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

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Research Group | 27 Feb 2024

Unpublished data.
Please do not take photos.

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Background

- Fatigue is an issue in aviation
- Controlled rest (CR) is available as a fatigue countermeasure (in some regions)
- Little is known about its use or effectiveness in standard ops

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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 define policy.

ICAO, 2015

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Background

A case for CR

- Current EASA regs allow duties up to 13 h with 2 pilots
- 'Uncontrolled' and unintentional rest occurs in absence of CR policy

NTSB: Both Pilots Asleep on Hawaii Flight

- ~50% of pilots used CR in the past year
- ~50% of flights contained CR
- Demonstrated in-flight benefits of a short nap

EASA 2016; Co et al., 1999; Rosekind et al., 2000; Marqueze et al., 2017; Gregory et al., 2010; NTSB, 2009; Hilditch et al., 2020; Rosekind et al., 1994

Background

But…

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

Air India pilot's 'sleep inertia' caused crash

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

By Alan Levin, USA TODAY

Enlarge AFP/Getty Images

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

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

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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

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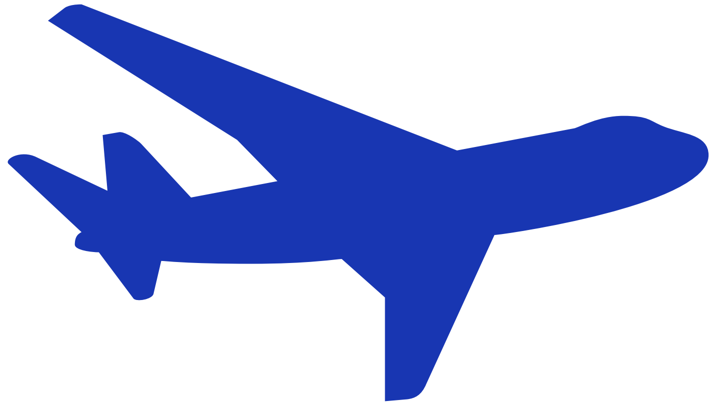
- n = 120 long-haul **flights**
  - non-augmented
  - >6.5 h
  - European airline



- n = 31 **pilots**
  - Could do multiple flights
  - 46 y mean age
  - 90% Male
  - 48% Captains

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Methods

Data collection

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

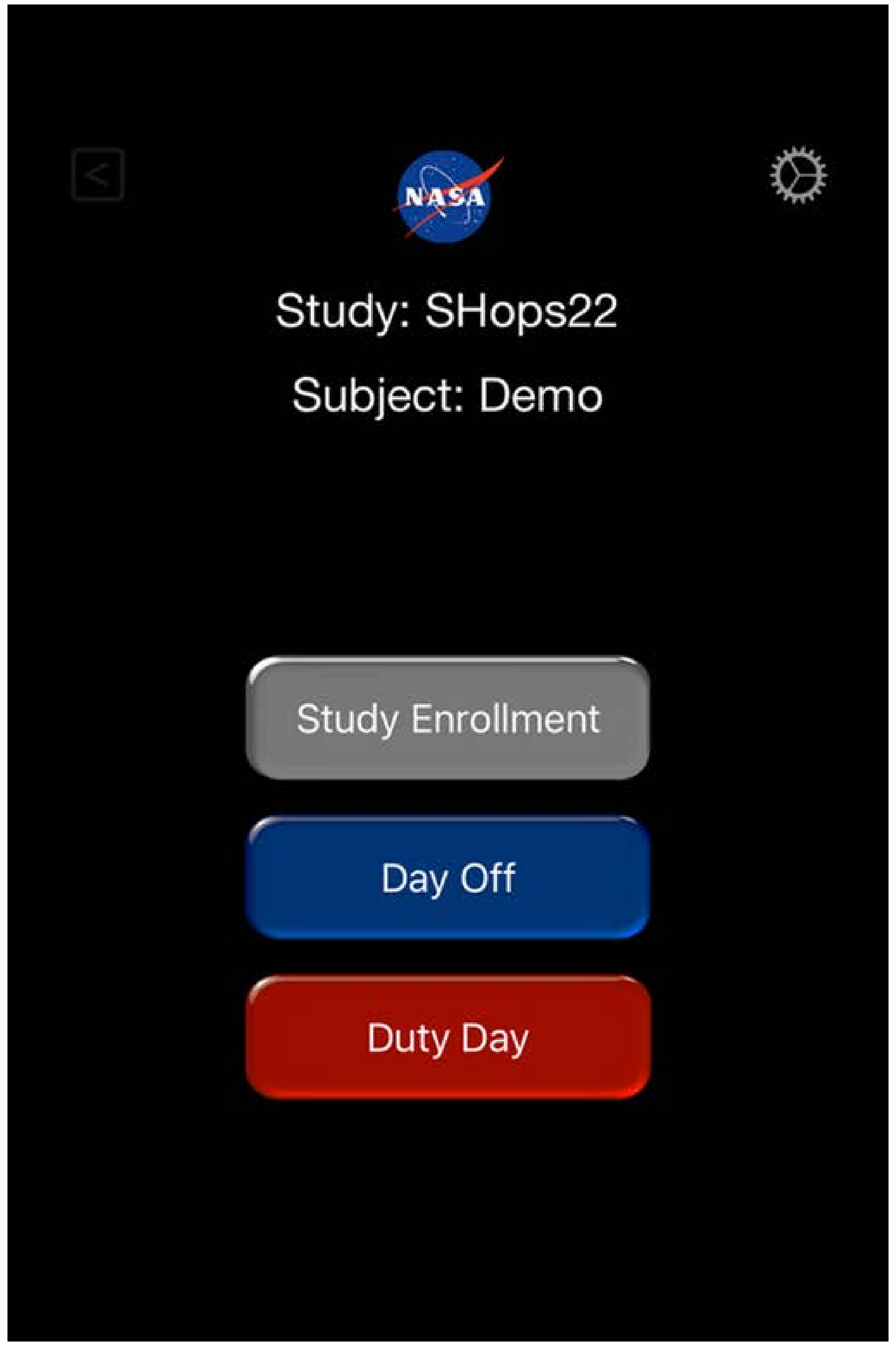

Image: Arsintescu et al., 2019; personal

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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)

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

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Methods

Analysis

- Model 2: *Pre-flight* predictors
  - KSS
  - PVT speed
  - PVT lapses
- Covariates
  - sleep in prior 48 h
  - timing of the flight

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Methods

Analysis

- Model 3: Impact of *CR* at TOD
  - KSS
  - PVT speed
  - PVT lapses
- Covariates
  - sleep in prior 48 h
  - timing of the flight
  - pre-flight scores
-

Methods

Analysis

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- Model 4: Impact of *sleep* at TOD
  - KSS
  - PVT speed
  - PVT lapses
- Covariates
  - sleep in prior 48 h
  - timing of the flight
  - pre-flight scores

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Results

Flights

Flight duration

8.3 h (0.8; 6.8-10.4)

Body

Night flights

55%

CR flights

Attempted: 70%

Successful: 63%

Twice: 20%

Mean (SD; range)

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Results

Controlled rest

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)

Mean (SD; range)

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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

Predictors

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Model 2: *Pre-flight* 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

Predictors

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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

Impact at TOD

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Model 4: Impact of sleep at TOD

Results

Impact 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

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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

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

Discussion

Limitations

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Discussion

Future research

- Qualitative factors: individual preference, cultural factors
- More frequent test points around rest period
    - Sleep inertia?
- EEG measures?

Thank you

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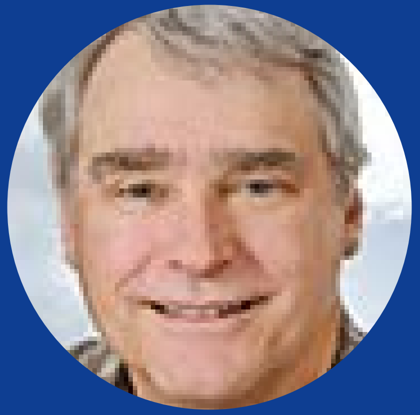

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