The Wilderness and Chronic Illness



Tom DeLoughery, MD MACP FAWM

Oregon Health & Sciences University

@bloodman

GENERAL HEMATOLOGY

OHSU

DISCLOSURE

Relevant Financial Relationship(s)

Speaker Bureau - None

Consultant/Research – none

Content Expert:

- **UpToDate: Iron deficiency**

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The Issue

- Increasingly people with chronic illness want to do adventure travel and be out in the wilderness

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The Issue

- Nepal Trekkers
  - 47% over 50
  - HTN 9%
  - Asthma 5%
  - Diabetes 2%

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Our Goal

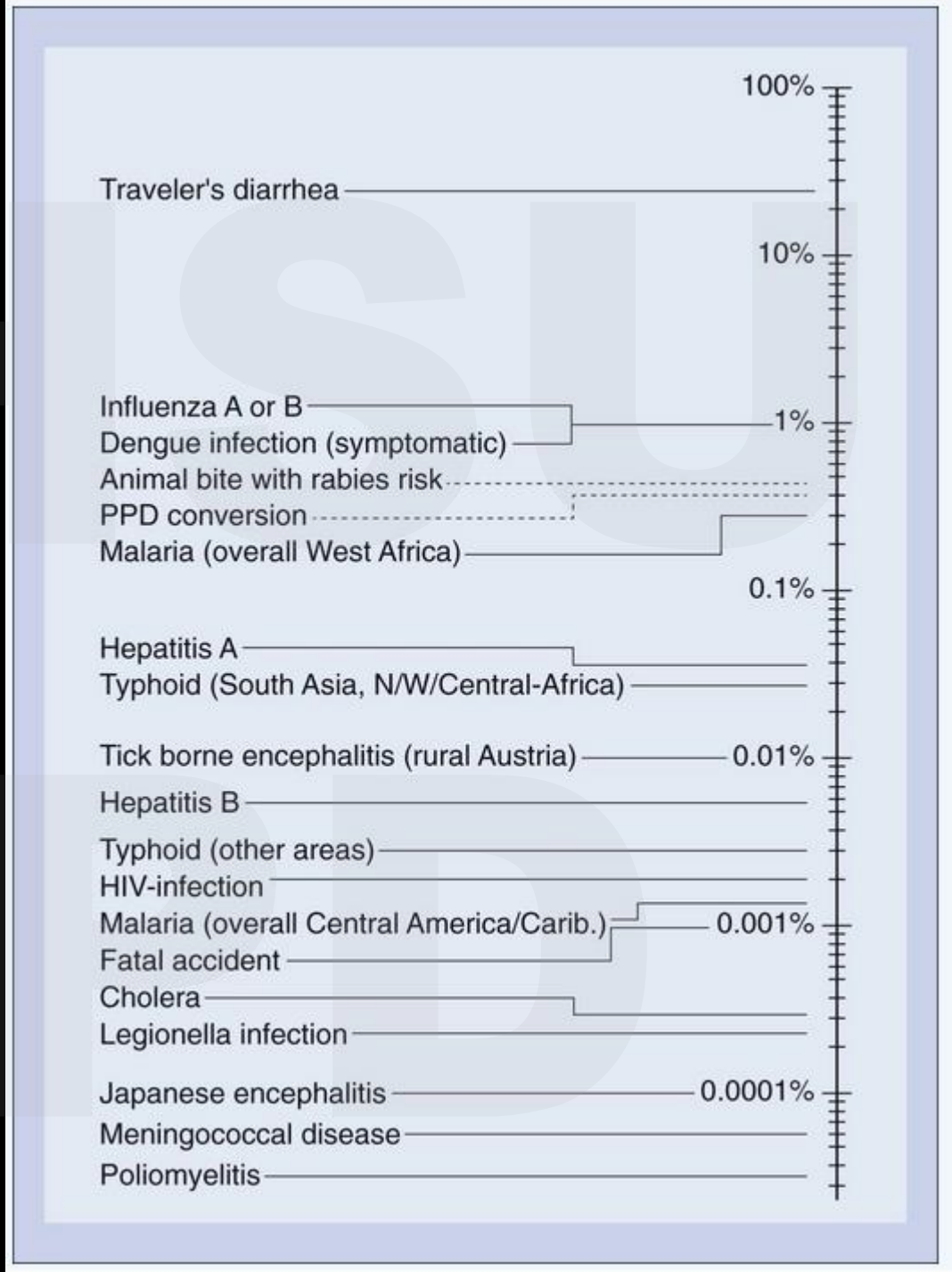
- Review common medical issues
- Review several “environments”

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Common Things are Common!

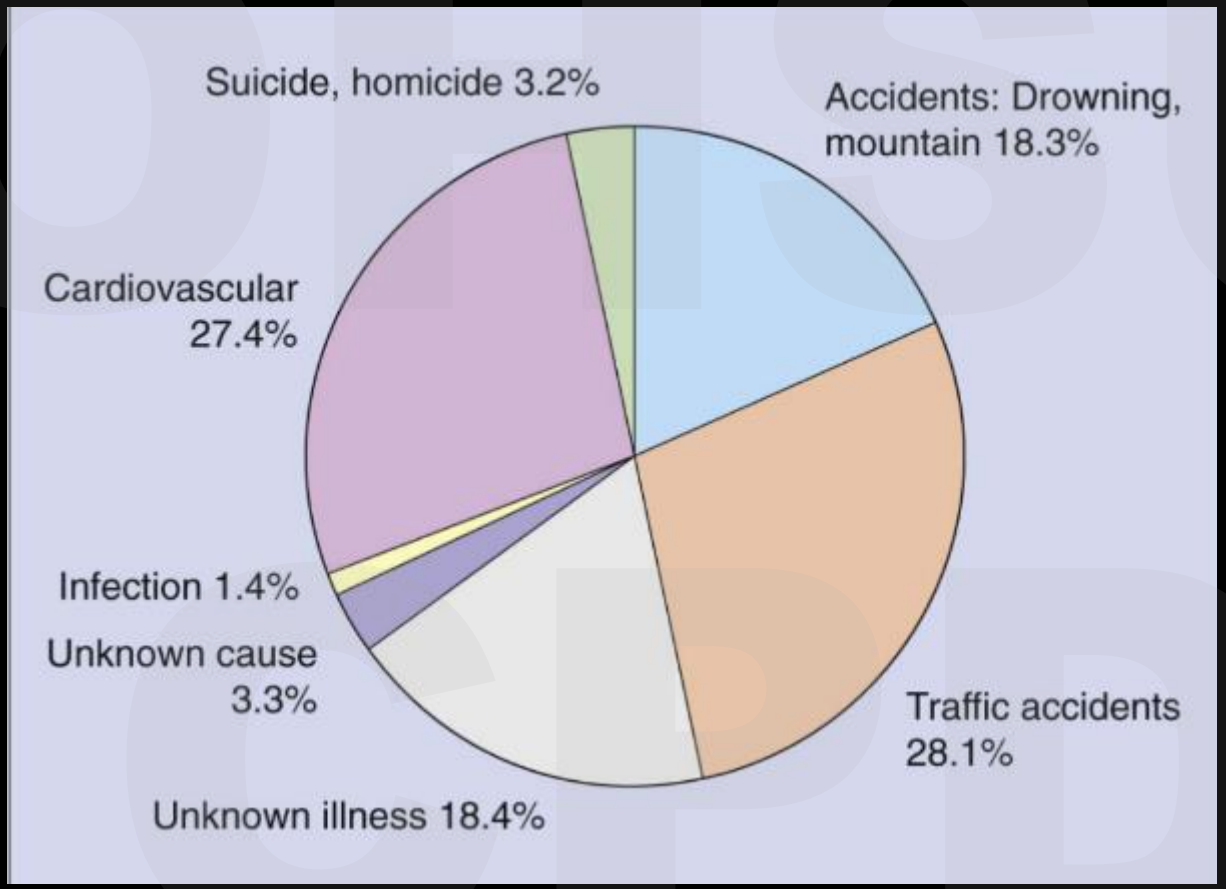
- Common diseases
  - Travelers' diarrhea
  - Respiratory infections
  - Urinary tract infections

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Keystone, Travel Medicine 2014

Cause of Travel Death



Keystone, Travel Medicine 2014

Trauma

- Most common cause of travel related deaths
- Motor vehicle accidents leading cause of trauma
  - Avoid driving
  - Seat belts
  - Try to find sober drivers

Travel Questions

- Environmental Risks?
  - Heat, hypoxia, etc
- Stability of disease process
- Treatment needed to control disease

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Common Concepts

- Underlying disease needs to be in control!
- Need to bring extra medication
  - If vital to life keep extra separate
- Need to be back-up of any devices especially batteries



Asthma

- Biggest predictor of exacerbations is poor control before travel
- Risk factors for exacerbations
  - Allergens
  - Cold
  - Exercise
  - Poor air quality

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Exacerbations

- 1-6% participants in adventure races seen for asthma exacerbations
- 3% of National Park medical incidences
- Prospective study
  - 43% with exacerbations
  - 37% worst one
  - 13% life threatening

Tips

- Good supply of rescue inhalers
- Weeks worth of steroids
- If asthma not well controlled inhaled steroids
- Should not travel if poor control

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Table 1. Simplified categorization scheme for the degree of asthma control

Variable	*Well-controlled*	*Not well-controlled*	*Very poorly controlled*
Symptoms	≤2 days per week	>2 days per week	Throughout the day
Nocturnal awakening	≤2 times per month	1–3 times per week	>4 times per week
Interference with normal activity	None	Some limitation	Extremely limited
Frequency of SABA use[a]	≤2 days per week	>2 days per week	Several times per day
FEV_1 or PEF	>80% predicted or of personal best	60–80% predicted or of personal best	<60% predicted or of personal best

FEV_1, forced expiratory volume in 1 second; PEF, peak expiratory flow.

Adapted from National Heart, Lung, and Blood Institute, National Asthma Education and Prevention Program. Expert Panel Report Guidelines for the Diagnosis and Management of Asthma: full report 2007. Available at: http://www.nhlbi.nih.gov/guidelines/asthma/asthgdln.p Accessed October 16, 2013.

[a] Refers to use of short-acting bronchodilators (SABA) for symptom relief and not for pre-exercise use for prevention of exercise-indu bronchoconstriction.

Wilderness Environ Med. 2014 Jun;25(2):231-40

COPD

- Mild (FEV_1 > 80%) – no major issues
- Others – careful evaluation
- CO2 retention, right heart failure – no exertion beyond baseline

Oxygen Dependent COPD

- Portable oxygen concentrator only option for air travel
- Need to check with airlines before travel
- Bring extra batteries
- Better than cylinders for travel

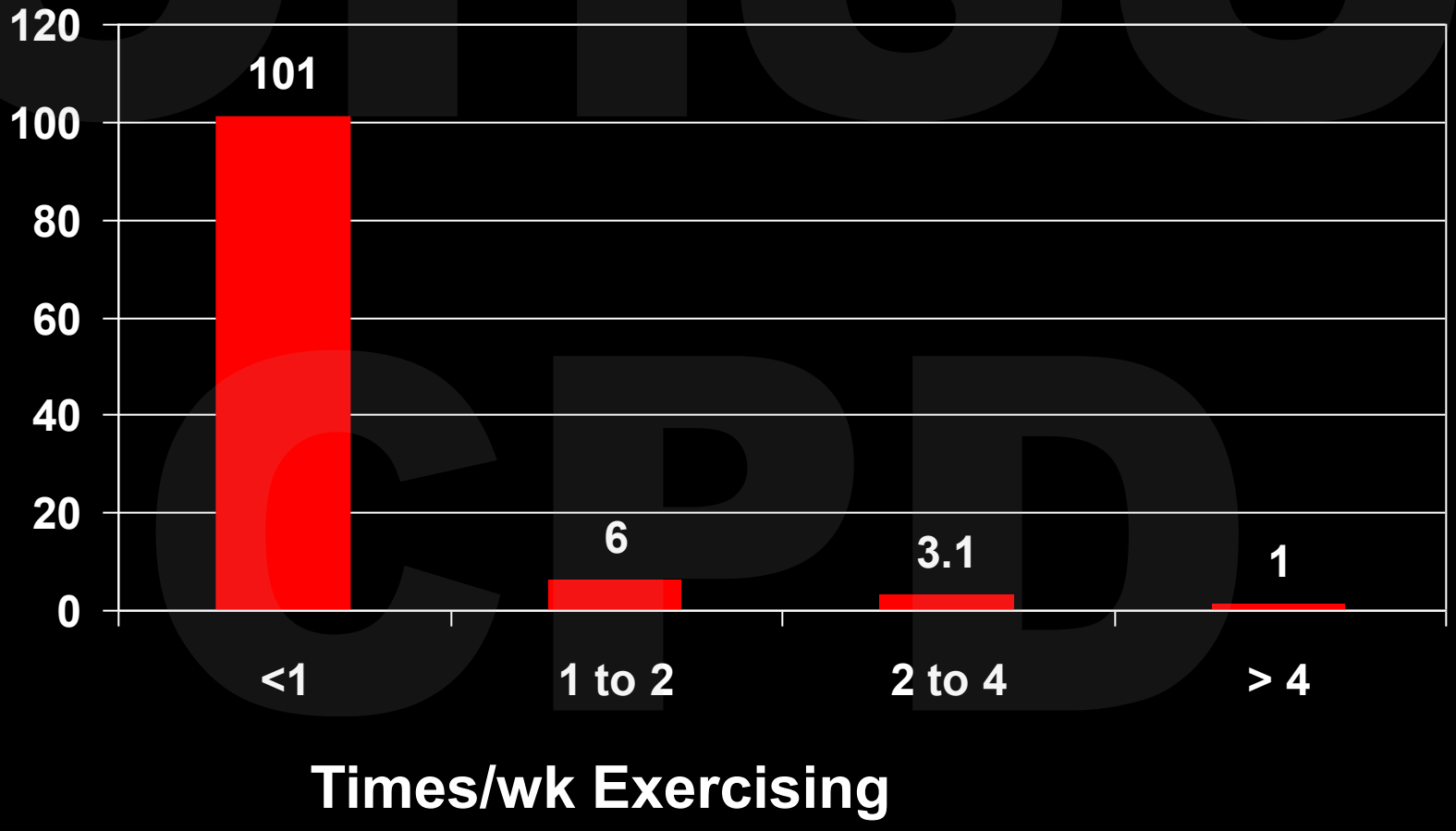


Cardiac Disease

- Leading killer of men and women in USA
- Most common cause of air travel deaths
- Paradox of exercise
  - 50-100 more times likely to have MI during exercise
  - Overall dramatic decrease in MI incidence and death in active people

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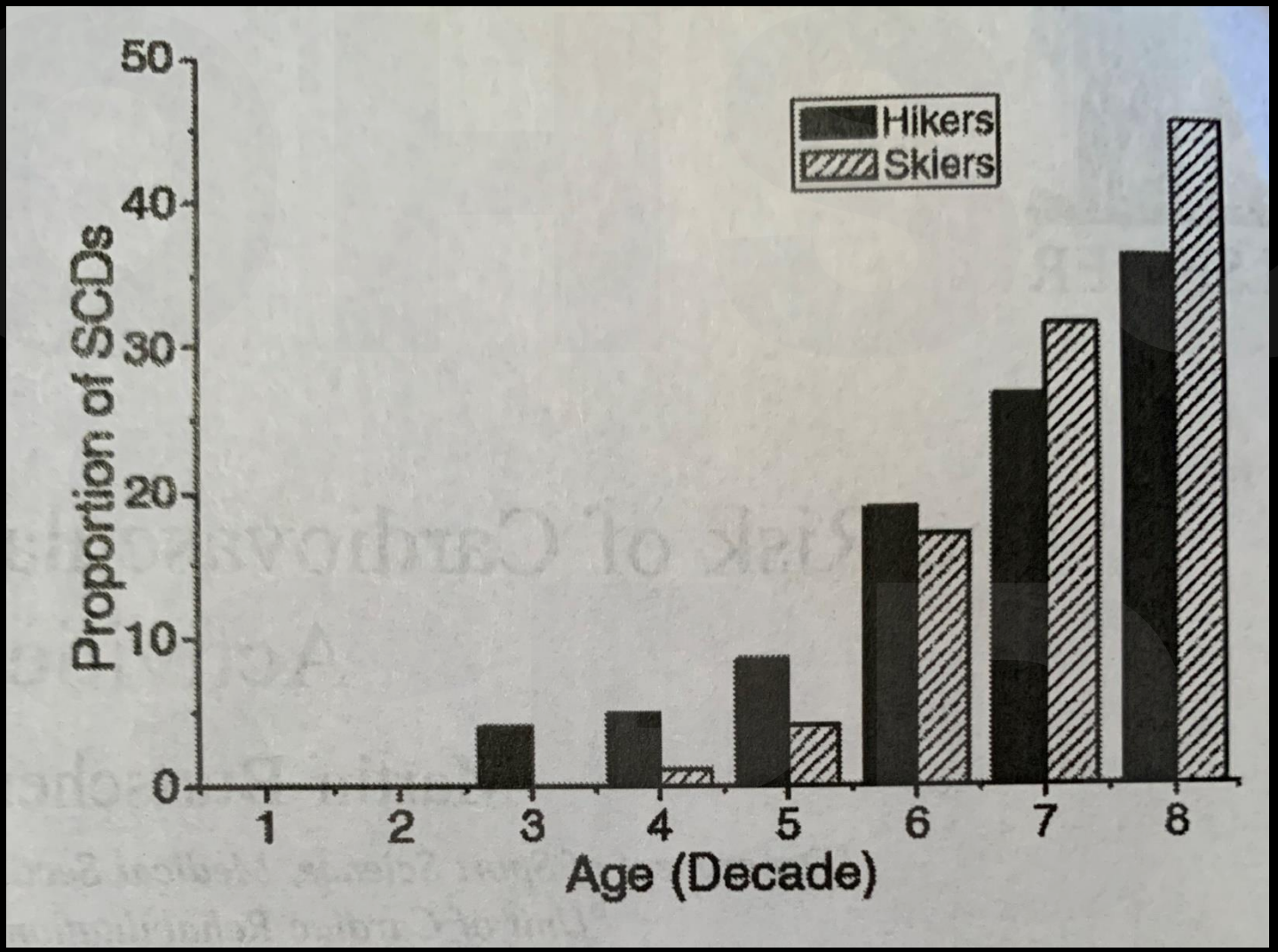
RR of MI during Exercise



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Sudden Death

- ~ 1:1,630,000 hr of skiing
- 50% death first day hiking/skiing
  - 8-30x baseline risk
  - Sudden increase in activity
- Risk factors: hx MI, CAD, hypertension


Hikers
Skiers
Proportion of SCDs
50
40
30
20
10
0
1
2
3
4
5
6
7
8
Age (Decade)

Sudden Death

- 1:780,000 hiking hrs
- 1:700,000 marathon hrs
- 1:1,630,000 skiing hrs
- 1:5,000,000 hiking club members

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Cardiac Disease: Considerations

- Asymptomatic patients
  - Understand level of activity on trip
  - If matches current activity no problem
  - If not patient needs conditioning
    - Exercise stress testing only for selected patients

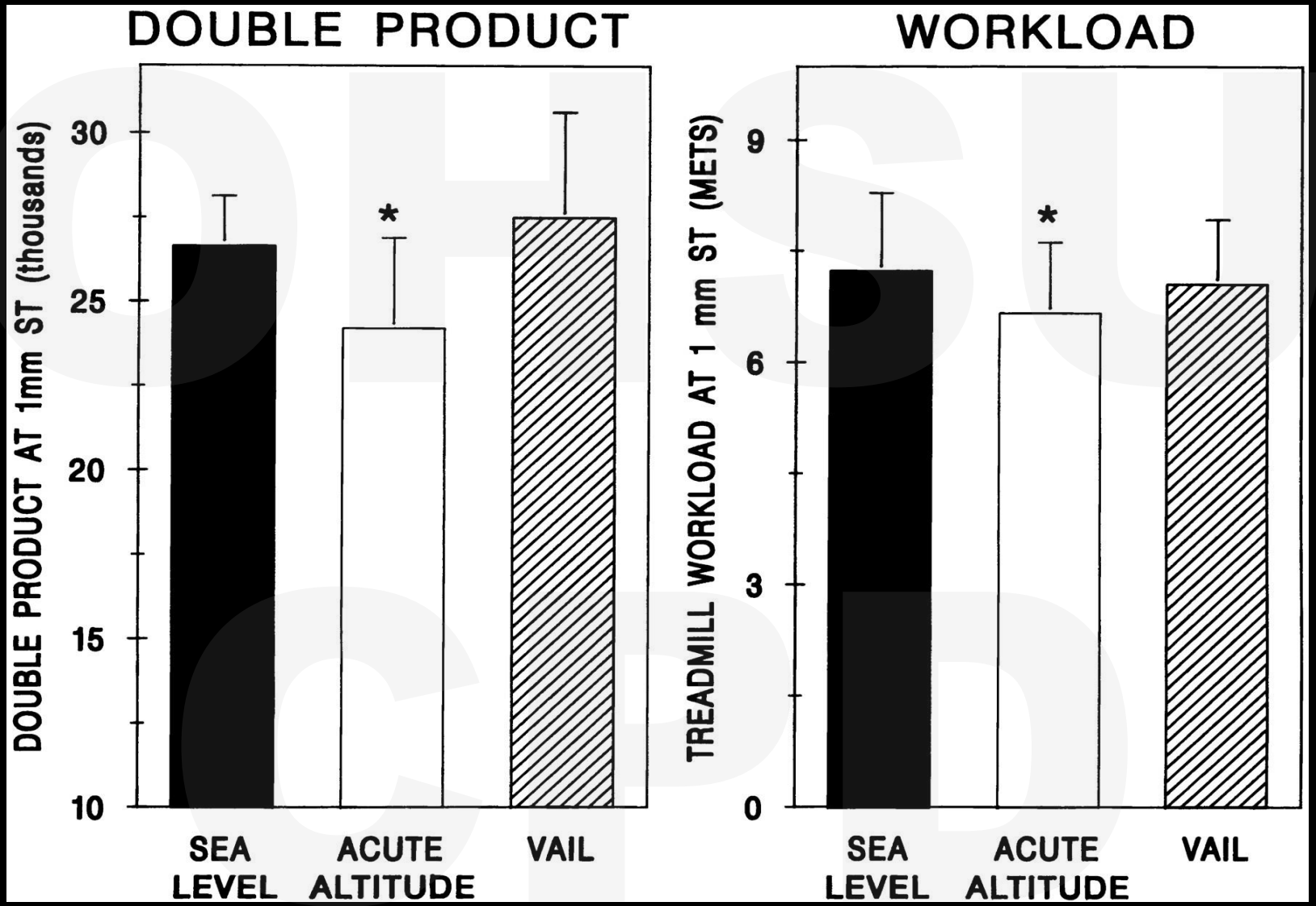
Erb Classification

- Extreme Performance Ventures
  - Climbing 8000m peaks
- High Performance Ventures
  - Altitude trekking
- Recreational Activities
- Therapeutic Activities

Pre-Existing Cardiac Disease

- Low incidence of problem at altitude
  - Amazing cardiac compensation for altitude
- No problems if activity consistent with baseline activity
  - Patient should not exert themselves first 3 days at altitude

2500 m acute vs 5 days at Vail



Circulation. 1997 Aug 19;96(4):1224-32.

Contraindication to Air Travel for Patients with Cardiac Disease

Table 1. **Contraindication to Air Travel for Patients with Cardiac Disease***

Myocardial infarction within previous 2 weeks
Angioplasty or intracoronary stent placement within previous 2 weeks
Unstable angina
Coronary artery bypass grafting within previous 3 weeks
Poorly compensated heart failure
Uncontrolled ventricular or supraventricular arrhythmias

* For more information, see references 10, 17–23.

Possick, S. E. et. al. Ann Intern Med 2004;141:148-154

Heart Failure

HF severity level	Recommendations
All HF patients	Carefully evaluate HF co-morbidities (e.g. pulmonary hypertension, anaemia, sleep apnoea) Carefully evaluate HF drugs (in particular diuretics, potassium supplementation, and β blockers). Whenever possible, β1 selective should be preferred to non-selective beta-blockers Slow ascent is recommended. Although we do not have precise data on advisable ascent rate, it is prudent not to exceed that recommended for healthy travellers (300–500 m/day when above 2500 m)
Stable NYHA I-II patients	May safely reach high altitude up to 3500 m Once at altitude, not heavier than moderate physical activity is recommended
Stable NYHA III patients	May safely reach high altitude up to 3000 m, if needed Once at altitude, not heavier than light physical activity is recommended
Unstable/NYHA IV patients	Avoid high altitude exposure

Patient risk class	Recommendations
General recommendations for all cardiovascular patients	Patients should continue pre-existing medications at HA. All therapy changes, especially dual anti-antiplatelet therapy after drug-eluting stent implantation, must be discussed with a doctor before enacting. Individuals who do not engage in physical exertion at low altitude should not engage in physical activity at HA. Acetazolamide administration seems to reduce the risk of subendocardial ischaemia at HA in healthy subjects, and thus use of acetazolamide for AMS prevention might be helpful. No data are available, however, in patients with CAD.
After AMI/CABG	Patients should wait at least 6 months after uncomplicated ACS episode as well as after revascularization before HA exposure.
After stenting	Patients should wait at least 6–12 months after coronary stenting before HA exposure.
Low risk (CCS 0-I)	May safely ascend to HA, up to 4200 m asl, and practice light-to-moderate physical exertion.
Moderate risk CAD (CCS II-III)	May carefully ascend up to 2500 m, but physical exercise heavier than light is contraindicated.
High risk (CCS IV)	Should not ascend to HA.

Cardiac Disease

- Cardiac rehab with goals match to that of planned travel
- Maximize cardiac medications
- ICD/Pacemaker patients should have complete information about the device
- Copy of baseline ECG

LVAD Traveling Myths

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Diabetes

- Very common issue
- Increasing numbers of active people with diabetes
- Growing technology for care

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Table 4. Wilderness society guidelines for DM

1. Complete a diabetes-specific health maintenance examination before wilderness travel
2. Based on the above examination, additional testing may be required in selected patients
3. Patients with diabetes must undergo a comprehensive cardiovascular risk assessment
4. No need for routine EKG testing for asymptomatic individuals with diabetes
5. Patients with diabetes with added co-morbidities need counseling to prevent further organ damage
6. Patients with diabetic retinopathy need ophthalmic evaluation and risks of wilderness travel discussed
7. A complete list of materials needed for wilderness travel is taken, both routine and emergency items
8. The wilderness athlete must possess medical records, basic diabetes plan, and emergency plan
9. Follow manufacturer's guide to protect glucose monitoring equipment and supplies
10. Keep extra glucose meters. pump, and accessories
11. Protect insulin from the elements. Keep extra supplies in another safe location
12. Know that more insulin is required in higher altitudes. Learn your own glycemic trends during test trips
13. Monitor blood glucose and ketones more frequently during high-altitude sickness
14. Use acetazolamide with caution if you are diabetic
15. Use glucocorticoids with caution if you are diabetic but do not hesitate to use for emergency edema
16. Data on cold effects on diabetes are inconclusive, so treatment is individualized
17. Use extreme caution and prevent cold injuries, especially with peripheral neuropathy and vasculopathy
18. Individualize diabetes management in hot climates; you are more prone for heat illness
19. Monitor blood glucose intensively before, during, and after intense physical activity
20. Integrate the effects of exercise and carbohydrate intake on blood glucose and personalize treatment
21. Individualize hydration strategies and integrate with effects of exercise, environment, and altitude
22. Be familiar with insulin regimen unique to your needs and integrate with exercise, diet, and climate
23. If medications other than insulin are used, be familiar with their effects and side effects in wilderness
24. Have an action plan ready to handle hypoglycemia; be familiar with recognizing nocturnal episodes
25. Be familiar with different modalities of use of glucose and glucagon in hypoglycemia situations
26. Be familiar with presentation of diabetic ketoacidosis and serum and urine ketone tests
27. Diabetic ketoacidosis and hyperosmolar state need emergent air evacuation to the base hospital
28. Have a clear triage plans for hyperglycemic emergencies
29. May treat diabetic ketosis if patient has good mental status, able to take oral feeds and hydration
30. Personalize insulin dosage for exercise-induced hyperglycemia based on individual's prior experience
31. Modern diabetes technology for monitoring and/or treatment may be used judiciously after education

Downloaded from

Exercise and Glucose

- Short-intense anaerobic
  - Cathecholamine burst
  - Increased blood glucose
- Long duration aerobic
  - Increase insulin sensitivity
  - Increase glucose uptake ~ 48
  - Hypoglycemia

Pre-trip Screening

- Neuropathy
  - Frostbite, blister risks
- Nephropathy
  - Avoid nephrotoxins
- Retinopathy
  - Increase risk of retinal hemorrhages

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Diabetes Type One

- Preparation
  - Carry extra of everything
  - Split supplies among team members
  - Technology can help but can fail!

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Glucometers

- Altitude
  - Errors can be seen > 6000ft
  - Over and underestimation of glucose
  - Errors ~ 5-10%
- Cold
  - Errors also induced
  - Keep everything warm
- Bring extra machine

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Increased Exercise

- Hypoglycemia
  - Greater sucrose use
  - Defective glucagon release
  - Increase insulin mobilization from exercising limbs
- Frequent monitoring
- Increased glucose intake

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Monitoring

- Glucose before, during and after exercise or CGM
- ~ 30-60 minutes
- Glucose < 100 before exercise- extra food
- Keep over 125 during exercise

Diabetes: Altitude

- Acetazolamide: dehydration, increased insulin requirements
- Dexamethasone: increase sugars
- Neuropathy: frostbite
- Diabetes: increased insulin requirements

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Insulin

- Protect from temperature extremes
- Avoid excess light exposure
- In cold keep close to body
- Extra insulin in separate storage
- Vent at altitude

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Raynaud's

- Common vascular issue
- Usually self limited
- Wilderness – impair hand function
- May be risk factor for frostbite

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Raynaud's

- Keeping both hands and core warm
- High quality gloves
  - Heated gloves interfere with avalanche transceivers
- Avoid nicotine, decongestants
- Pharmacologic
  - Calcium channel blocks

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Photo: Lindsey Fell

Anticoagulation

- 1-2% of the population on anticoagulation
  - Higher in older patients
- Special travel considerations

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Approach

1. Why is the patient on anticoagulation?
2. Do they need to stay on anticoagulation?
3. What are the choices for their anticoagulation?
4. Will there be any drug interactions with medications needed for travel?
5. How will they monitor their anticoagulation while traveling?

Why Is The Patient On Anticoagulation?

- Indications for most patients
  - Atrial fibrillation
  - Mechanical valves
    - Warfarin only choice
  - Venous thrombosis

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Do They Need To Stay On Anticoagulation?

- Review indications for anticoagulation
- Atrial fibrillation and valves long term
- Some venous thrombosis can stop

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What Are The Choices For Their Anticoagulation?

- Simplest for atrial fibrillation and valve patients is to switch to direct oral anticoagulants
- Mechanical valve patients must stay on warfarin

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Will There Be Any Drug Interactions With Medications Needed For Travel?

- DOACs
  - HIV drugs and Azoles
- Warfarin
  - Start new drugs a few weeks before travel
  - Short courses (day or so) ok

Warfarin Drug Interactions

- Acetazolamide: No
- Atovaquone/Proguanil: Yes - raises INR
- Azithromycin: Yes - raises INR
- Chloroquine: No
- Ciprofloxacin: Yes - raises INR
- Dexamethasone: Yes - raises INR
- Doxycycline: Yes - raises INR
- Levofloxacin: Yes - raises INR
- Mefloquine: No
- Primaquine: No
- Proguanil: Yes - raises INR
- Trimethoprim-Sulfamoxole: Yes - raises INR

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Travel INR Monitoring

- Self monitor
  - New kits size of Glucometer
- http://www.anticoagulationeurope.org/files/files/booklets/GettingaINRtestabroad.pdf

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Extreme Activities and Anticoagulation

- Unclear if anticoagulation poses extra risk of injury!
- Recommendations
  - Helmets
  - No boxing, tackle football
  - Hold dose day of extreme activity?



Neuropathies

- 20 million people have neuropathies
- Multiple causes
- Decreased foot sensation
  - Increased frostbite
  - Increased blisters
  - Increased infections
- Patient education
- Good fitting shoes/boots
- Early and aggressive therapy of blisters/foot wounds

Memory

- Ability to retain new information declines with age
- Normally not to the point of interfering with function

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Dementia

- Increasing issue in older patients
  - 5% > age 65
  - 35-50 > age 80
- Symptoms
  - Retaining new information
  - Handling complex task
  - Spatial ability and orientating
- Subject may/will not mention
- Need to ask spouse/friends

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Diagnosis

- Need to raise issue
- SLUMS or MoCA good screen
- Rule out other causes
  - Depression
  - Drugs/alcohol
  - Structural issues

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Dementia: Travel

- Needs traveling companion
- For moderate impairment and beyond needs to be very structure trip

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DJD

- Activates need to be in their functional range
- Exercise/PT helpful
- Maximize pain control with oral/topical NSAIDS

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Prosthetic Joints

- 500,000 joints replaced yearly
- Physical therapy
  - Build muscle strength around joint
  - Increase mobility
- Increasing leniency on activity

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3233
ANCHORAGE
MAYOR'S MARATHON
ConocoPhillips

Activity Allowed

- Safe:
  - Swimming, hiking with poles – smooth terrain, cycling
- Greater risk
  - Cross country skiing, horseback riding, hunting uneven terrain
- Risky activity (????)
  - Downhill skiing, rock climbing, running

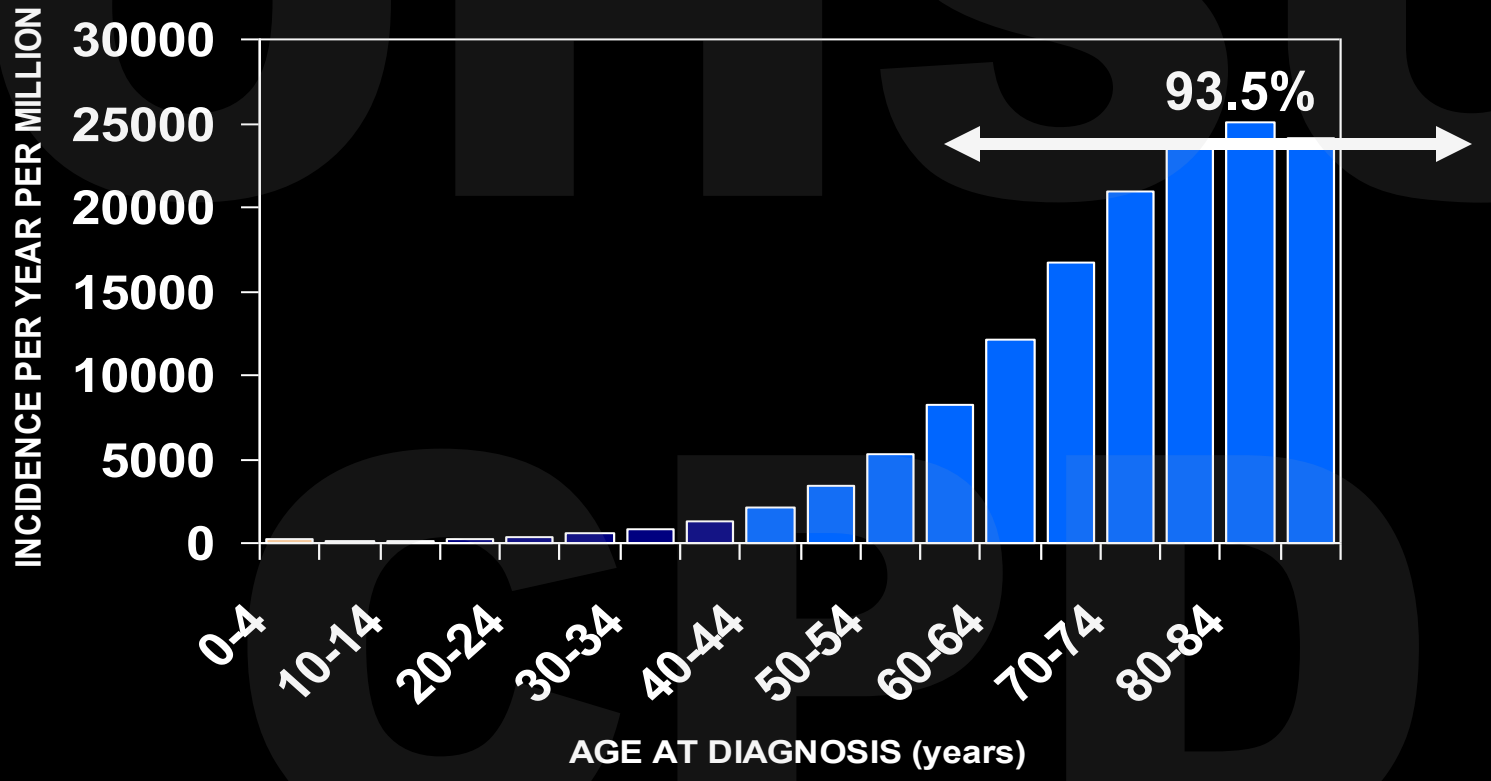


Cancer

- Many patients are survivors or on therapy
- Increasingly patients have prolonged survival even on therapy

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US Cancer Incidence



Chemotherapy

- Acute effects
- Chronic effects

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Acute Chemotherapy Effects

- Neutropenia
  - Never should be more than 2 hours away for health care facility
- Nausea/vomiting
  - 5HT blockers, Decadron, Ativan

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Chronic Chemotherapy Effects

- Lung damage
- Cardiac damage
- Neuropathy

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Bleomycin

- Can lead to long term lung damage
  - Fibrosis
- Can see overwhelming toxicity if exposed to high FIO_2
- Controversy about scuba diving increase lung injury
- Patients who have received bleomycin should have PFT checked before major expeditions

Anthracyclines

- Doxorubicin, mitoxantrone,..
- Cardiac damage 2-5%
  - Can be subtle esp young patients
- Patients who have receive anthracycline should have cardiac function checked before major expeditions

Neuropathy

- Common side effect of:
  - Bortezomib
  - Platinum agents
  - Taxanes
  - Vincristine
- Problems
  - Balance
  - More prone to infections and frostbite

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Targeted Therapies

- Paradigm of patients controlling metastatic disease with oral therapy
  - Gleevec, Sorafenib, Tykerb
- Multiple agents in developments
- Good tumor control with minimal side effects

Targeted Therapy

- Must insure patient has adequate supply of drug
- If lost major problems
  - Availability
  - Expense!
    - Gleevec $118,000 ($326/pill)
    - Revlimid $163,000 ($446/pill)

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Photo: Lindsey Fell

High Altitude

- Traveler at risk of hypoxia at altitude?
- Traveler at risk for impaired ventilatory responses
- Traveler at risk of pulmonary vascular responses
- Traveler at risk due to hypoxia!

Risk of Hypoxia at Altitude?

- Underlying lung or cardiac disease will increase hypoxia at altitude

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Risk for impaired Ventilatory Responses

- Unable to respond to hypoxia
- Severe COPD, neuromuscular disease
- Carotid body damage or irradiation

Risk Of Pulmonary Vascular Responses

- Hypoxia increases pulmonary artery pressure
- Pulmonary HTN, right heart failure

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Risk due to Hypoxia

- Many underling chronic disease cannot tolerate hypoxia
  - Advance lung disease
  - Decompensated heart failure
  - High risk pregnancy
  - MI last 90 days
  - Unstable angina
  - Uncontrolled seizures



Heat Illness: Risk Factors

- Cardiac disease
- Diabetes
  - Dehydration
- Skin diseases
  - Impairs heat loss
- Obesity

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Risk Factors

- Overweight
- Smoking
- Previous heat illness
- Mild illness
- Sunburn
- Recent air travel
- Lack of sleep

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Medications

- Anticholinergics
- Antihistamines
- Beta blockers
- Diuretics
- Ethanol
- Lithium
- Phenothiazines
- Psychotropic
- Salicylates
- Sympathomimetics (cocaine, meth…)
- Tri-cyclic antidepressants

Cold

- Asthma
- Diabetes
  - Impaired thermoregulation, frostbite
- Peripheral vascular disease
- Raynaud's

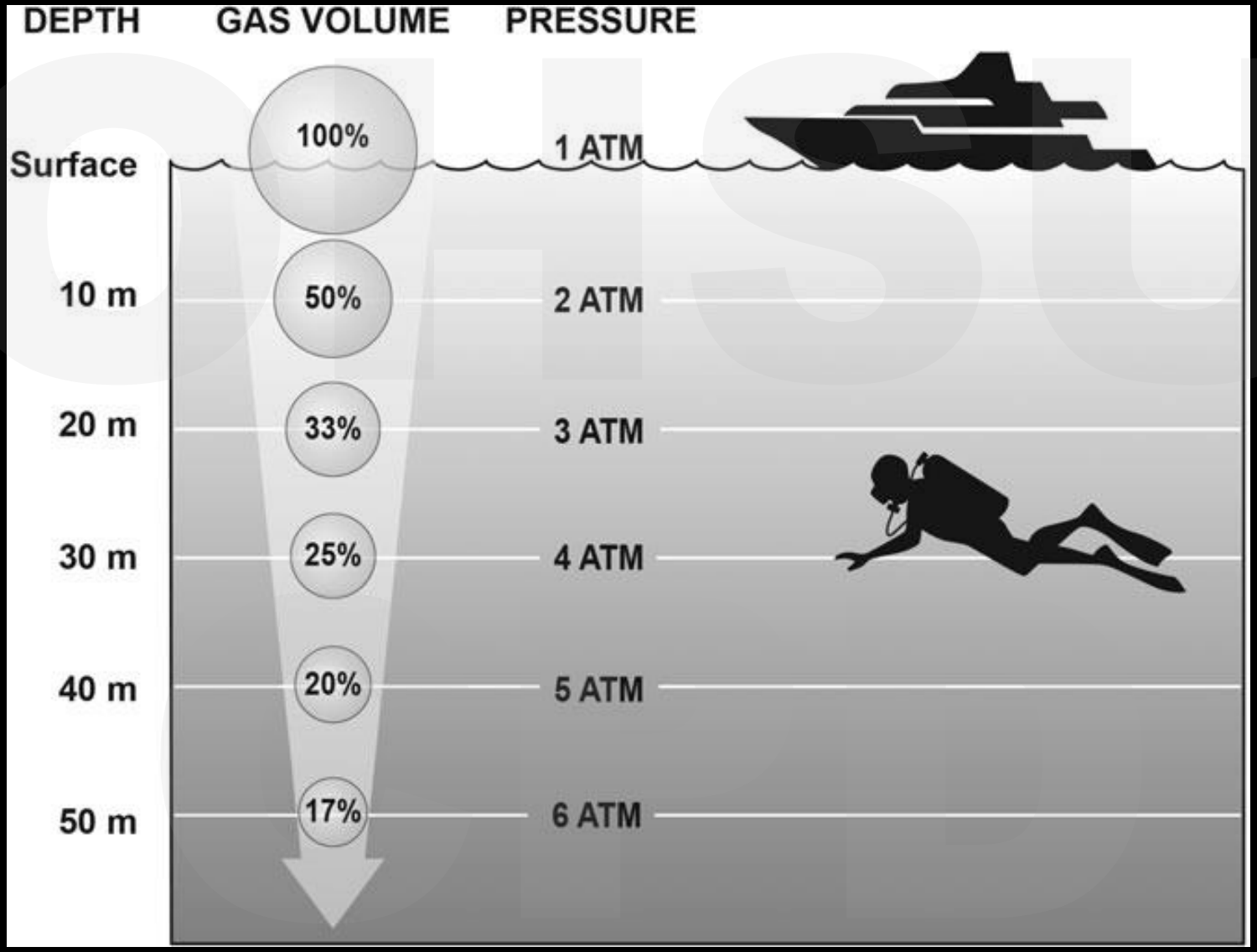
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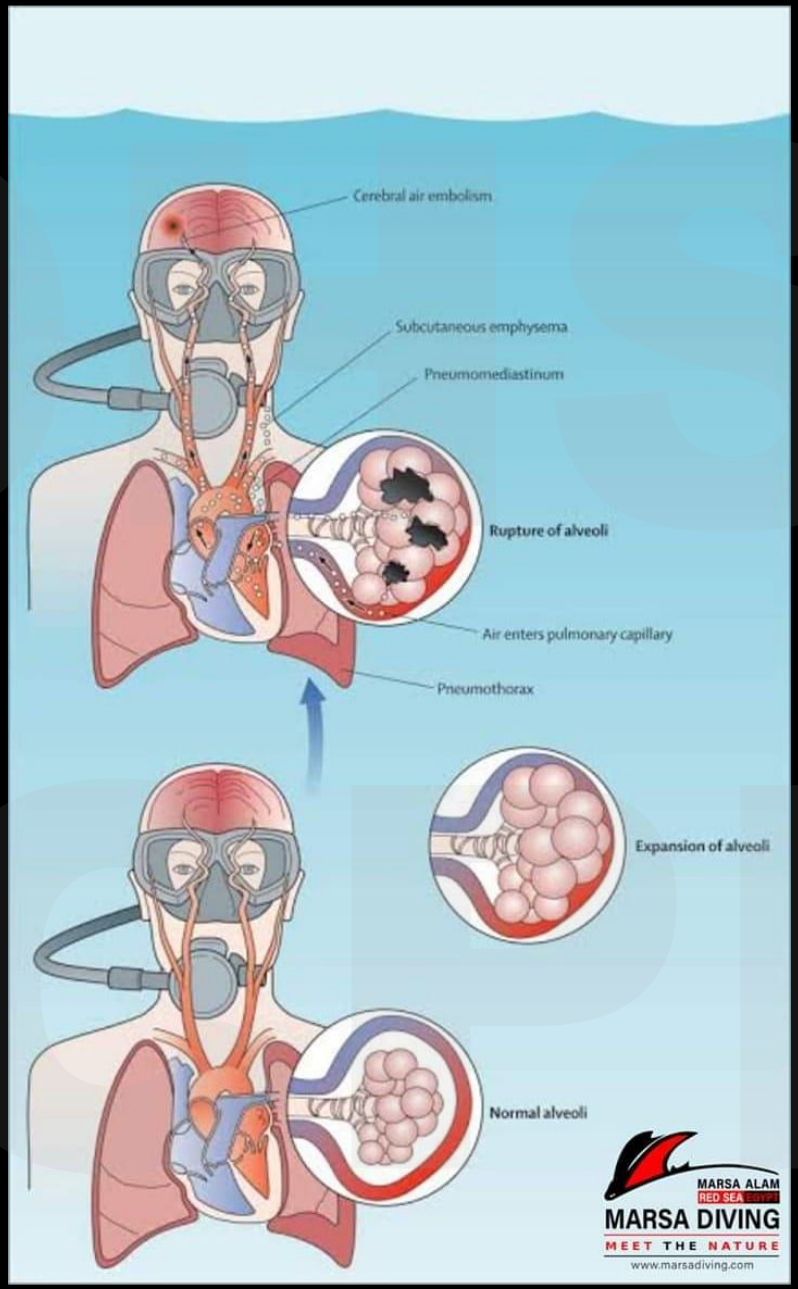


Diving!

- https://dan.org great source of information

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DEPTH
GAS VOLUME
PRESSURE
Surface
100%
1 ATM
10 m
50%
2 ATM
20 m
33%
3 ATM
30 m
25%
4 ATM
40 m
20%
5 ATM
50 m
17%
6 ATM


Cerebral air embolism
Subcutaneous emphysema
Pneumomediastinum
Rupture of alveoli
Air enters pulmonary capillary
Pneumothorax
Expansion of alveoli
Normal alveoli
MARSA ALAM
RED SEA EGYPT
MARSA DIVING
MEET THE NATURE
www.marsadiving.com

Asthma

- Barotrauma is major concern
- Recommend not to dive is asthma precipitated by cold, exercise, emotion
- No diving if use rescue medications in past 48 hours
- Remains controversial

Contraindicates to Diving

- ENT – upper respiratory infections, Eustachian tube dysfunction, perforation of tympanic membrane
- Lungs –, COPD with impaired lung function, lung cysts, bullae and bronchiectasis.
- Cardiac – Recent (< 1 year) acute coronary syndrome, congestive heart failure, angina, severe mitral or aortic stenosis
- Seizures (5 year rule)
- Sickle cell disease
- Stroke

Common Concepts

- Underlying disease needs to be in control!
- Need to bring extra medication
  - If vital to life keep extra separate
- Need to be back-up of any devices especially batteries

