

# Effects of Fatigue in Portuguese Commercial Airline Pilots

*84<sup>th</sup> Annual AsMA Scientific Meeting*  
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# Disclosure Information

84<sup>th</sup> Annual AsMA Scientific Meeting

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- ✓ I have no financial relationships to disclose
- ✓ I will not discuss off-label use and/or investigational use in my presentation

# Fatigue

## Definition (ICAO)

*“a physiological state of reduced mental or physical performance capability resulting from sleep loss or extended wakefulness, circadian phase, or workload (mental and/or physical activity) that can impair a crew member’s alertness and ability to safely operate an aircraft or perform safety related duties”*

# Fatigue

## Causes

Short/Medium haul (SMH)

Sleep deprivation  
High workload

Long haul (LH)

Sleep deprivation  
Circadian disturbances

Night flights,  
Jet lag,  
Early wakeups,  
Time pressure,  
Multiple sectors,  
Consecutive duty periods without sufficient recovery

# Fatigue

## Consequences

### Performance

Short memory  
Decision making  
Reaction times  
Reduced vigilance

### Mood

Degraded mood  
Irritability  
Loss of motivation

### Health

Cancer  
Heart problems

**Increased incident/accident risk!**

# Accidents in which fatigue was a contributing factor



Guam, 1997  
228 deaths



Little Rock, 1999  
11 deaths, 110 wounded



Buffalo, 2009  
51 deaths



Mangalor, India, 2010  
158 deaths

# Objectives

## ➤ Determine a self-reported prevalence value of fatigue for Portuguese airline pilots

- Analyze differences between fatigue levels and type of flights
- Understand the perception of pilot's of their own fatigue levels

## ➤ Determine self-reported prevalence values of sleep/sleepiness, anxiety and depression for the study population

- Analyze differences between type of flights
- Analyze potential associations with fatigue and supposedly related variables:
  - Sleep disturbances
  - Diurnal sleepiness
  - Anxiety
  - Depression
  - Duty hours
  - Sectors flown
  - Hours of flight
  - Etc.

## Inclusion criteria

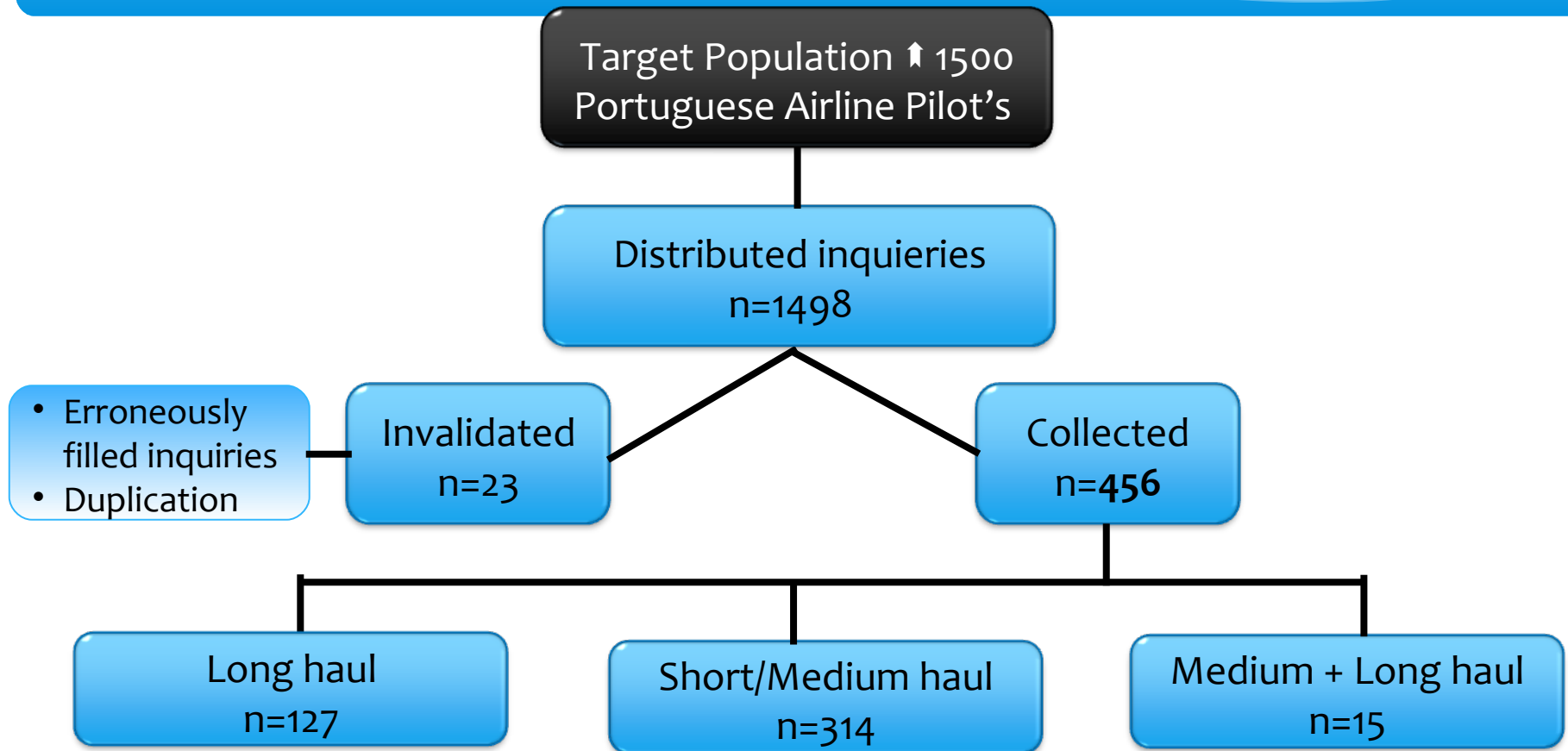
- Airline pilots working on Portuguese companies;
- Age between 20 and 65 years old;
- Being flow in the last 6 months.

## Exclusion criteria

- Haven't answered all questions;
- Duplication of questionnaires;
- Do not have delivered the questionnaire in the stipulated time (1<sup>st</sup> of April until 15<sup>th</sup> May).



# Methods



Response rate = **30.6%**

## Methods

# Baseline Characteristics of the Study Population

- Dimension – 456
- Average Age – 39,31 years
- Male – 442 (96,9%)
- Female – 14 (3,1%)
- **Captains – 234 (51,3%)**
- **First Officers – 222 (48,7%)**
- Medium/long haul – 15 (3,3%)
- Short/Medium haul – 314(68,9%)
- Long haul – 127 (27,9%)
- *Duty hours (28 days) – 98,5h*
- *Flight hours (28 days) – 60,2h*
- *Sectors flown (28 days)– 22,1*

# Methods

## Self-response questionnaire

- Sociodemographic data
- Labor variables
- Fatigue perception
- Psychological evaluation scales



|  | Cronbach's $\alpha$ |
|--|---------------------|
| Fatigue Severity Scale (FSS)                 | 0.856               |
| Jenkins Sleep Scale (JSS)                    | 0.839               |
| Epworth Sleepiness scale (ESS)               | 0.825               |
| Hospital Anxiety and Depression Scale (HADS) | 0.922               |
| Anxiety sub-scale                            | 0.870               |
| Depression sub-scale                         | 0.859               |

# Results

Target Population ↑ 1500  
Portuguese Airline Pilot's

Distributed inquiries  
n=1498

- Erroneously filled inquiries
- Duplication

Invalidated  
n=23

Collected  
n=456

Fatigue  
Prevalence  
89.3%

Long haul  
n=127

Fatigue  
Prevalence  
84.3%

Short/medium haul  
n=314

Fatigue  
Prevalence  
93%

Medium + Long haul  
n=15

N.S.

Response rate = **30.6%**

# Results

## Self-reported Prevalence Values

| %                  | Total Sample | SM-H | L-H  |
|--------------------|--------------|------|------|
| Fatigue            | 89.3         | 93   | 84.3 |
| Sleep disturbances | 35.1         | 34.4 | 36.2 |
| Diurnal sleepiness | 57.7         | 61.8 | 51.2 |
| Anxiety            | 38.6         | 39.5 | 37   |
| Depression         | 49.6         | 50.6 | 47.2 |

# Results

## Associations with fatigue\*\*

### L-H Pilots

### SM-H Pilots

- ✓ Sleep disturbances \*\*
- ✓ Daytime sleepiness \*
- ✓ Anxiety \*\*
- ✓ Depression \*\*

Non-labor variables

- ✓ Night periods \*\*
- ✓ Duty hours \*
- ✓ Sectors flown \*
- ✓ Hours flown\*\*

Labor variables

- ✓ Sleep disturbances \*\*
- ✓ Daytime sleepiness \*\*
- ✓ Anxiety \*\*
- ✓ Depression \*\*

- ✓ Night periods \*
- ✓ Early starts \*

\* p < 0.05    \*\*p < 0.01

# Results

# Multiple regression

## L-H Pilots

$R^2=0.461$

- ✓ Sleep disturbances \*\*
- ✓ Daytime sleepiness
  - ✓ Anxiety
  - ✓ Depression
- ✓ Night periods
- ✓ Duty-hours
- ✓ Sectors flown
- ✓ Hours flown \*

## SM-H Pilots

$R^2=0.305$

- ✓ Sleep disturbances \*\*
- ✓ Daytime sleepiness \*
  - ✓ Anxiety
  - ✓ Depression \*\*
- ✓ Night periods
- ✓ Early mornings

\*  $p < 0.05$     \*\*  $p < 0.01$

# Results

# Multiple regression

## L-H Pilots

$R^2=0.461$

- ✓ **Sleep disturbances \*\***
- ✓ Daytime sleepiness
  - ✓ Anxiety
  - ✓ Depression
- ✓ Night periods
- ✓ Duty-hours
- ✓ Sectors flown
- ✓ **Hours flown \***

## SM-H Pilots

$R^2=0.305$

- ✓ **Sleep disturbances \***
- ✓ **Daytime sleepiness \***
  - ✓ Anxiety
  - ✓ **Depression \***
- ✓ Night periods
- ✓ Early mornings

\*  $p < 0.05$     \*\* $p < 0.01$



# Results

# Fatigue Perception

Piloting error due to fatigue

91.4%

So fatigued that should not be at the controls

86.8%

Dozing-off/falling asleep in the cockpit without prior agreement

53.5%

Not fit for flight due to fatigue

18.4%

Reported fatigue to the company (HFCR)

18.6%

# Conclusions

- SM-H pilots presents statistically significant higher levels of fatigue than L-H pilots;
- SM-H pilots consequently present higher frequency values for diurnal sleepiness, anxiety and depression, only sleep disorders were higher in L-H pilots, probably due to circadian disruptions;
- SM-H pilots fatigue predictors were: sleep disorders, levels of diurnal sleepiness and depression;
- L-H pilots fatigue predictors were: sleep disorders and number of hours flown;
- Although pilots have conscience of their level of fatigue and its implications, they don't report it.

# Publications

Reis, C.; Mestre, C. & Canhão, H. 2013. ***Prevalence of Fatigue in a Group of Airline Pilots***. Aviation, Space and Environmental Medicine (accepted)

Reis, C.; Mestre, C. & Canhão, H. ***Multiple Approaches to Airline Pilot's Fatigue – a survey study***. (submitted)

## Acknowledgements:

- Portuguese Airline Pilots Associations
- APPLA – Associação Portuguesa de Pilotos de Linha Aérea
- SPAC – Sindicato de Pilotos da Aviação Civil



**Thank you for your  
attention!**

Questions ?

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