

Literature Review and Gathering of Available Data regarding the age dependent risk of incapacitation due to medical reasons (Deliverable No. 1)

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Introduction

Difficult to relate total incapacitation risk in commercial air transport to age

- Large individual health differences as age increases
- Medical conditions do not have to lead to total incapacitation
- Difficult to determine whether an accident was the result of incapacitation

Literature is difficult to summarize

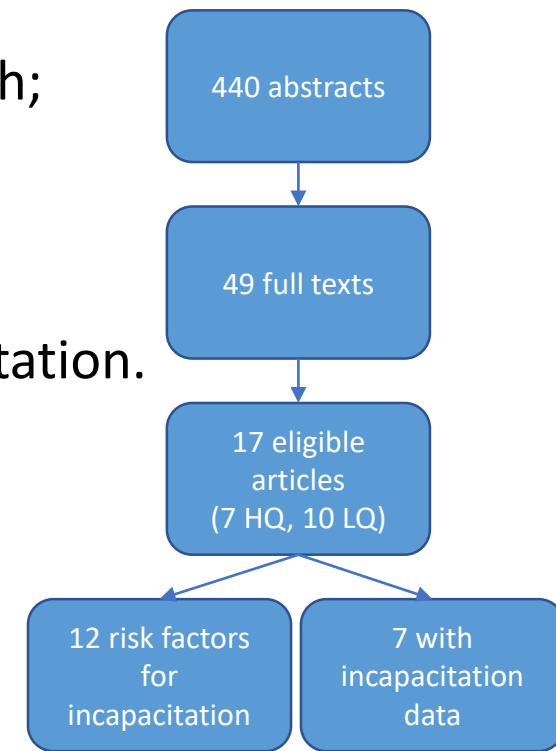
- Number of studies are scarce
- Data might be dated (not reflecting the current population health status)
- Outcomes are difficult to compare due to inconsistency of (in)dependent variables used
- Limited data of pilots aged 60 years and older

Objectives Deliverable No. 1

1. Analysis of literature data on incapacitation and medical fitness of EU CAT Pilots
2. Obtaining and analyzing data of CAT Pilots from European NAA's
3. Analysis of the retrieved incapacitation and health related data
4. Description of risk factors for sudden incapacitation and their relation to age in the general population

1. Analysis of the literature (method)

- A systematic computerized search and selection procedure
- Pre-defined inclusion criteria
 - Language and literature: Peer-reviewed and written in English or Dutch;
 - Design: Cross-sectional, case-control, prospective or retrospective;
 - Population: Helicopter, CAT, general, or military pilots;
 - Outcome: A form of total incapacitation, or a risk factor for
 - Analyses: data describes association between age and (total) incapacitation.
- Independent abstract appraisal, consensus meeting, snowball sampling
- Quality assessment
- Levels of evidence synthesis



1. Analysis of the literature (results)

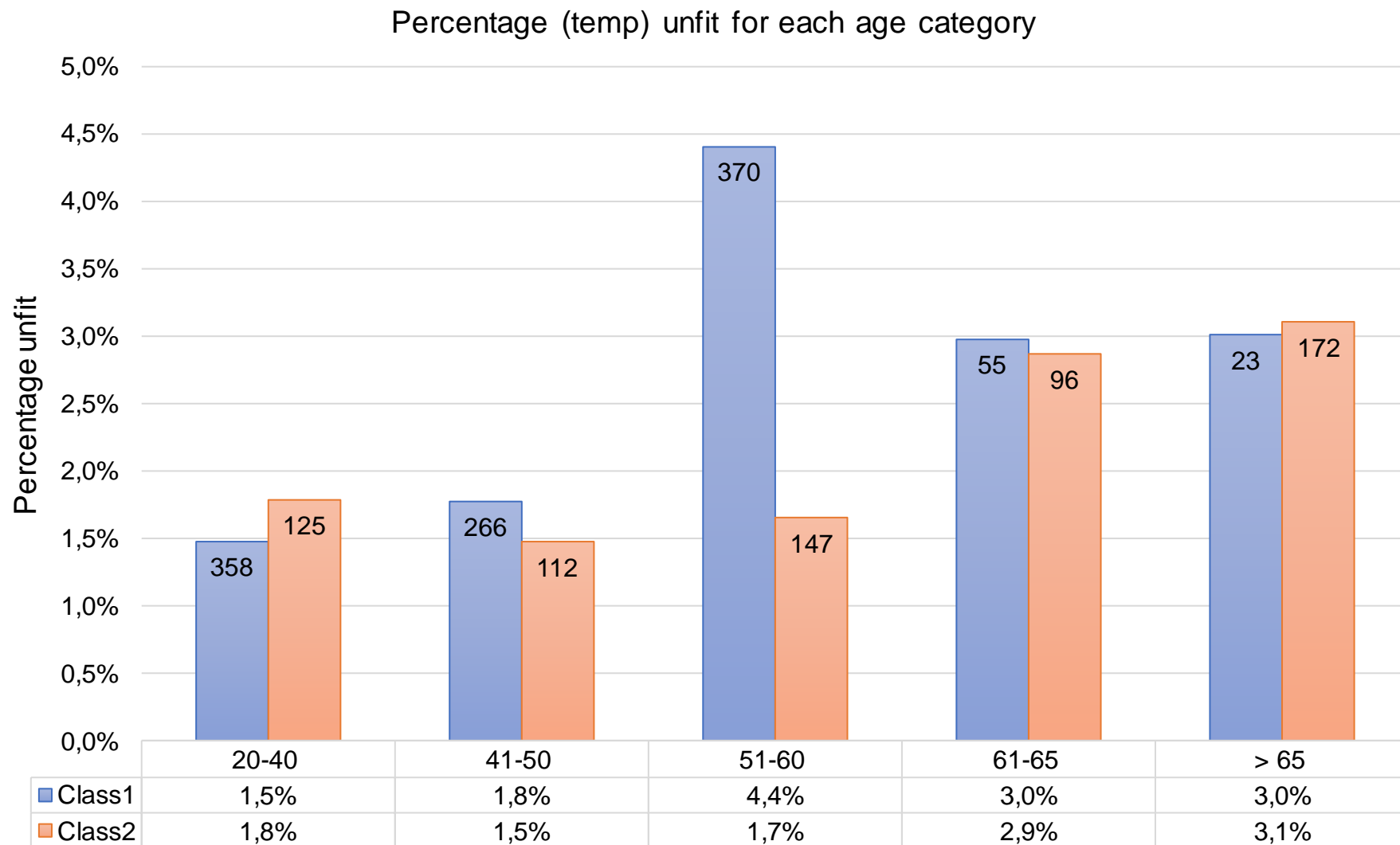
- In-flight incapacitation as a consequence of medical problems is rare
 - up to 0.45 times per 10^6 flight hours or **0.25% per annum**
- Conflicting results regarding the relation with age
 - 3 out of 7 studies did not find an association
 - Multiple studies uses proxies for incapacitation
 - Data from before 2005
- Majority of the incapacitation causes are age-independent
 - E.g gastro-intestinal conditions, laser strikes, headaches
- Most frequent **age-dependent** medical causes for total incapacitation
 - cardiovascular, cerebrovascular and neurological conditions.
- Most prevalent medical reasons for long-term grounding of pilots
 - Cardiovascular, neurological and psychological/psychiatric conditions
- Disqualification rates increase with age
 - The assessment of this risk is hindered by small numbers of pilots aged over 60

2. Analysis of the collected data (method)

- Six (out of 18) countries supplied medical data of good quality
 - Number of pilots screened
 - Number of pilots declared (temporarily) unfit
 - Medical diagnosis
 - Age
 - CAT category (Class 1 and 2)
- The data was pooled
- The association between age, CAT class and unfitness was determined
 - for the medical indications with the highest risk for incapacitation.

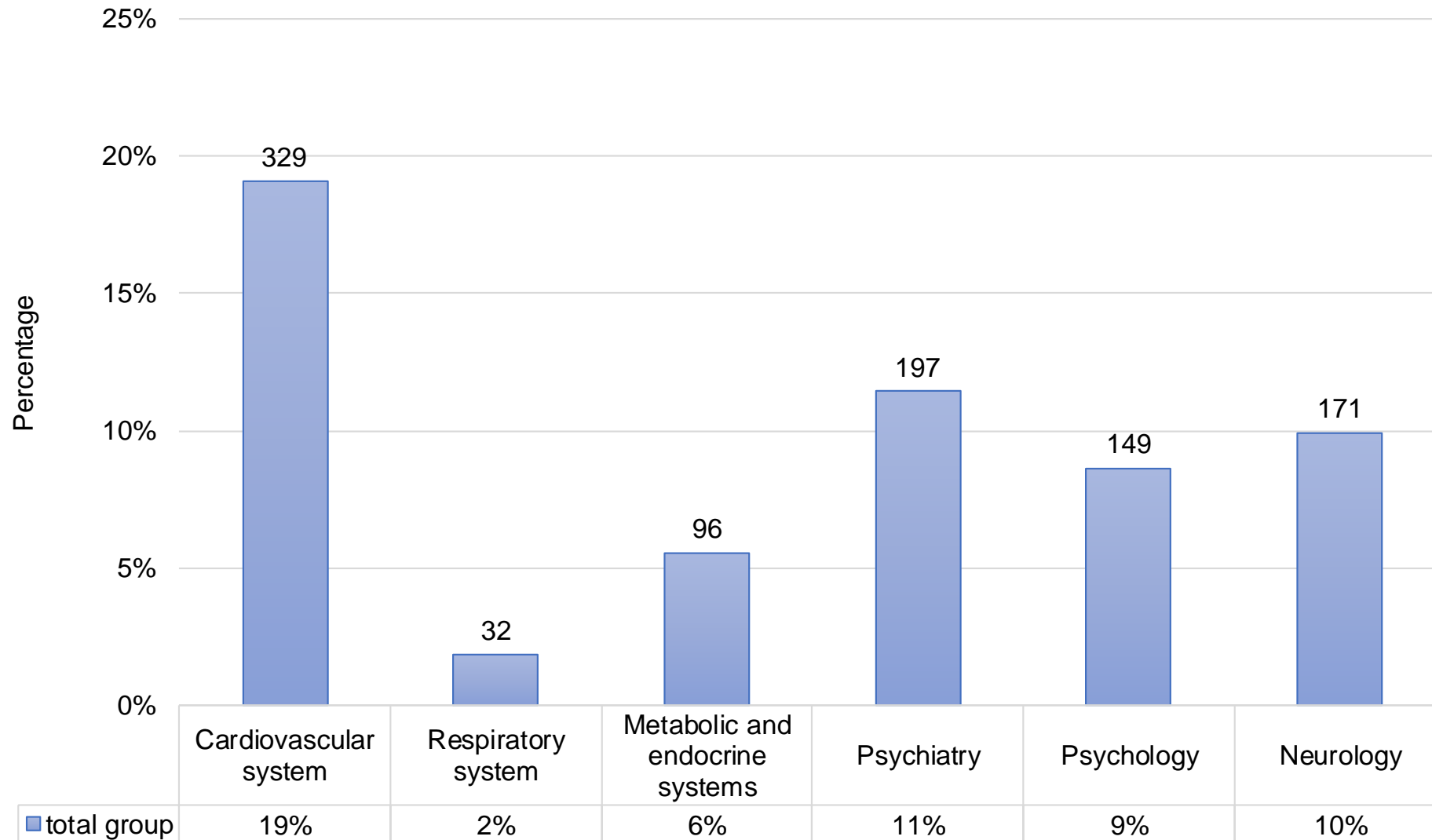
2. Analysis of the collected data (results)

CLASS1	UNFIT (%)
50,101	1,072 (2.1%)
CLASS2	UNFIT (%)
32,334	652 (2.0%)
TOTAL	UNFIT (%)
82,435	1,724 (2.1%)



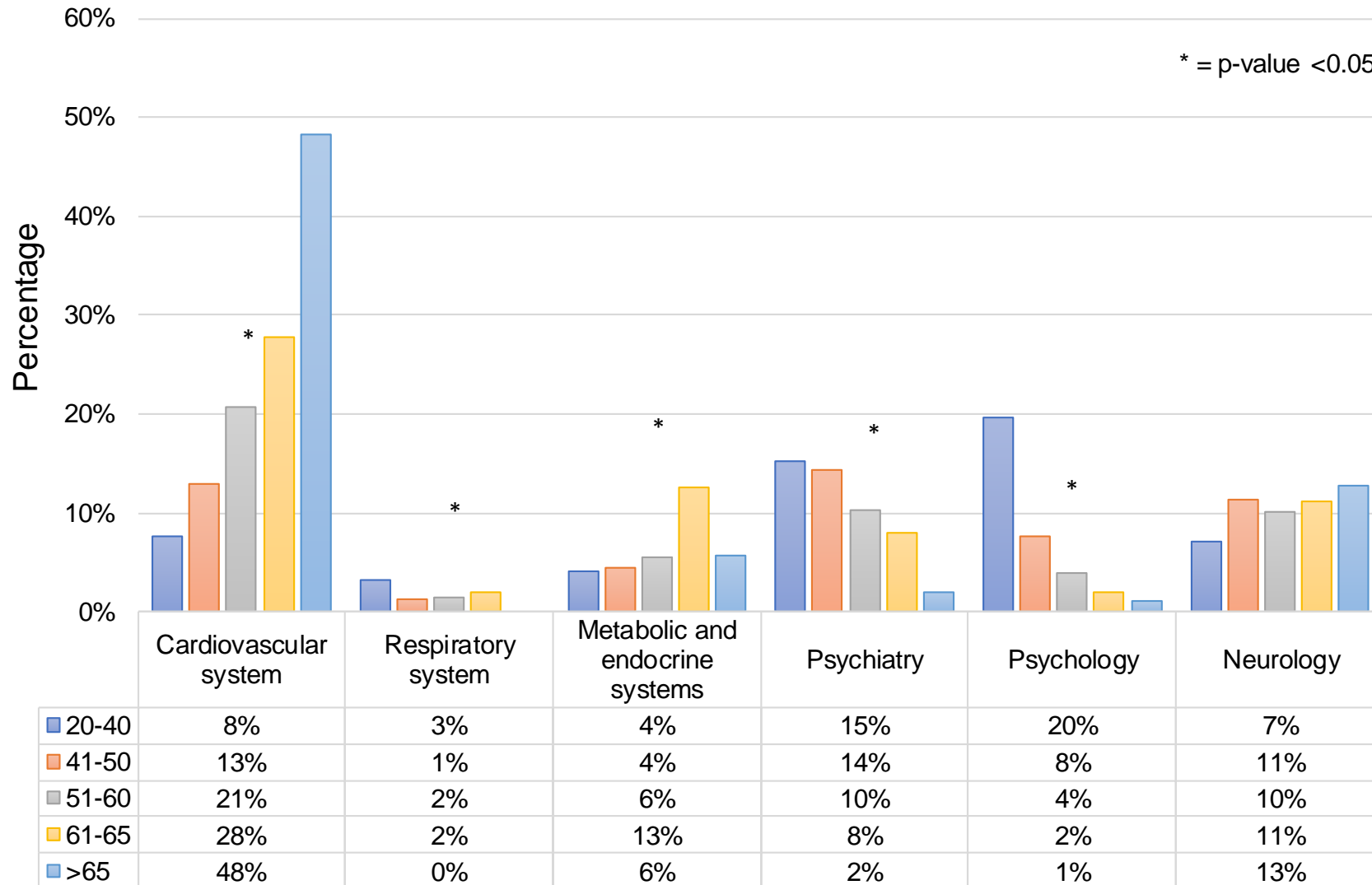
2. Analysis of the collected data (results)

Percentage of total unfit per medical indication



2. Analysis of the collected data (results)

Percentage of total unfit per age group and medical condition



2. Analysis of the collected data (conclusion)

Main findings

- An effect of increasing age on the medical disqualification rate
- Cardiovascular conditions is the most frequent (19%) reason for grounding.
- Significant increase of cardiovascular unfitness cases with increasing age.

Strenghts

- Good representation of the European pilot population
- More cases of Class 1 pilots ≥ 60 compared to similar studies

Limitations

- a larger response would have led to better generalizable results
- Possible healthy worker effect in the ≥ 60 cohort

3. Risk factors for sudden incapacitation (method)

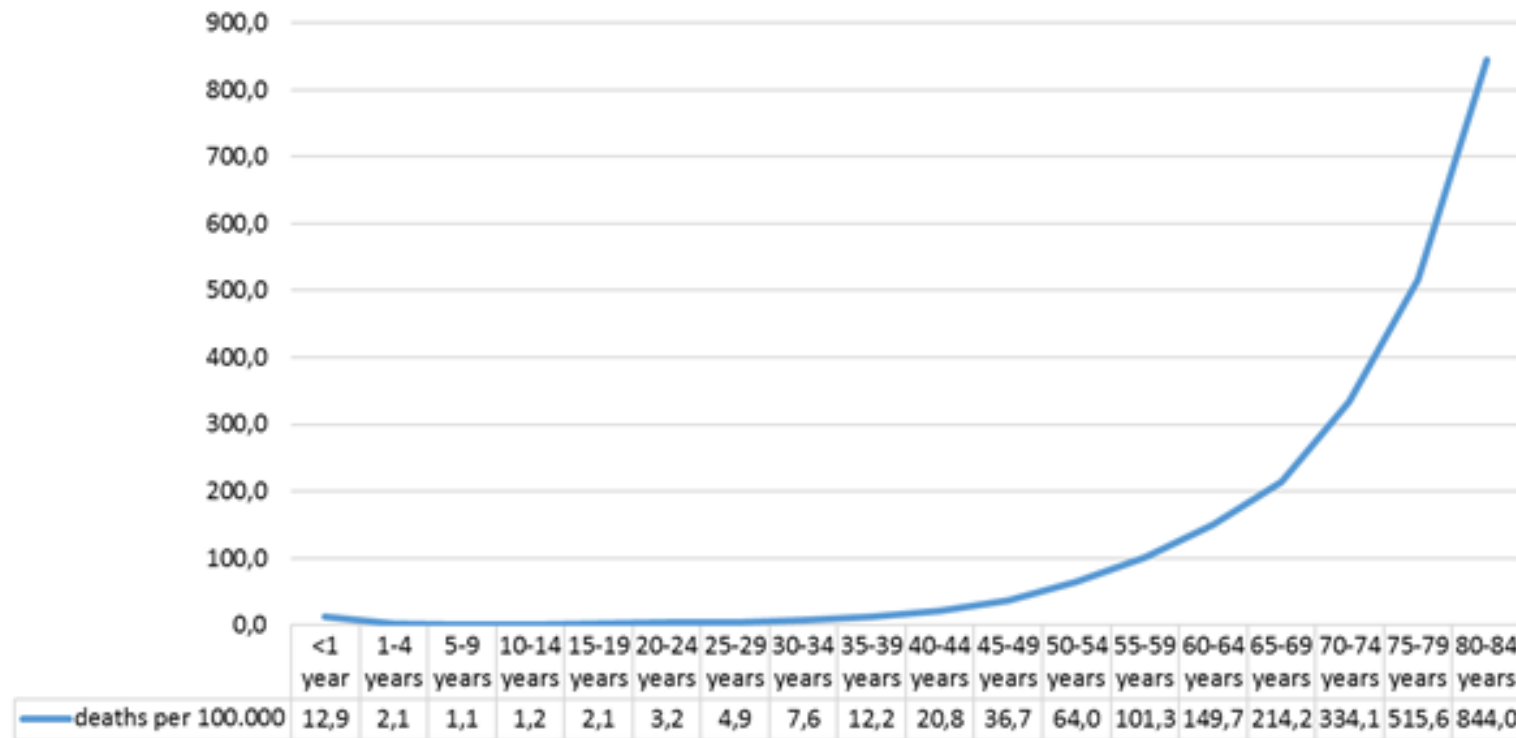
- Analysis of the epidemiological literature
 - the effect of aging on medical conditions that we found to have a high risk for total incapacitation
 - sudden death, cardiovascular conditions, stroke, syncope, seizures, migraine, acute psychosis, and nephrolithiasis.
- Analysis is predominantly based on the general population
- NB. pilots are found to be healthier and have a higher life expectancy compared to the general population

All card death	SMR 0.47	AMI Incidence	SIR 0.34
40-49 yrs	SMR 0.26	40-49 yrs	SIR 0.16
50-59 yrs	SMR 0.48	50-59 yrs	SIR 0.20
60-69 yrs	SMR 0.44	60-69 yrs	SIR 0.32
70-79 yrs	SMR 0.45	70-79 yrs	SIR 0.46
≥80 yrs	SMR 1.40	≥80 yrs	SIR 0.69

3. Risk factors for sudden incapacitation (results)

Sudden death

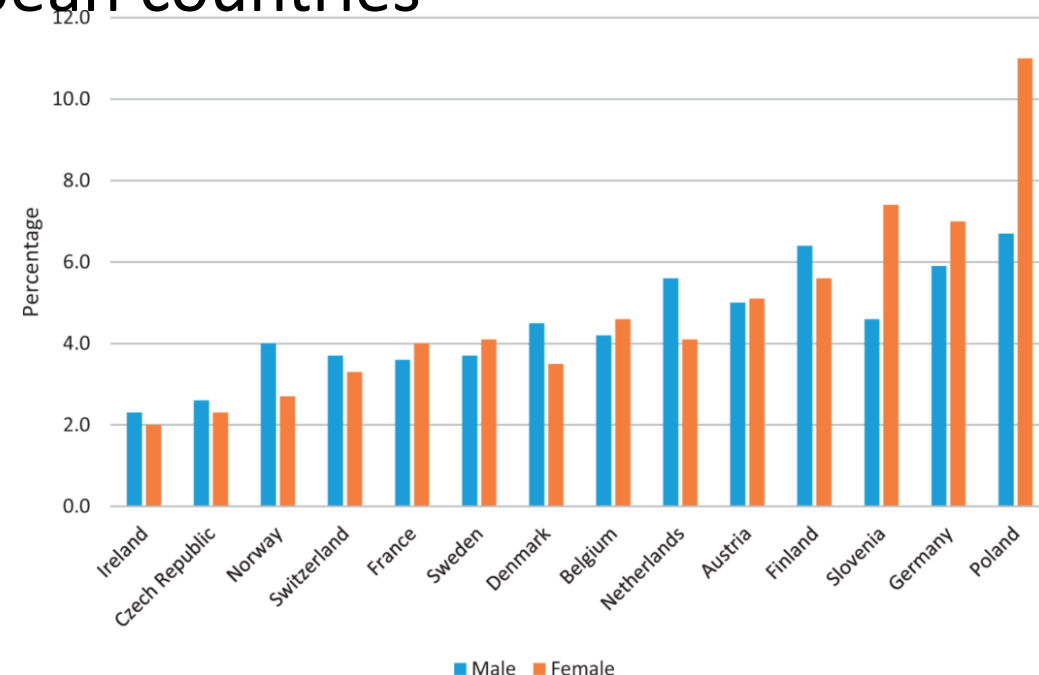
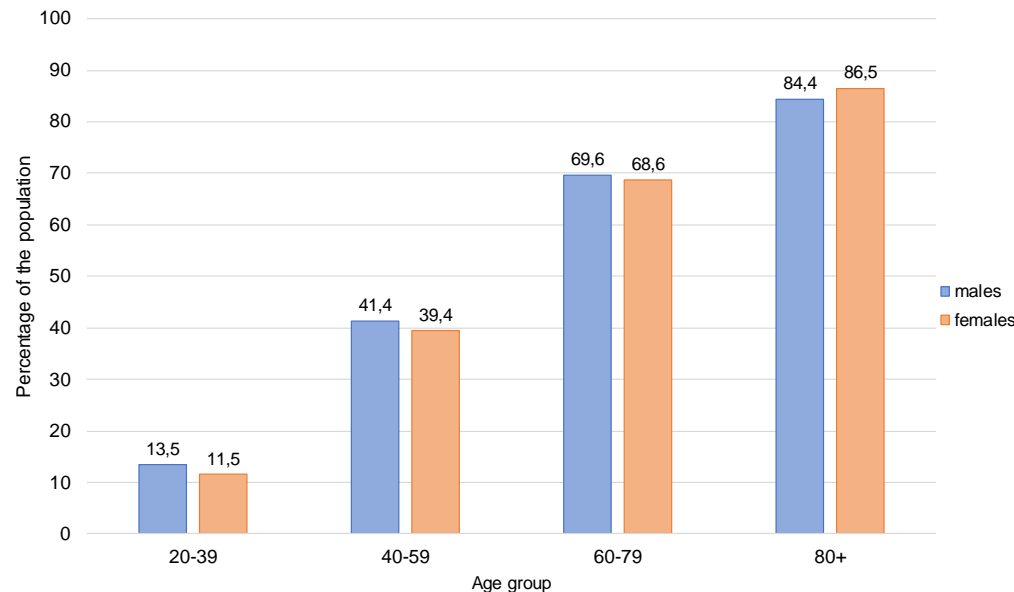
- Great majority of cases are caused by cardiovascular reasons
- The risk of sudden cardiac death increases exponentially with age



3. Risk factors for sudden incapacitation (results)

Cardiovascular risk

- Cardiovascular diseases remain a leading cause for morbidity/mortality
- Cardiovascular risk increases with age in the general population
- Risk is higher in central and eastern European countries



3. Risk factors for sudden incapacitation (results)

Stroke risk

- Is the second leading cause of death after ischemic heart disease (Benjamin et al., 2018).
- Recent decline in mortality due to timely treatment
 - the number of incidents of non-fatal IS events remained stable
- The incidence of (first-ever) ischemic stroke (IS)
 - increases between 50 and 65 years of age
 - increases sharply in the age cohorts of 65-74 years and beyond.



3. Risk factors for sudden incapacitation (results)

Syncope risk (loss of consciousness)

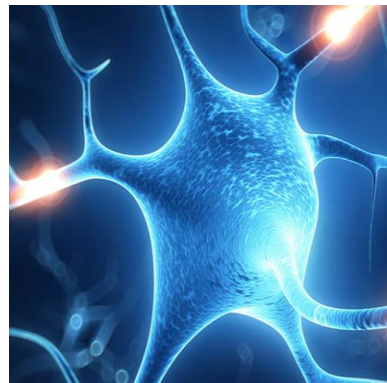
- caused by insufficient cerebral perfusion, resulting in a short loss of consciousness (average 12 seconds)
- incidence is difficult to estimate because many cases are not referred to medical care and/or are not registered
- Estimated annual incidence rate of 6% (Moya et al., 2009)]
 - highest prevalence between 10 and 30 years of age
 - significant increase in the incidence of syncope after 70 years of age



3. Risk factors for sudden incapacitation (results)

Neurological risk

- Grand mal, petit mal, absence
- all three forms of epileptic seizure cause incapacitation in the cockpit
- Age dependent
 - 30-40 cases per 100.000 in people aged 20-60 years
 - Increases to 100-170 cases in people >65 ((late-onset seizure(s)))
- Causes
 - vascular diseases, tumours, metastatic growths in the brain
 - Lack of sleep, alcohol abuse
- The risk increases with indications for cerebrovascular diseases



3. Risk factors for sudden incapacitation (results)

Psychiatric risk

- Most cases of acute psychosis arise in men under 30 and women under 35
- A second peak occurs in people over 60 years (Brugha et al., 2005).
 - Connection between degenerative brain processes and the onset of **non-affective psychosis** in older people
- Major depressive disorder can develop at any age
 - Rates differ between countries
 - Higher incidence rates for women
 - No evidence for an increased risk with age



Risk factors for sudden incapacitation (results)

Nephrolithiasis risk

- An acute renal stone can be totally incapacitating
 - Not frequently reported
- Prevalence differs widely between different countries and continents
- Most studies find an increase of the prevalence with increasing age

age	prevalence
20-29 yrs	3.1%
30-39 yrs	6.9%
40-49 yrs	9.8%
50-59 yrs	13.1%
60-69 yrs	19.1%

Scales et al., 2012



Discussion and conclusion Deliverable No. 1

- Moderate evidence for an increase in the incapacitation rate with age
- Most frequent age-dependent medical conditions that lead to grounding of pilot are cardiovascular, neurological, or psychiatric.
- This was also found analyzing the medical data provided by the NAA's
 - And the additional literature analysis of the general population
- It is appropriate to concentrate surveillance of pilots at greatest risk of cardiovascular and cerebrovascular medical events
 - especially those over the age of 50.
- Further implications and future directions regarding age limitations will be presented tomorrow.

Q&A