

DEEP BREATHS: PULMONARY ISSUES AND COMMERCIAL AIR TRAVEL

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OBJECTIVES

- Recognize the unique environment of commercial aircraft
- Be familiar with test options
- Have a framework assessment
- Understand hurdles with travel





WHAT IS AEROSPACE MEDICINE |

AEROSPACE MEDICINE CONCERNS THE
DETERMINATION AND MAINTENANCE OF THE
HEALTH, SAFETY, AND PERFORMANCE OF PERSONS
INVOLVED IN AIR AND SPACE TRAVEL.



AEROSPACE MEDICINE

- Part of Preventive Medicine
- Board certification available
- Two civilian training programs
- Military
- FAA training







MEDICAL CERTIFICATION

Nearly all pilots need a medical certification.

Exams done by Aviation Medical Examiners

Trained by the FAA

Usually straight forward

Delta Captain

30 years of experience

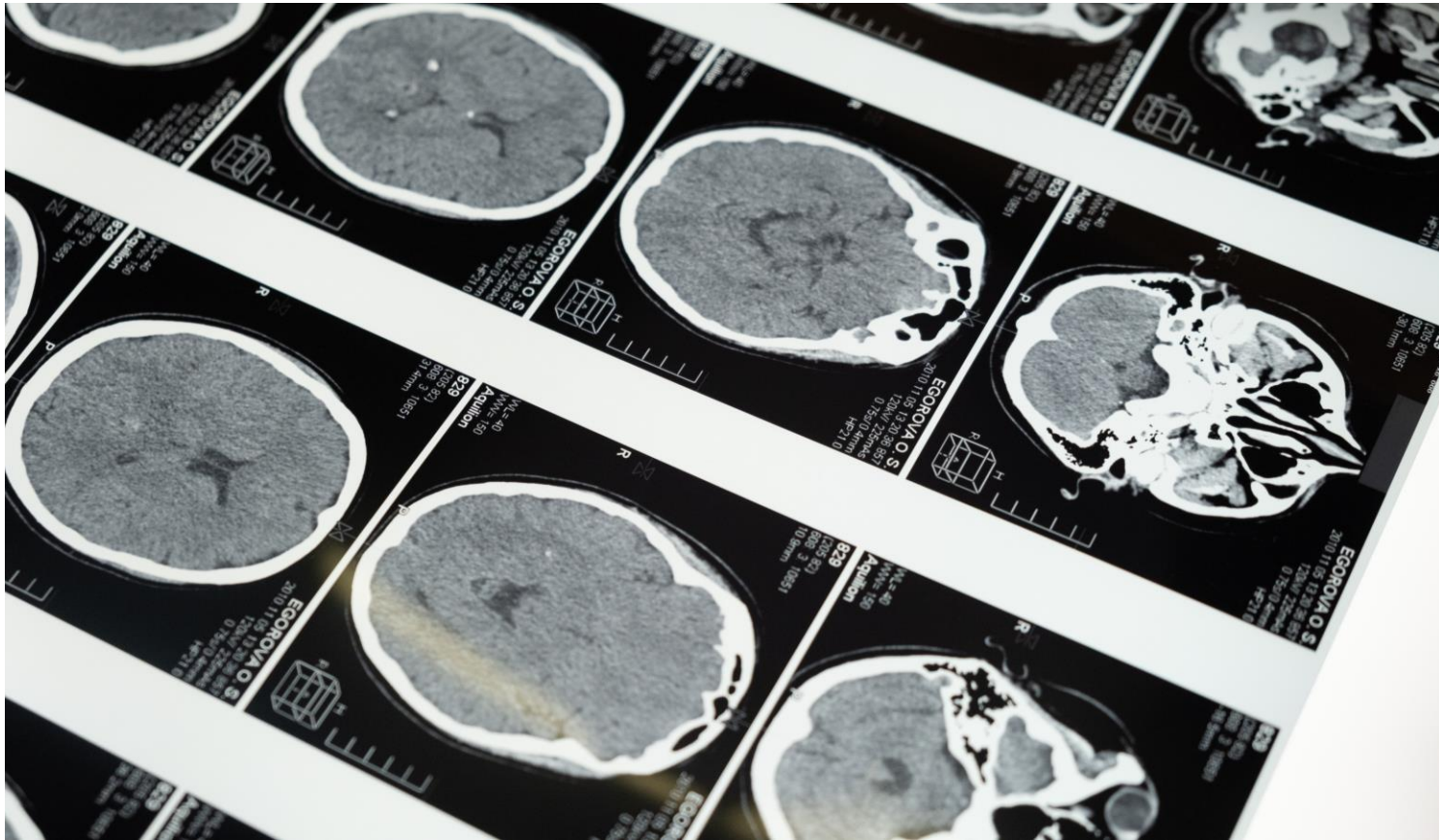
Bicycle crash

LOC for two minutes

DAY IN THE LIFE



CAN THE PATIENT RETURN TO FLIGHT?



- Brain imaging
- Inpatient video EEG
- Cardiac stress test
- Neuropsychological test
- Psychiatry consultation
- Medication review

DAY IN THE LIFE

DAY IN THE LIFE

Myocardial infarction

Mood disorders

ADD

Cerebrovascular accident

Alcohol and drug abuse



HISTORY OF AVIATION AT MAYO CLINIC

G-suit

M-1 anti-g straining maneuver

Oxygen masks

Emergency oxygen systems for Boeing





CABIN ENVIRONMENT



Mt. Everest

29,032ft - 67% Less Oxygen

Mt. Quandary

14,265ft - 42% Less Oxygen

Pikes Peak

14,115ft - 41% Less Oxygen

Colorado Springs

6,035ft - 21% Less Oxygen

Sea Level

0ft - 100% Oxygen



Thinner air

Better fuel efficiency

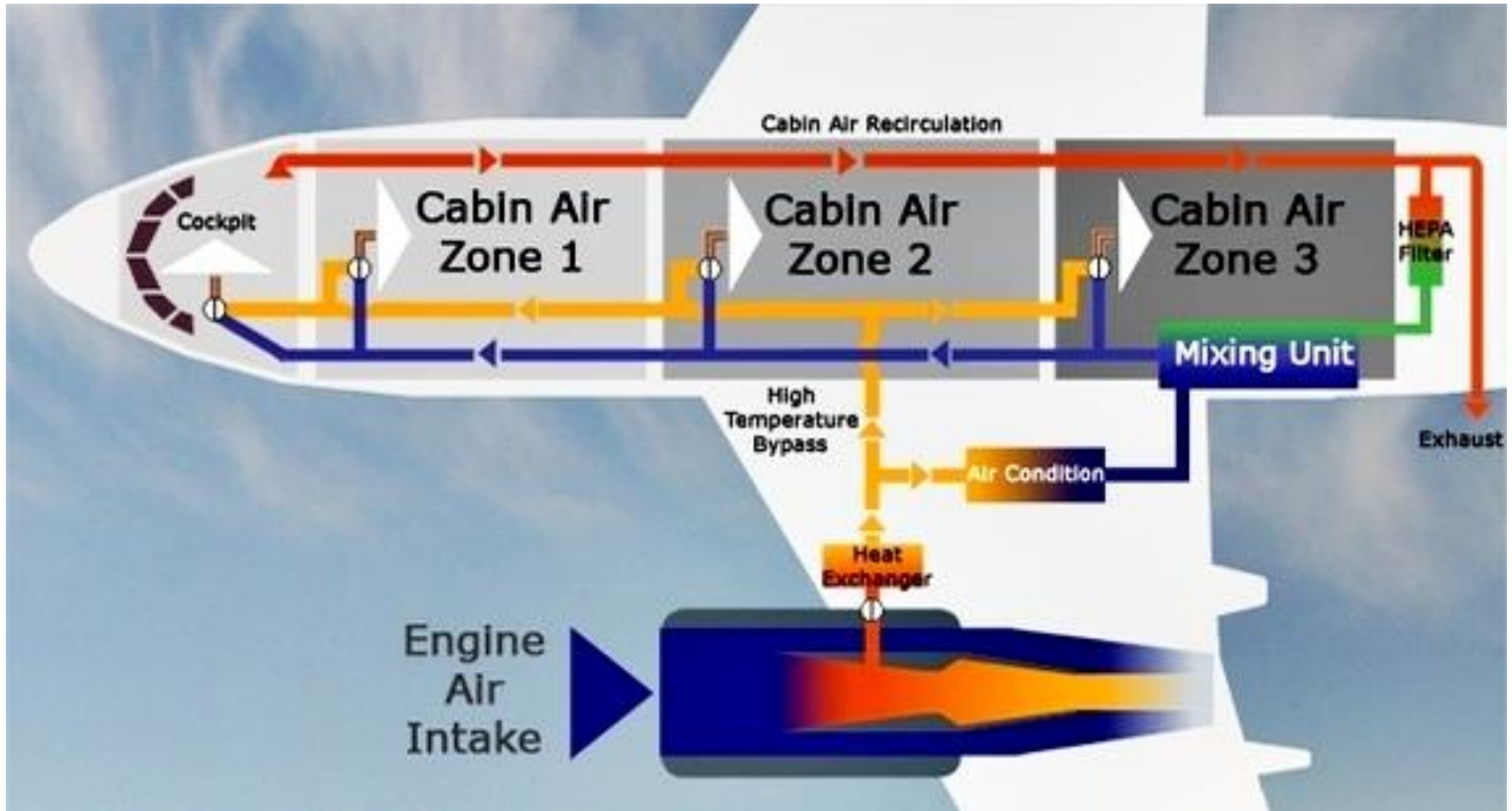
Avoid weather

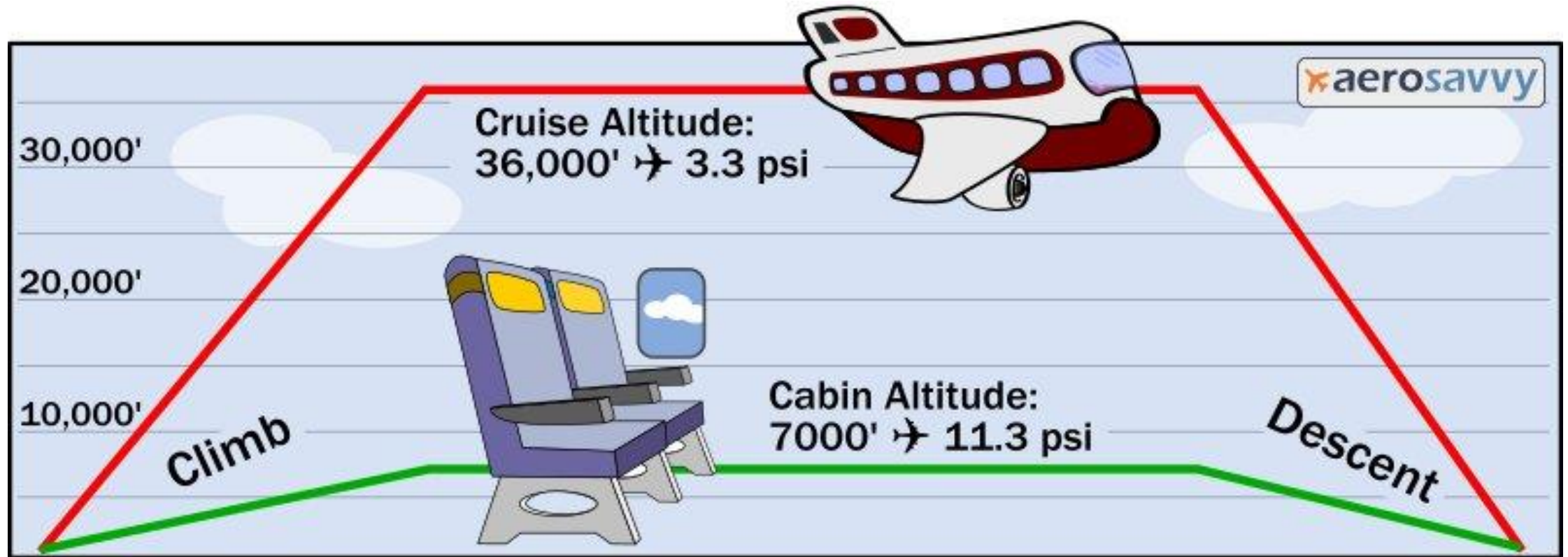
Avoid obstacles

Safety buffer

HIGHER IS BETTER







WHY NOT SEA LEVEL

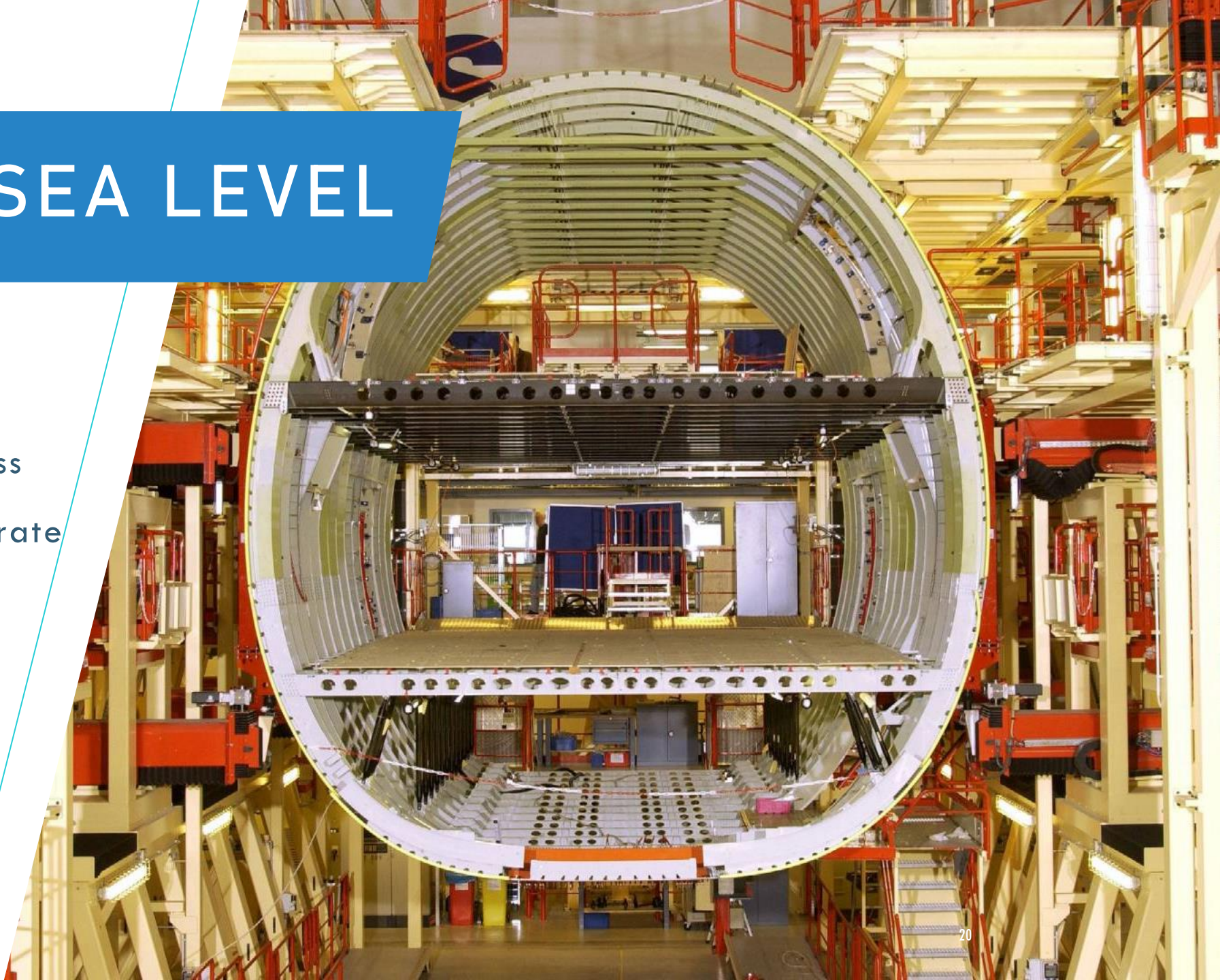
Think: Balloon

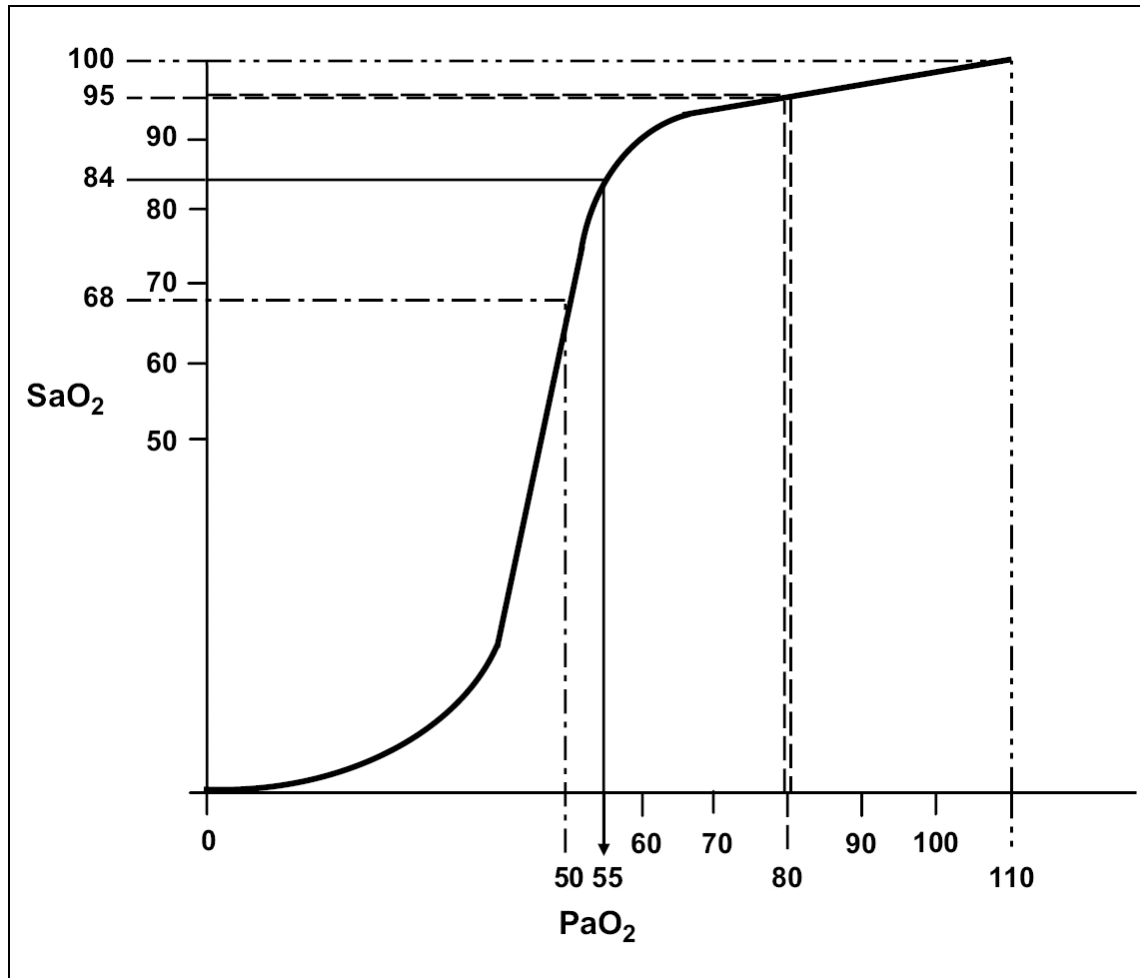
More metal to resist stress

More equipment to generate pressure.

More weight

More fuel





Oxygen-hemoglobin dissociation curve

WHY 8000 FT?



ASSESSMENT |

EMBRACE THE OTTER

Optimize

Trip

Test?

Evaluate

Resources





Symptoms?



Baseline exercise
capacity/stats



Treatment regimen



Recent exacerbations

OPTIMIZE



FLAGS

FEV1 <50%

Restrictive chest wall condition (VC <1L)

ILD with SpO2 \leq 95% or DLCO \leq 50%

Pulmonary HTN

Long term oxygen therapy or CPAP

Cancer involving lung



FLAGS

Cardiovascular comorbidities

Prior problems

Within ≤ 6 wks

Pneumothorax

PE/DVT

Hosp for resp condition



TRIP

Legs

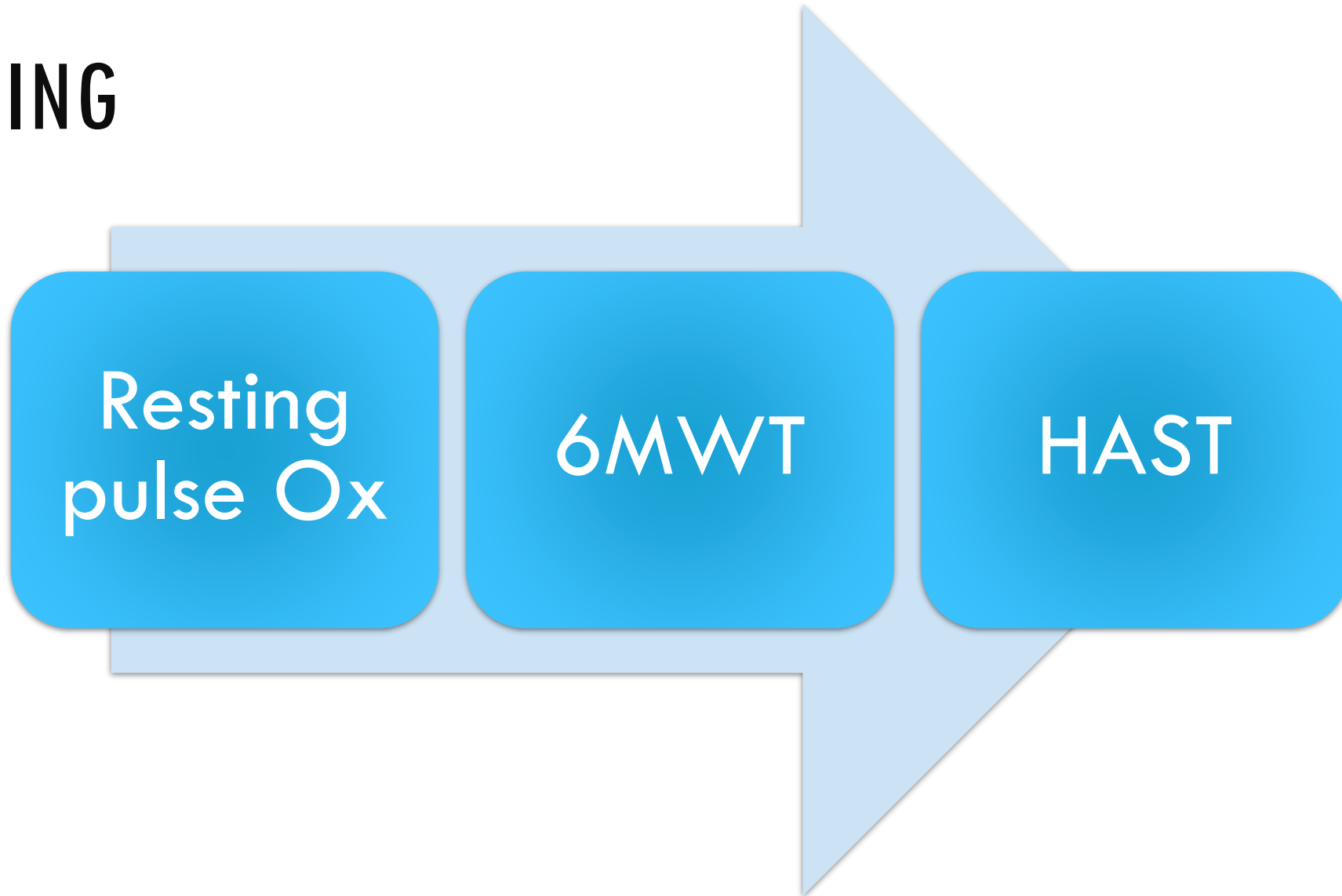
Length of flights

Layovers

Altitudes during and
at destination

Time away

TESTING





“

“WALK 50M/CLIMB 10-12 STEPS
WITHOUT DISTRESS”

NOT GOOD ENOUGH

”

RESTING OXIMETRY

SpO₂ ≥ 95%

- Likely no O₂
- 23% still had PaO₂ <50mmHg during flight
- Test still if:
 - MRC score ≥ 3 – 6MWT
 - Exertional dyspnea at sea level

SpO₂ 92 - 95%

- Empiric O₂
- 6MWT or HAST

SpO₂ ≤ 92

- 2L greater than baseline

6-MINUTE WALK TEST

Oxygen

- **Resting SpO₂ 92 – 95%**
- **SpO₂ \leq 84% on 6MWT**
- **Give O₂**

Go to HAST

- **Resting SpO₂ 92 – 95% & SpO₂ \geq 84% on 6MWT**
- **Resting SpO₂ \geq 95% & SpO₂ \leq 84%**

HYPOXIA ALTITUDE SIMULATION TEST

Breath 15.1% oxygen (simulate 8000 ft)

- Mix nitrogen and oxygen
- 40% venturi mask with nitrogen as the driving gas

Monitor ECG and pulse ox

Arterial blood gas

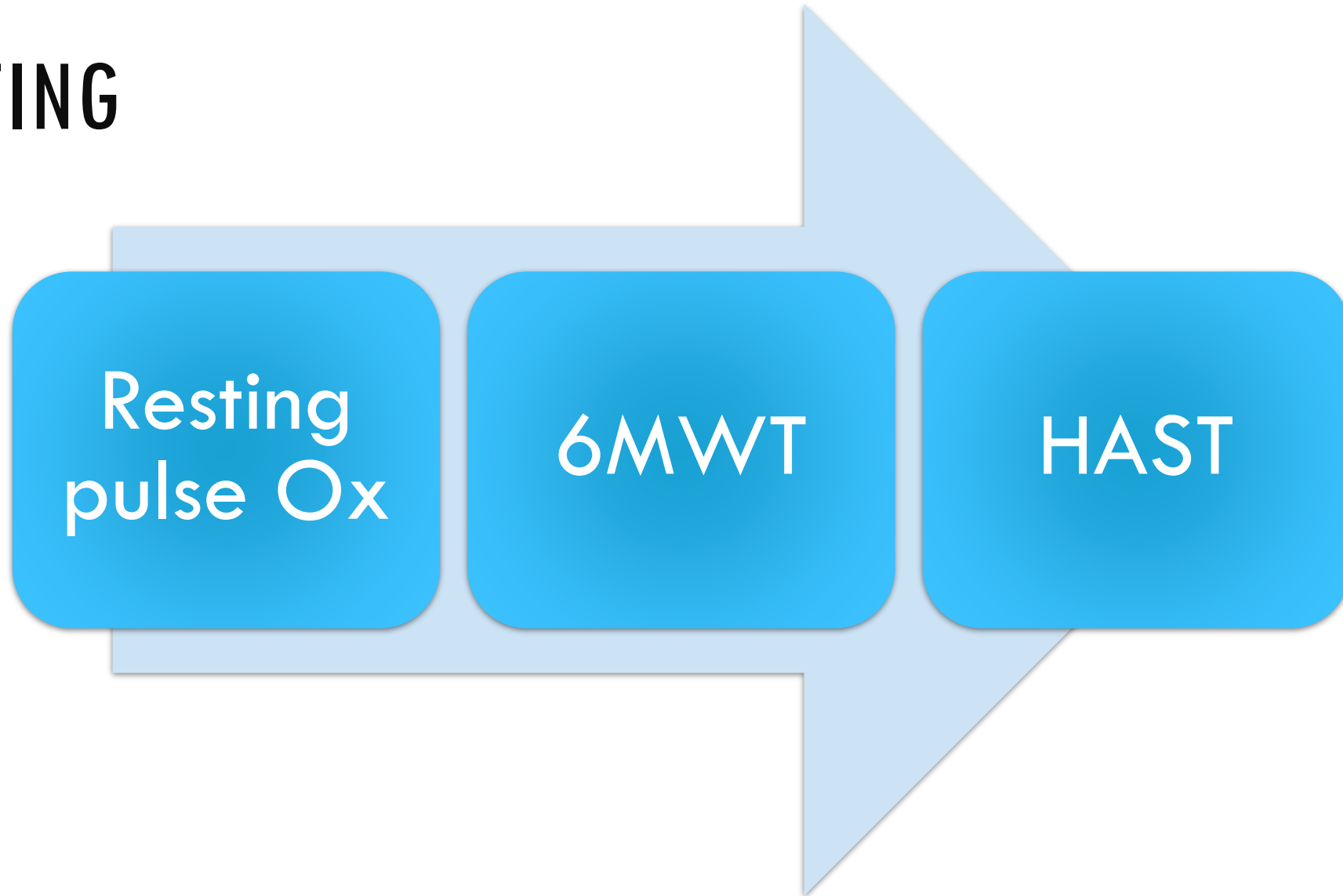
Can titrate O₂ supplementation for SpO₂ ≥ 88%

Can simulate exertion

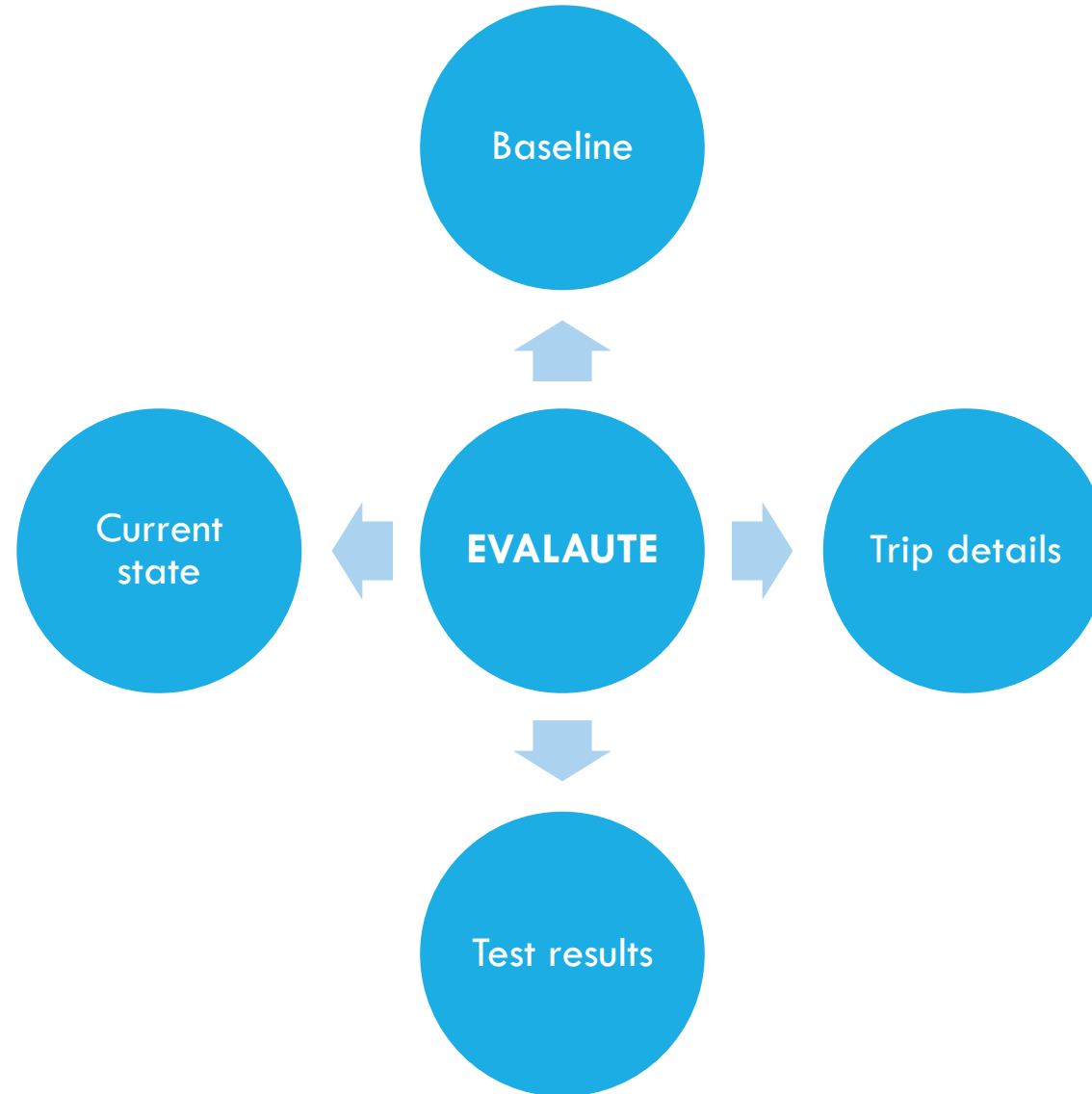
Normobaric test



TESTING



EVALUATE



RESOURCES - MEDICATIONS

Get necessary refills

Don't put meds in checked luggage

Airline rescue meds are rarely available

In 2021

- 5700 guns confiscated at TSA
- Most loaded



RESOURCES - OXYGEN

Each airline unique

Delta

- No supplemental oxygen

United

- Select routes, except currently

British Airlines

- Can use oxygen cylinders

RESOURCES - OXYGEN

No liquid oxygen

Not free

- United: 150\$ per flight segment

Arrange at least 48 hours prior

Medical provider forms

3 THE MACHINE REMOVES THE NITROGEN

2 THE MACHINE COMPRESSES THE OXYGEN

4 THE MACHINE PROVIDES PURIFIED AIR

1 THE MACHINE DRAWS IN AIR FROM THE ENVIRONMENT



RESOURCES- OXYGEN

POC/CPAP

- May or may not use plug
- Battery that will last 150% of flight time
- Battery approved for travel
- DC Power adapter
- Fit in overhead or under seat
- “May need to be checked”



PLAN AHEAD



SPECIFIC DISEASE CONSIDERATIONS |

COPD

- Sea level sats alone do not predict HAST outcome
- HAST does not predict inflight sx
- Worry about cardiac comorbidities
- Test if:
 - $\leq 95\%$ resting SpO₂
 - MRC >3
 - $\leq 84\%$ 6MWT
 - Worried about hypercapnia

AG R, J L, JA I. Using laboratory measurements to predict in-flight desaturation in respiratory patients: are current guidelines appropriate? *Respiratory medicine*. 2008 Nov 2008;102(11)doi:10.1016/j.rmed.2008.05.005

ASTHMA

Most with mild/mod disease ok

Caution with severe

Sea level sats not predictive

- 37 adults with severe asthma
- 57% needed inflight O₂ by HAST
- 2/3 had SL sats \geq 95%

INTERSTITIAL LUNG DISEASE

UK Flight Outcomes Study

- 186 patients
- Sea level SpO₂ nor FEV₁ not predictive

Test if:

- SL PaO₂ \leq 9.42 kPA OR
- TLCO \leq 50%

RK C, RJ S, MR P. Is air travel safe for those with lung disease? *The European respiratory journal*. 2007 Dec 2007;30(6)doi:10.1183/09031936.00024707



OSA

2015 hypobaric chamber study

10 patients

↑ AHI (11 vs 2)

↑ Hypoxemia (88% vs 93%)

↓ Sleep time (349min vs 393min)

Improved with CPAP

K N, MJ L, TV C, et al. Effects of positive airway pressure on patients with obstructive sleep apnea during acute ascent to altitude. *Annals of the American Thoracic Society*. 2015 Jul 2015;12(7)doi:10.1513/AnnalsATS.201411-506OC



OSA

2018 UK Study

394 survey responses (53% response rate)

1/3 reported troubles using CPAP in flight

Power cord too short most common issue

99 overnight flights

50 flights: no reported sleep

49 flights: no use of CPAP

R B, O J, P C-J, S F. Travel with CPAP machines: how frequent and what are the problems? *Journal of travel medicine*. 01/01/2018 2018;25(1)doi:10.1093/jtm/tax085

PEDIATRIC THOUGHTS

Term (>37 weeks)

- 1 week delay before flight

Preterm and not at delivery date

- require oxygen

<1 yr with resp disease

- Test if able
- <85% SpO₂ – O₂ available

INFECTIONS FROM FLYING

- 2016 systematic review
 - Influenza
 - Secondary attack rate of 7.5%
 - 42% sitting within two rows of index case
 - Not associated
 - Length of flight
 - Number of sick individuals

K L, C A. Review Article: Influenza Transmission on Aircraft: A Systematic Literature Review. *Epidemiology (Cambridge, Mass)*. 2016 Sep 2016;27(5)doi:10.1097/EDE.0000000000000438

INFECTIONS FROM FLYING

- 2021 review
 - SARS-COV-2
 - 18 studies
 - Low quality
 - Secondary attack rate 0-8.2%

EC R, C H, EA S, et al. Transmission of SARS-CoV-2 associated with aircraft travel: a systematic review. *Journal of travel medicine*. 10/11/2021 2021;28(7)doi:10.1093/jtm/taab133

INFECTIONS FROM FLYING

Top to bottom air flow

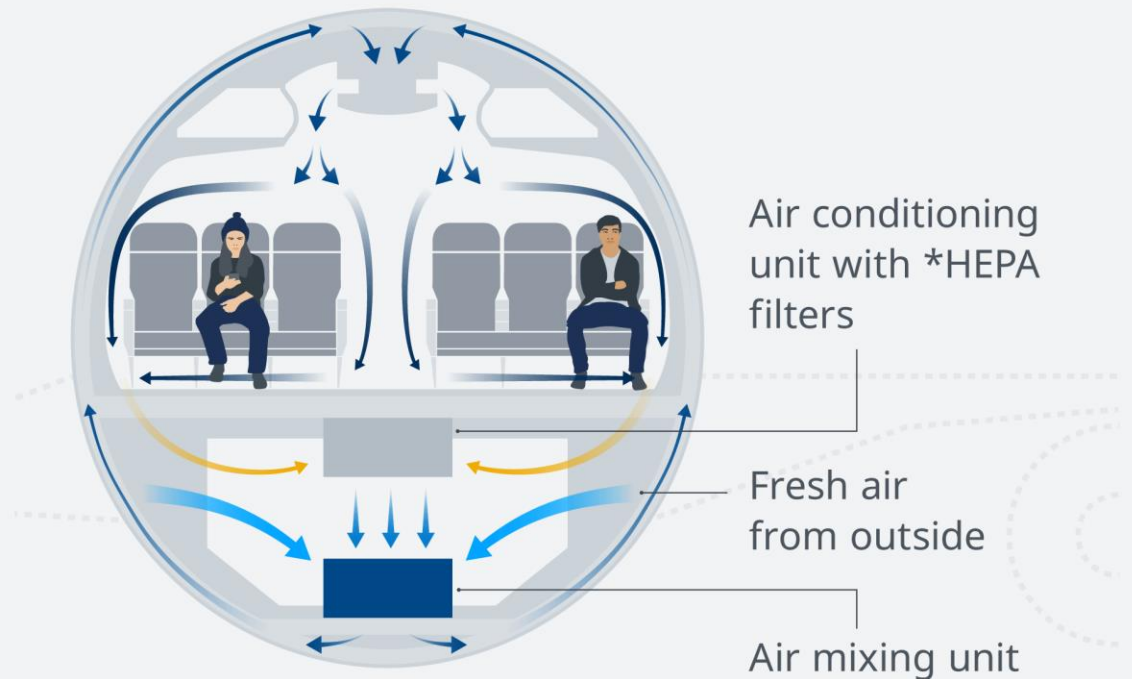
HEPA filtration

High exchange rate

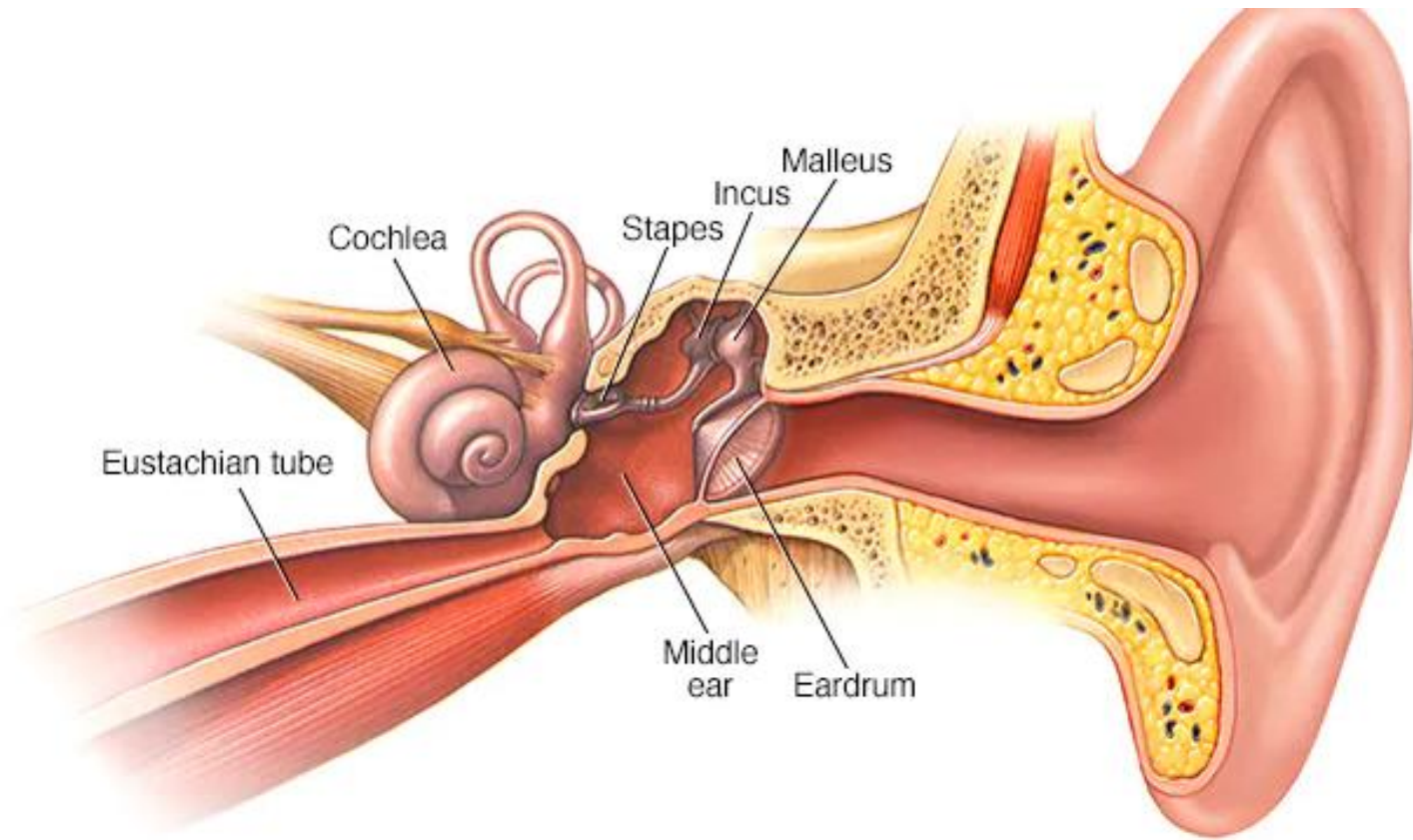
Cleanest air

Except when on the ground

How air circulation works on a plane



Source: IATA; *High-Efficiency Particulate Air

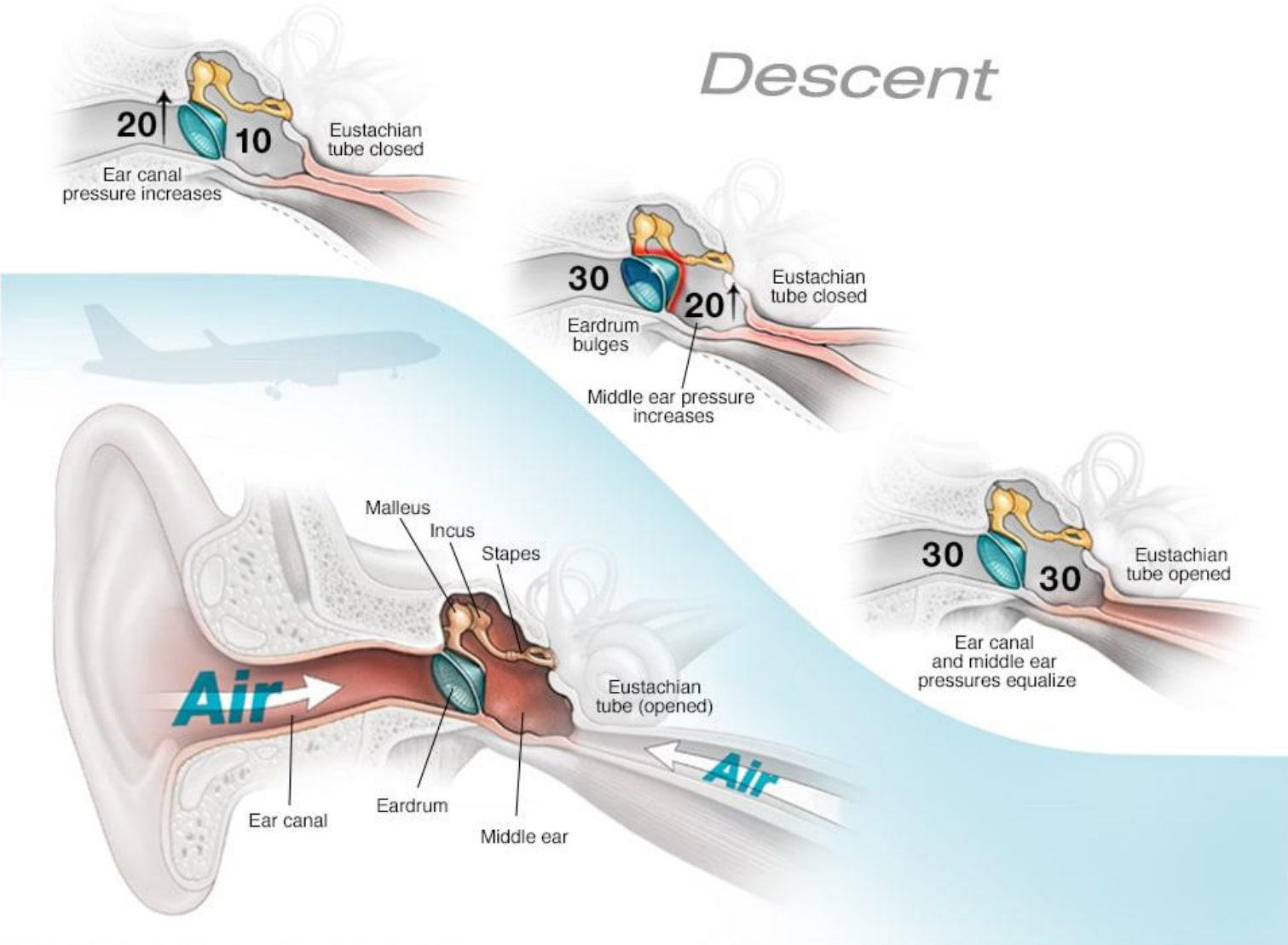


Caution URI

Airplane ear (aka)
barotrauma

FLYING WITH INFECTIONS

Descent



AIRPLANE EAR — SYMPTOMS

- Pain/stuffiness/trouble hearing
- Ringing
- Vertigo
- Bleeding

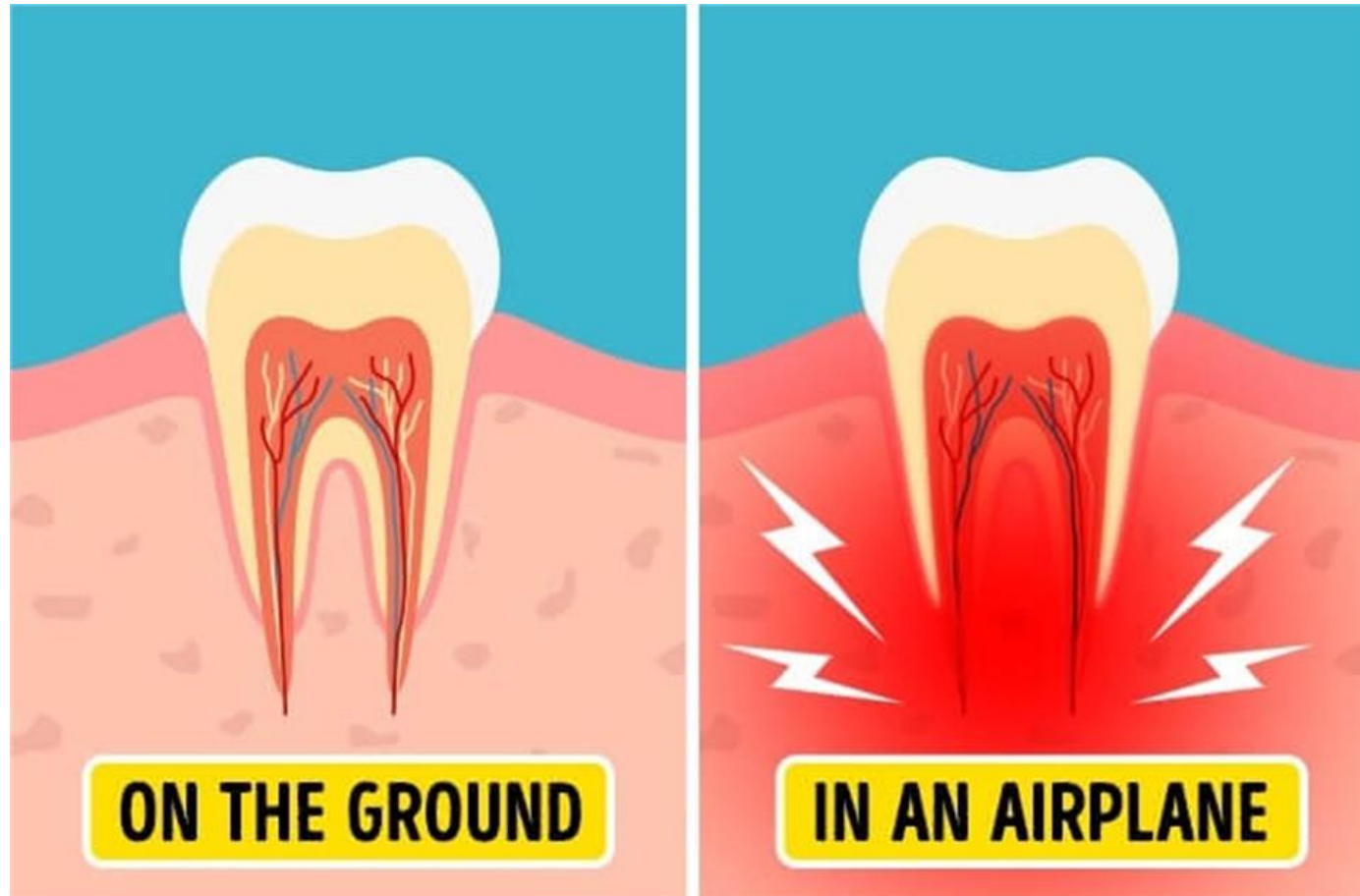
AIRPLANE EAR — RISK FACTORS

- A small eustachian tube
- URI
- Middle ear infection (otitis media)
- Hay fever (allergic rhinitis)
- Sleeping during ascent and descent

AIRPLANE EAR — PREVENTION

- Yawn and swallow
- Valsalva
- Nasal spray 30 min before take off and landing
- Allergy meds
- Filtered earplugs
- Decongestants cautiously

TOOTH SQUEEZE





STRESS CONSIDERATIONS







THE FRIENDLY SKIES

PREPARE FOR ANXIETY

- Best laid plans hardly work with air travel
- Educate patients on possible stress situations
- Provide resources/strategies for management

IS IT JUST ME?

2016 Malaysia Study

- 182 primary care providers
- 11.5% felt confident to assist
- Avg score on knowledge test: 45%

2019 Turkey study

- 242 pulmonologist
- Only 31% warned patients about air travel
- 16.2% correct on knowledge tests

WL N, N A. Knowledge, confidence and attitude of primary care doctors in managing in-flight medical emergencies: a cross-sectional survey. *Singapore medical journal*. 2020 Feb 2020;61(2)doi:10.11622/smedj.2020016

B E, H A, M A. Are pulmonologists well aware of planning safe air travel for patients with COPD? The SAF COP study. *International journal of chronic obstructive pulmonary disease*. 08/22/2019 2019;14doi:10.2147/COPD.S210854

SUMMARY

- The cabin environment during commercial flight is not at sea level.
- Test in a systematic fashion
- No, not everyone needs HAST
- Plan ahead
- Consider overall trip.
- Flying sucks, so expect exertion and stress

THANK YOU!



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