flights
  - non-augmented
  - >6.5 h
  - European airline
- *n* = 31 pilots
  - Could do multiple flights
  - 46 y mean age
  - 90% Male
  - 48% Captains



Hilditch et al., 2024 *Front Environ Health*

Methods

Data collection

- 14-day data collection period
- Collected KSS/PVT (5-min)
    - Pre-flight
    - In-flight (TOD)
    - Post-flight
- Actigraphy

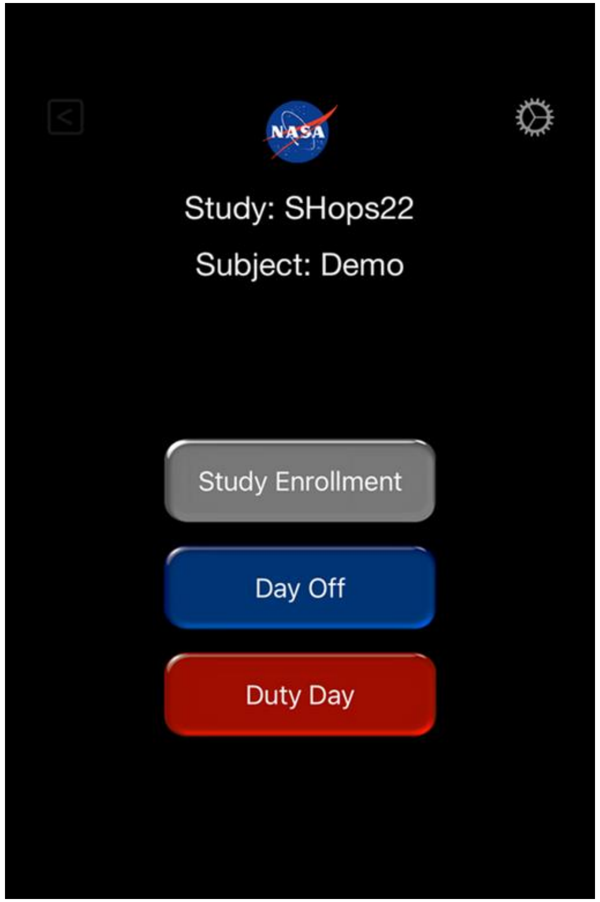


Image: Arsintescu et al., 2019; personal

Hilditch et al., 2024 *Front Environ Health*

Methods

Analysis

- Model 1: *Sleep/wake* predictors
  - Sleep in prior 24 h
  - Sleep in prior 48 h
  - Hours of cont. wakefulness
  - Timing of the flight (night* vs. day)

- Model 2: *Pre-flight test* predictors
  - KSS
  - PVT speed
  - PVT lapses
  - Covariates from Model 1

*Night = flight touched 0200-0459, relative to home base time.

Hilditch et al., 2024 *Front Environ Health*

Methods

Analysis

- Model 3: Impact of *CR* at TOD
  - KSS
  - PVT speed
  - PVT lapses
  - Covariates + pre-flight scores

- Model 4: Impact of *TST* at TOD
  - KSS
  - PVT speed
  - PVT lapses
  - Covariates (as above)

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Results

Flights

Flight duration

8.3 h (0.8; 6.8-10.4)

Mean (SD; range)

Night flights

55%

CR flights

Attempted: 70%

Successful: 63%

Twice: 20%

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Results

Controlled rest

Mean (SD; range)

CR duration

44 min (12; 15-104)

Sleep per CR attempt

28 min (15; 0-81)

Total sleep per flight

36 min (22; 0-94)

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Model 1: *Sleep/wake* predictors

Model	*Variable*	*b*	*SE*	*p*	η^2_p	*OR*	95% CI_{OR}
Model 1:	Sleep Duration (Prior 24 h)	0.37	0.33	.27	.07	1.44	0.76, 2.75
Sleep and Flight Characteristics	Sleep Duration (Prior 48 h)	-0.43	0.22	.05	.07	0.65	0.42, 1.00
	Hours of Wakefulness	-0.01	0.12	.95	.03	0.99	0.79, 1.25
($R^2_M = .23$; $R^2_C = .56$)	Flight Timing	2.63	0.99	.01*	.13	13.81	1.99, 95.80

Results

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Model 2: *Pre-flight test* predictors

Model	*Variable*	*b*	*SE*	*p*	η^2_p	*OR*	*95% CI$_{OR}$*
Model 2:	KSS	1.42	0.52	.01*	.14	4.14	1.48, 11.57
Pre-Flight Neurobehavioral Measures	PVT Speed	-0.62	1.11	.57	.01	0.60	0.06, 4.75
($R^2_M = .35$; $R^2_C = .57$)	PVT Lapses	-0.85	0.44	.05	.10	0.43	0.18, 1.00

Results

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Model 3: Impact of *CR* at TOD

	Model 3a: KSS ($R^2_M = .32$; $R^2_C = .46$)				Model 3b: PVT Speed ($R^2_M = .62$; $R^2_C = .64$)				Model 3c: PVT Lapses ($R^2_M = .11$; $R^2_C = .41$)			
Variable	*b*	*SE*	*p*	η^2_p	*b*	*SE*	*p*	η^2_p	*b*	*SE*	*p*	η^2_p
Controlled Rest	-0.27	0.36	.45	0.01	0.19	0.09	.03*	0.07	-0.29	0.31	.34	< .001
Covariates												
Pre-Flight Score	0.33	0.13	.02*	0.09	0.67	0.07	< .001*	0.55	0.04	0.08	.65	0.04
Sleep Duration (Prior 48 h)	0.16	0.07	.03*	0.07	-0.02	0.02	.22	0.02	0.12	0.08	.14	0.08
Flight Timing	1.27	0.32	< .001*	0.19	-0.21	0.09	.02*	0.08	0.89	0.31	.004*	0.11

Results

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Model 4: Impact of *TST* at TOD

	Model 4a: KSS ($R^2_M = .33; R^2_C = .33$)				Model 4b: PVT Speed ($R^2_M = .58; R^2_C = .65$)				Model 4c: PVT Lapses ($R^2_M = .13; R^2_C = .20$)			
Variable	*b*	*SE*	*p*	η^2_p	*b*	*SE*	*p*	η^2_p	*b*	*SE*	*p*	η^2_p
Sleep Amount During Controlled Rest	0.02	0.01	.11	.06	0.003	0.003	.24	.04	-0.01	0.01	.31	.01
Covariates												
Pre-Flight Score	0.32	0.17	.06	.08	0.66	0.12	< .001*	.47	-0.07	0.20	.75	< .001
Sleep Duration (Prior 48 h)	0.17	0.09	.07	.07	-0.02	0.02	.43	.02	0.18	0.08	.02*	.11
Flight Timing	1.31	0.46	.008*	.16	-0.29	0.12	.02*	.15	0.56	0.45	.21	.03

Results

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Discussion

Summary

- **Predictors:**
  - Flying at night
  - Pre-flight subjective sleepiness
- **Impacts at TOD:**
  - PVT speed improved w/ CR
  - Not related to sleep amount

Discussion

Limitations

- No circadian phase marker
- No direct comparison flights
- No social/cultural factors
- Only non-augmented flights

Discussion

Future research

- Qualitative factors: individual preference, cultural factors
- More frequent test points around the rest period, e.g., sleep inertia
- EEG measures

Thank you

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Funded by the NASA Airspace Operations and Safety Program, System-Wide Safety