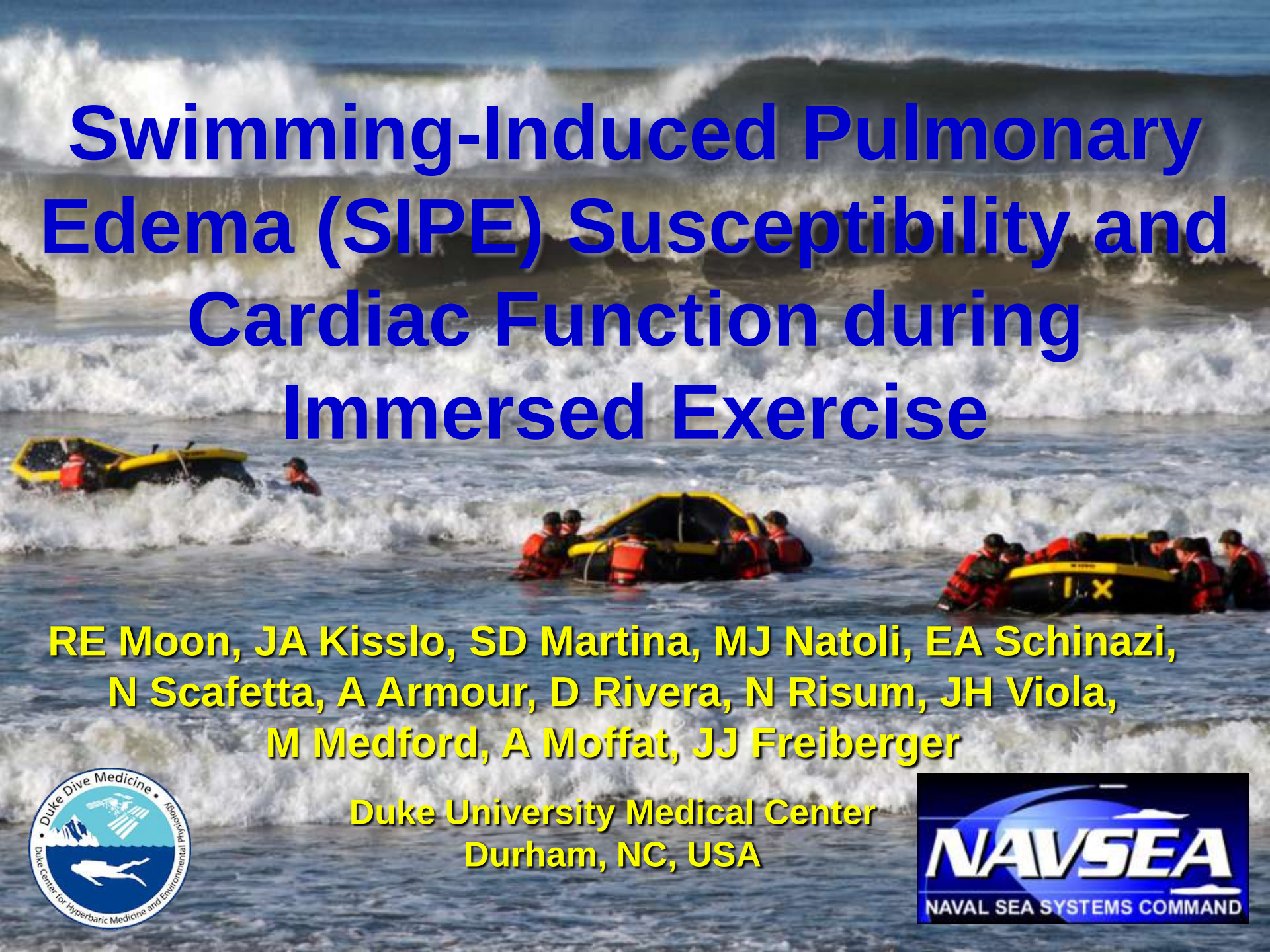

Swimming-Induced Pulmonary Edema (SIPE) Susceptibility and Cardiac Function during Immersed Exercise

RE Moon, JA Kisslo, SD Martina, MJ Natoli, EA Schinazi, N Scafetta, A Armour, D Rivera, N Risum, JH Viola, M Medford, A Moffat, JJ Freiberger

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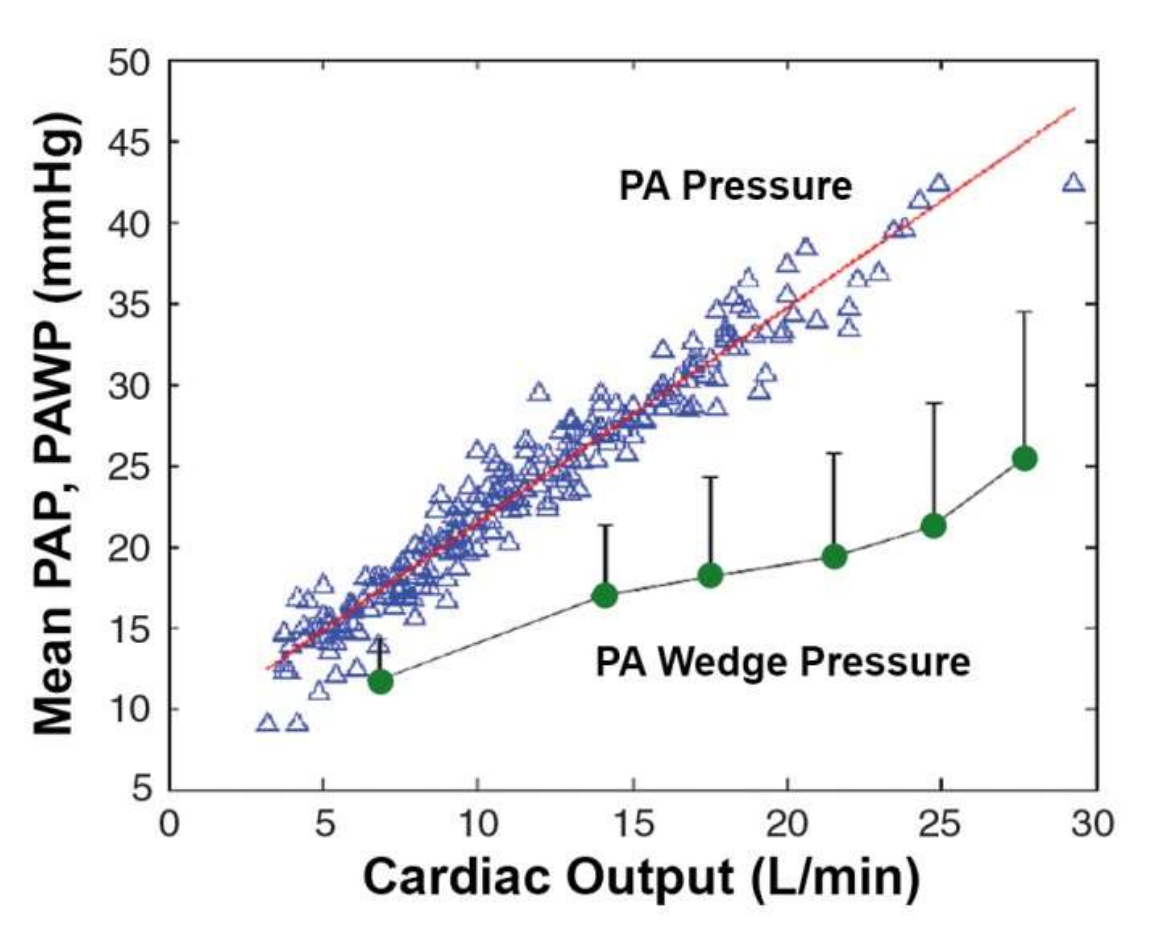
NAVSEA
NAVAL SEA SYSTEMS COMMAND

Introduction

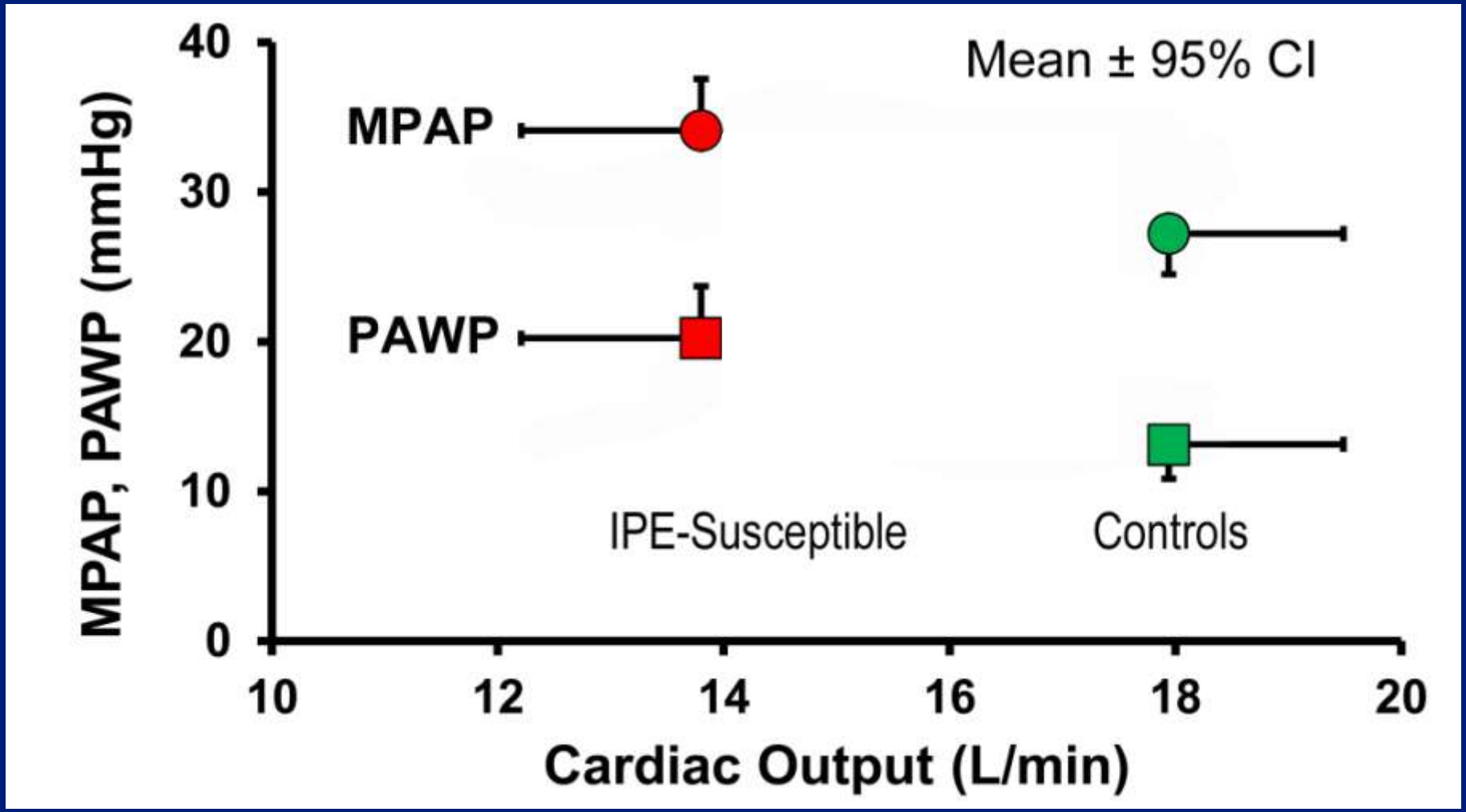
- Evidence suggests that SIPE is due to high pulmonary vascular pressures in susceptible individuals

Pulmonary Artery and Wedge Pressures During Exercise



Naeije R, Chesler N. *Compr Physiol* 2:711, 2012

PAP and PAWP During Cold (20°C) Immersed Exercise

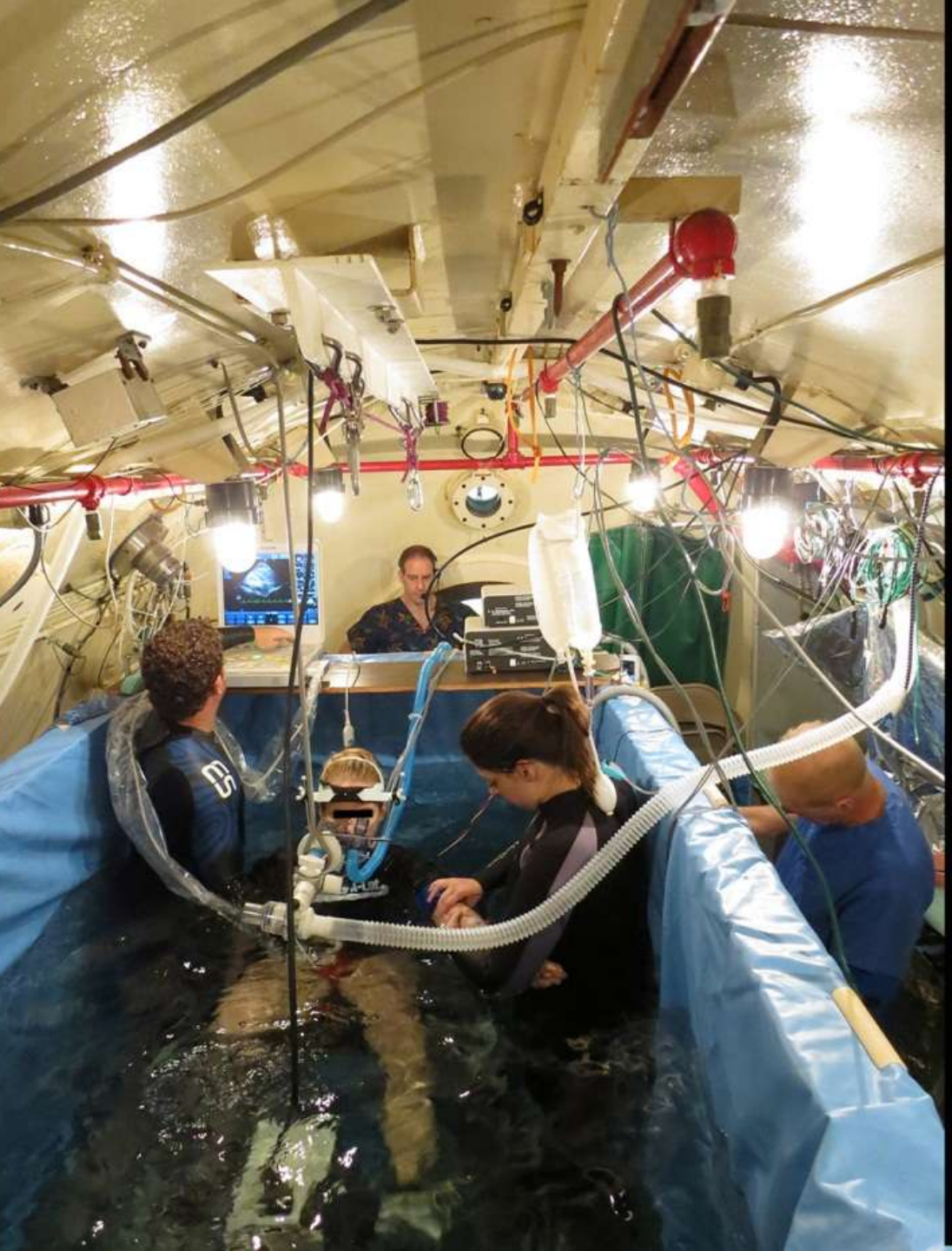


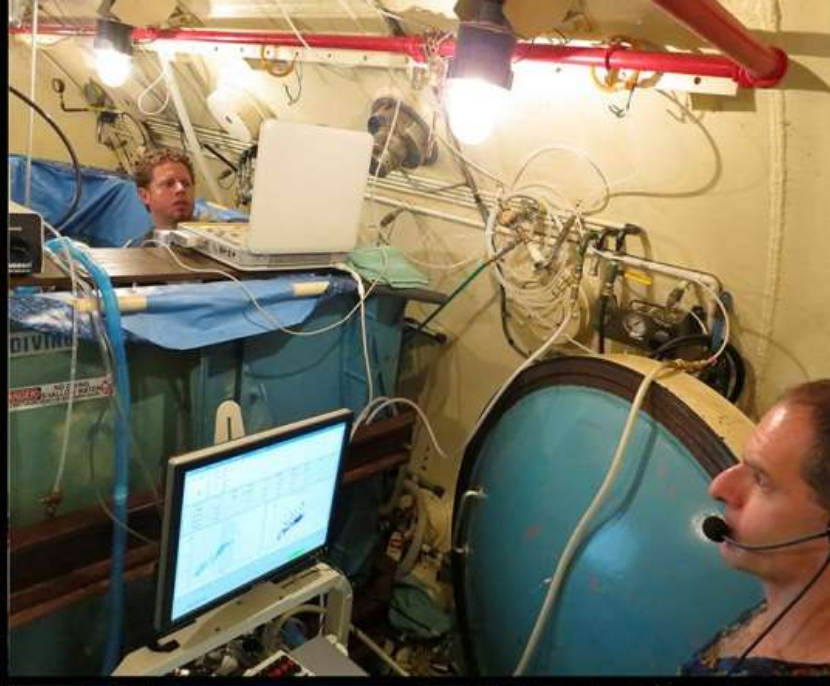
Introduction

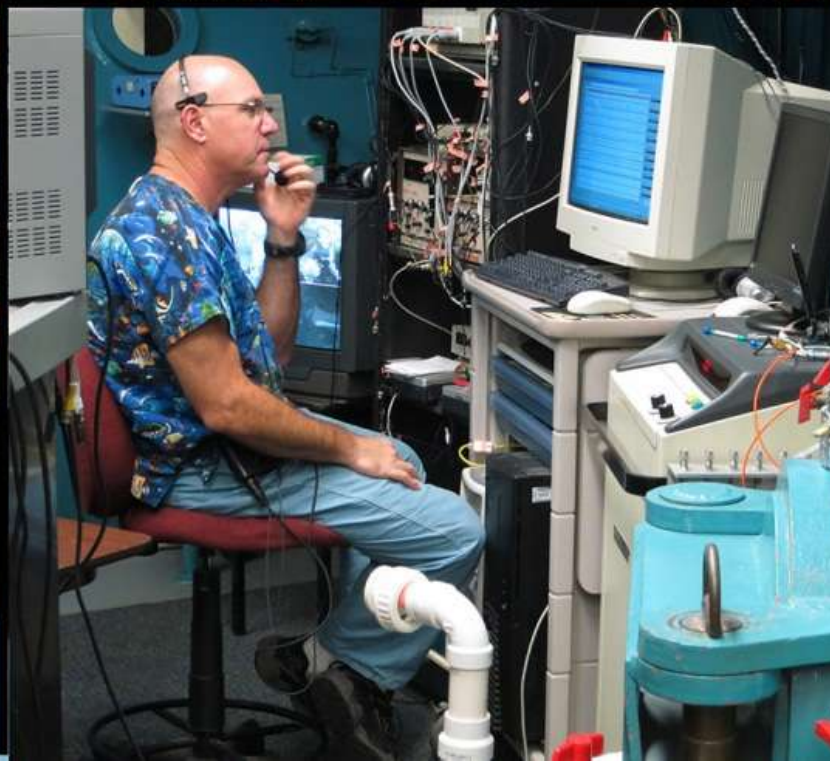
- Evidence suggests that SIPE is due to high pulmonary vascular pressures in susceptible individuals
- Hypothesis: high pulmonary vascular pressures are due to impaired LV diastolic compliance

Methods

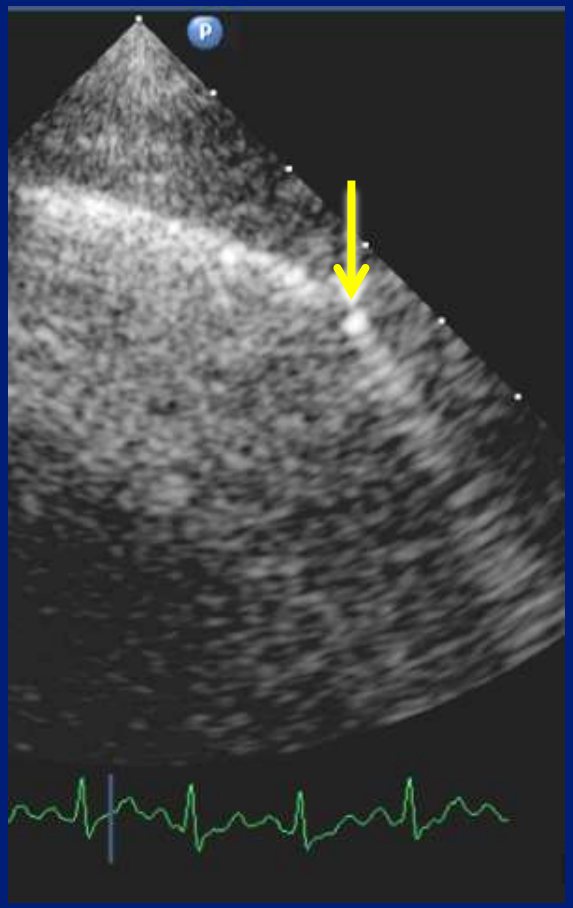
- After institutional approval and informed consent, 219 normal volunteers screened to identify 83 individuals with a TR jet
- 46 studied with transthoracic echocardiography (TTE) during head-out immersion in 20°C water, during rest and 40 minutes of moderate exercise (typical VO_2 2 L/min)
- 14 individuals with prior SIPE history similarly studied
- Measurements:
  - Dry rest
  - Immersed rest
  - Immersed early and late exercise
  - Immersed post-exercise

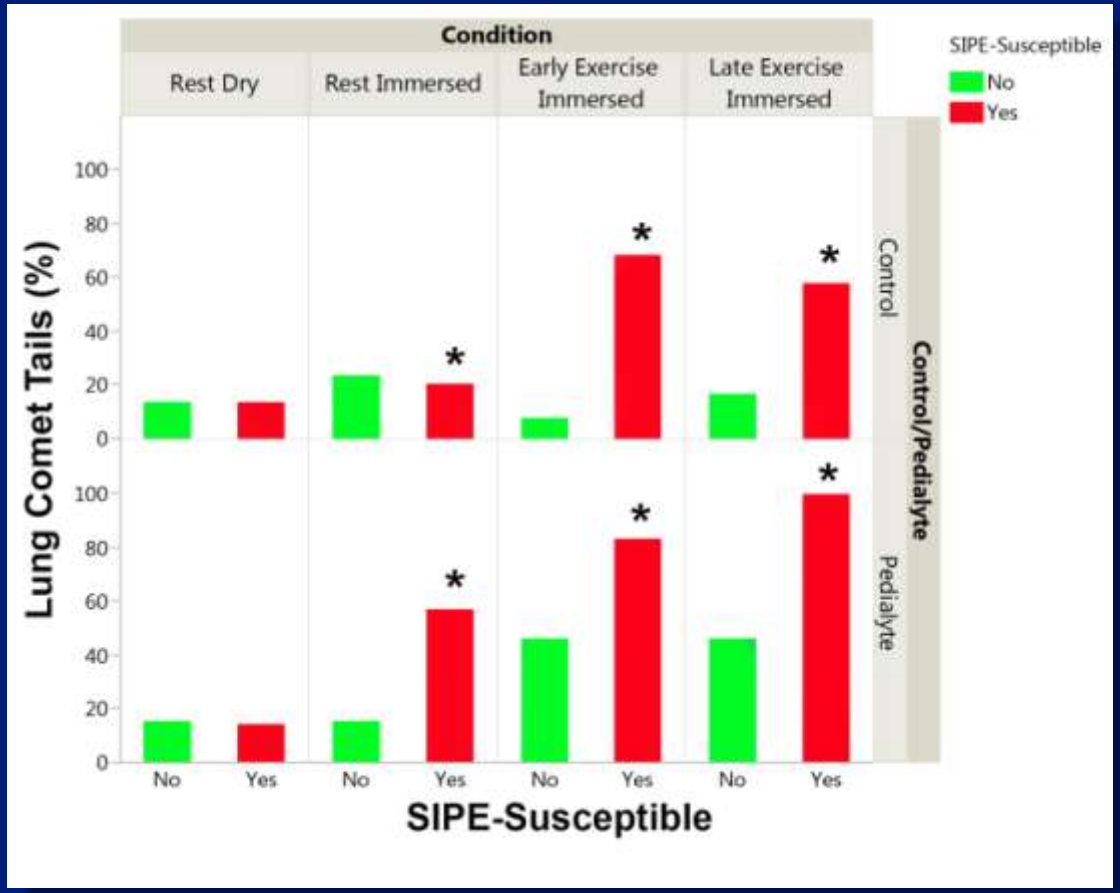




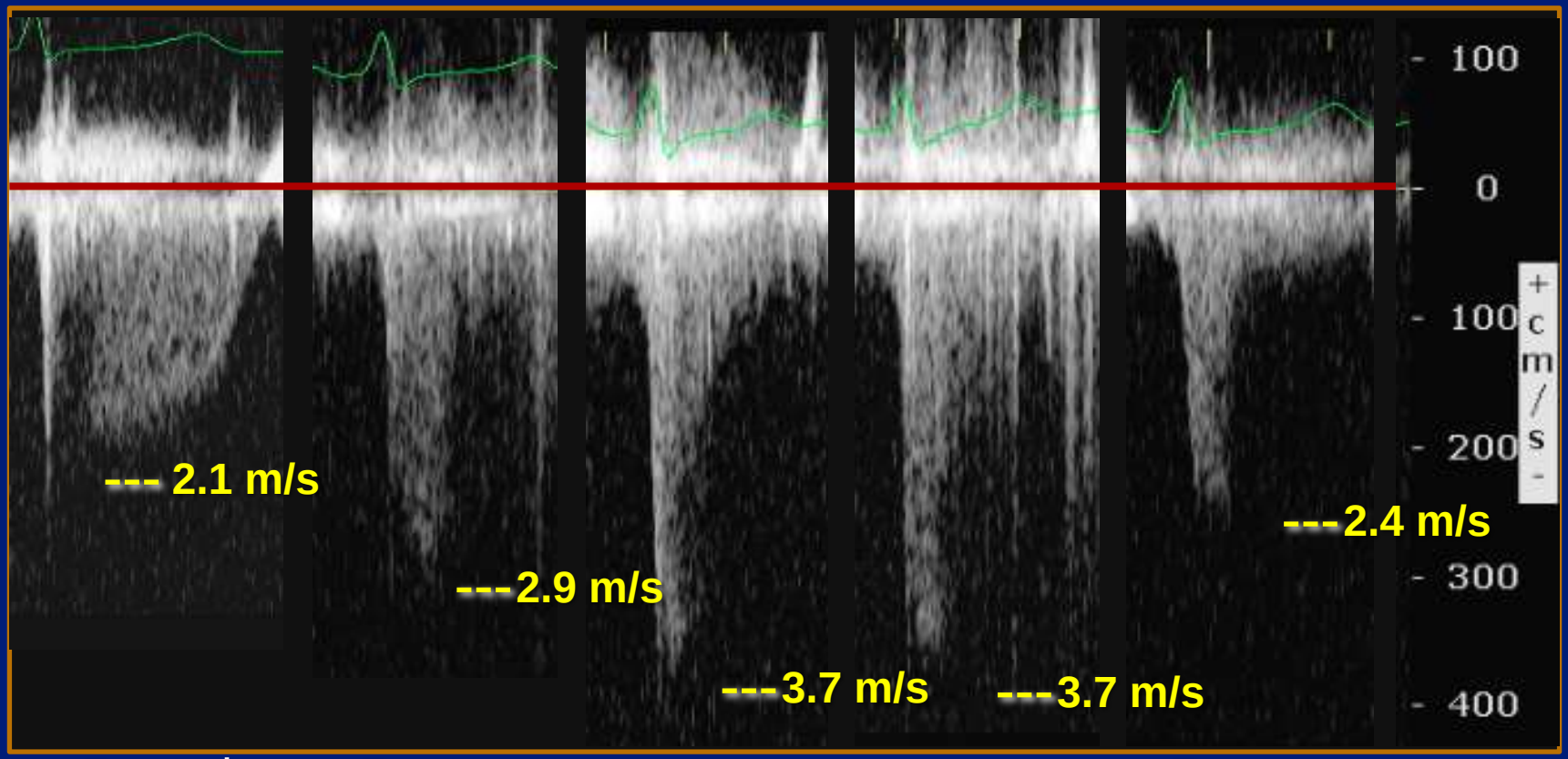


Comet Tails




Condition
Rest Dry
Rest Immersed
Early Exercise Immersed
Late Exercise Immersed
SIPE-Susceptible
No
Yes
Lung Comet Tails (%)
Control/Pedialyte
Control
Pedialyte
0
20
40
60
80
100
*
No
Yes
SIPE-Susceptible

Increase in TR Velocity



Rest, dry
18 mmHg

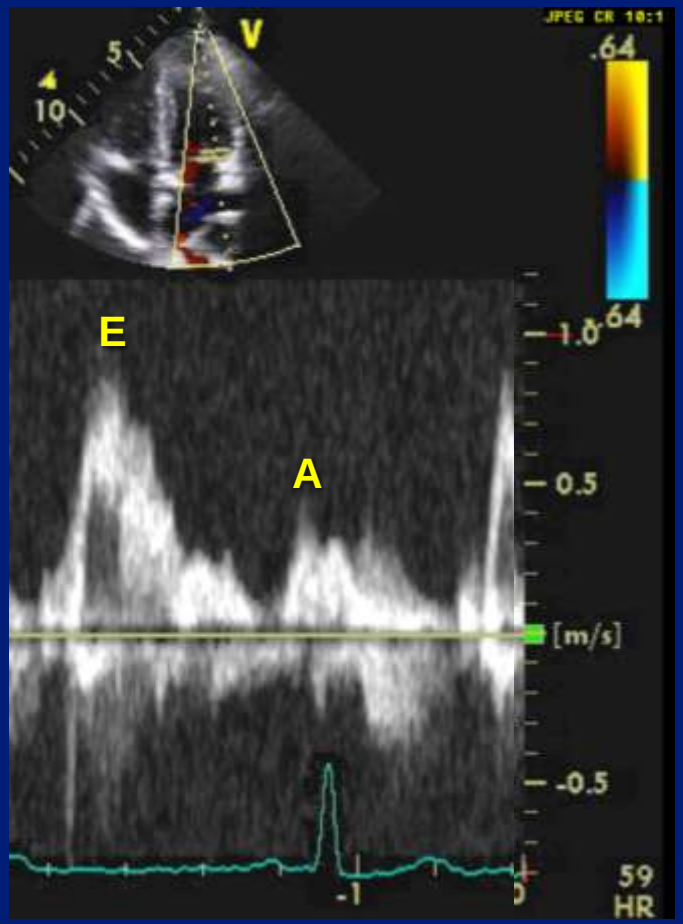
Rest, wet
34 mmHg

Early exercise, wet
55 mmHg

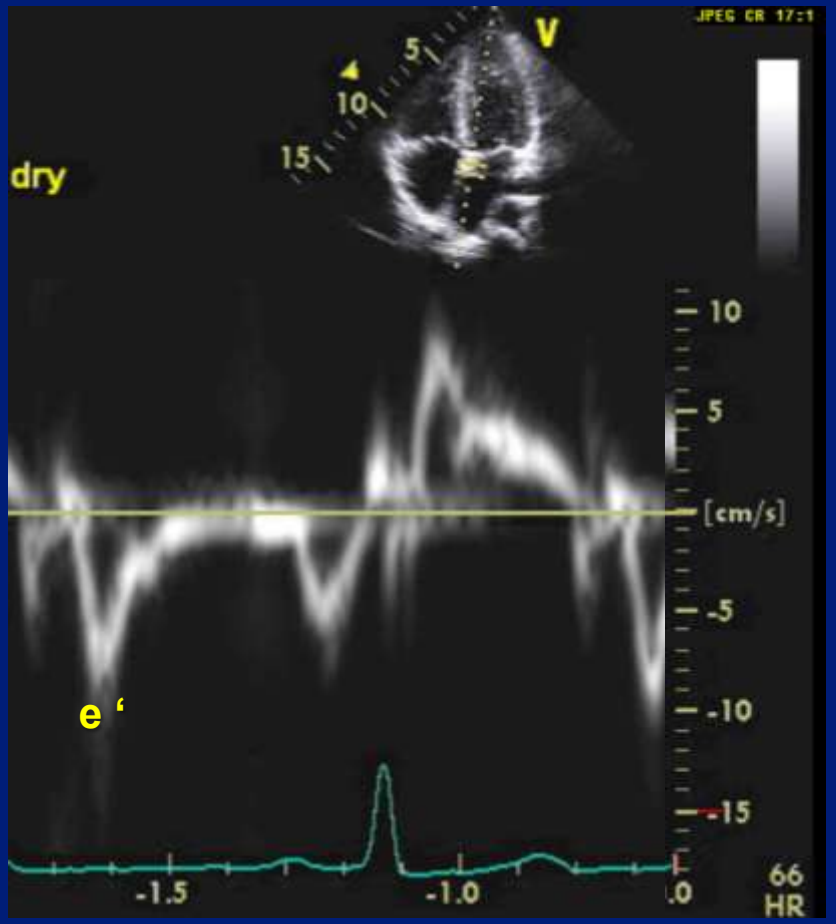
Late exercise, wet
55 mmHg

Recovery, wet
23 mmHg

Measurement of E/e’



Diastolic Flow Velocity



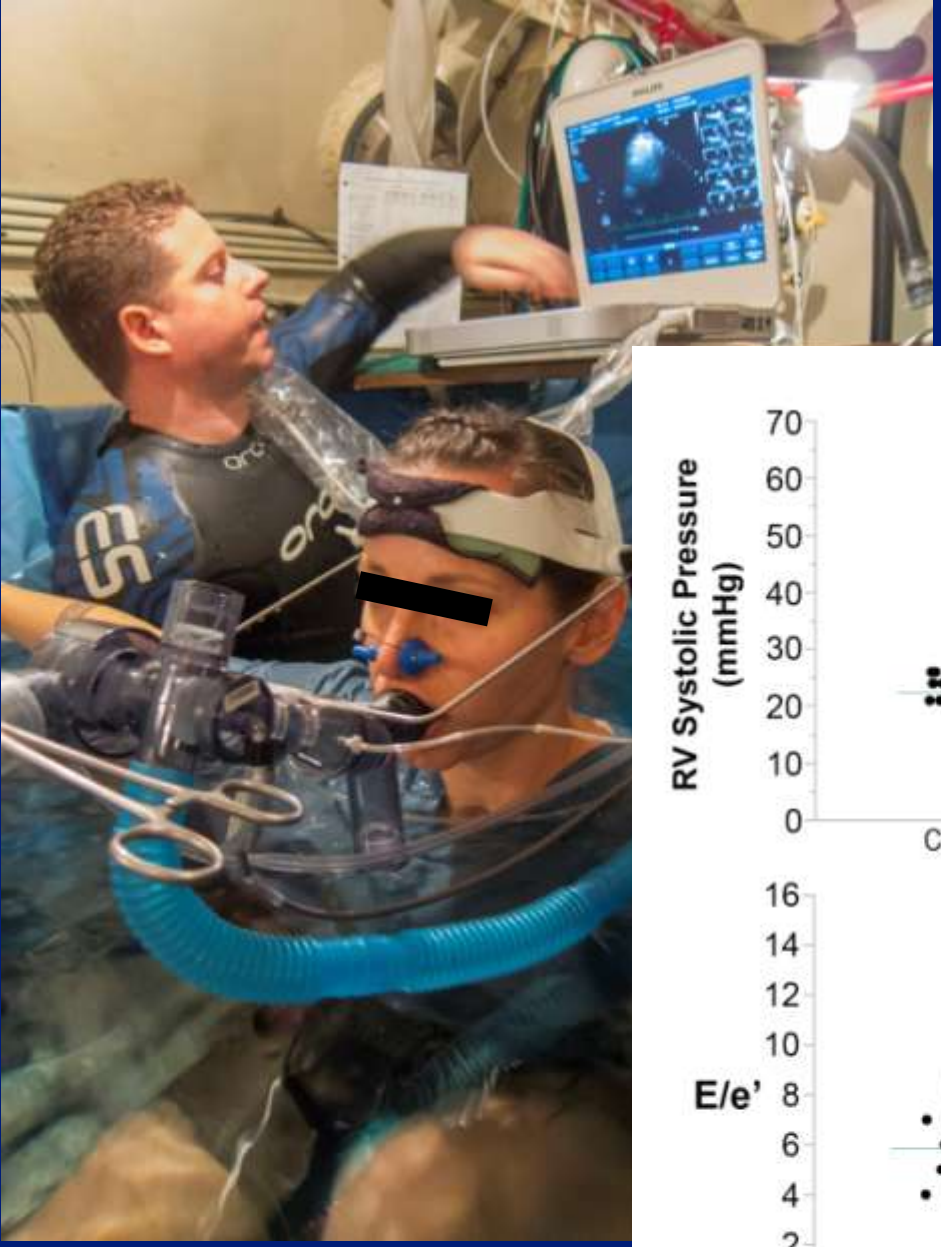
Mitral Valve Annular Velocity

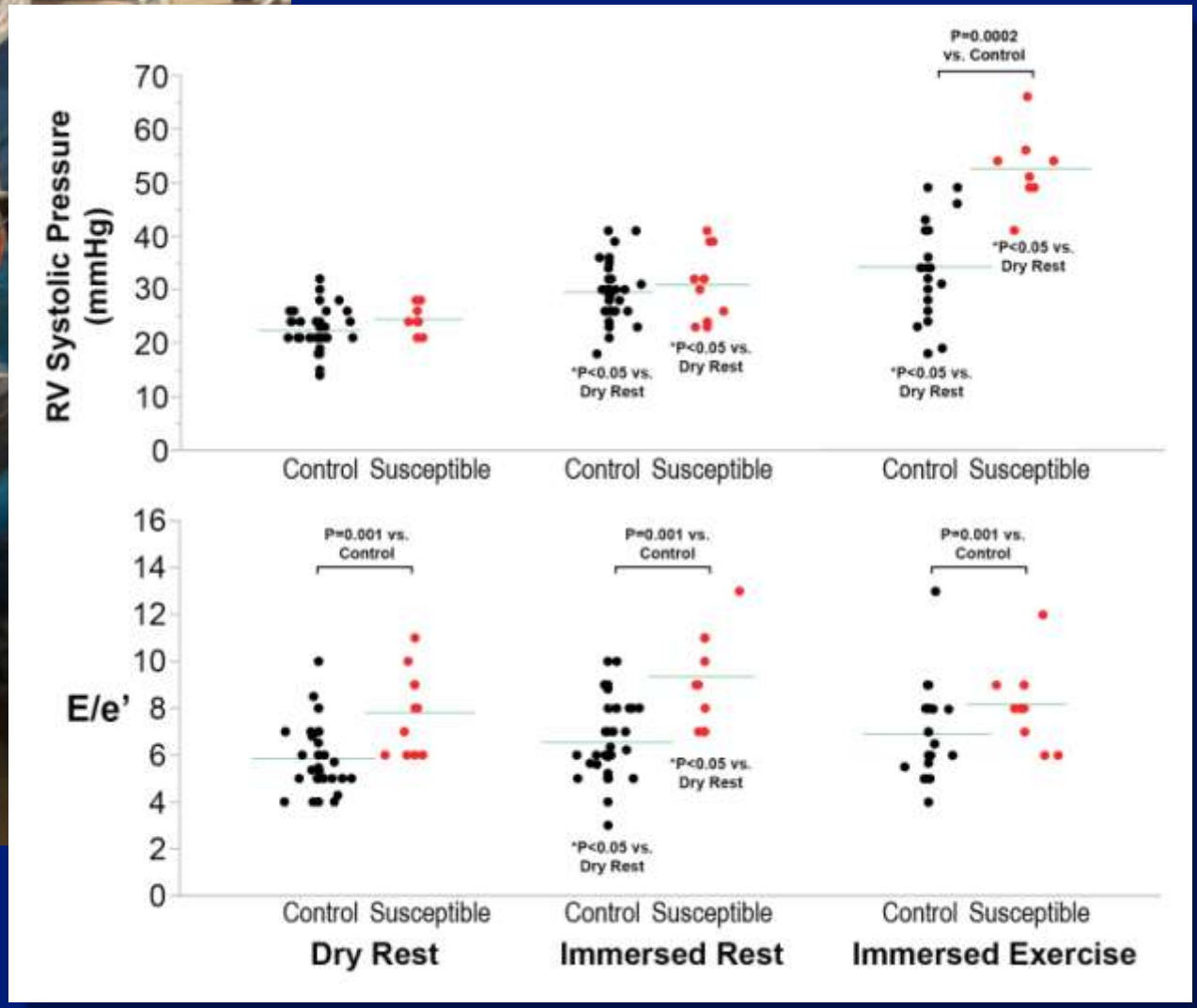
Demographics

	SIPE-Susceptible	Controls
N	14	46
Age (mean±SD, range)	41.8±9.3, 23-53	25.8±6.4, 19-50
M/F	2/12	24/22

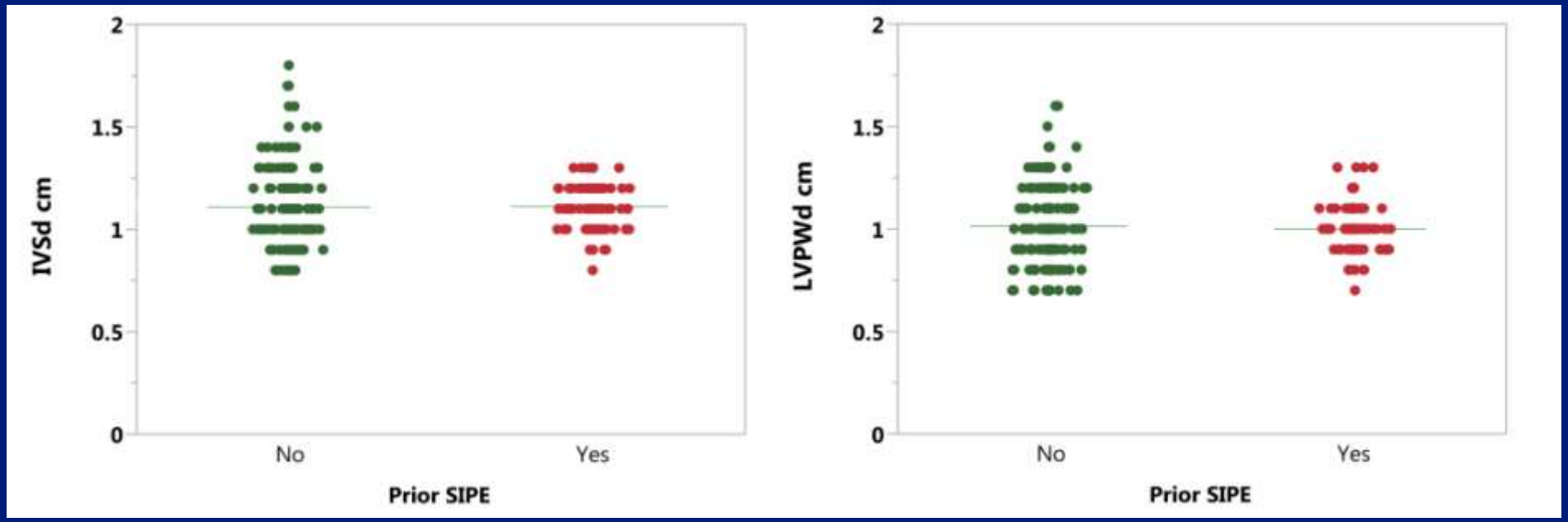
Activity Precipitating SIPE	N
Triathlon	7
Diving	5
Windsurfing	1
SEAL Training	1
TOTAL	**14**

Results



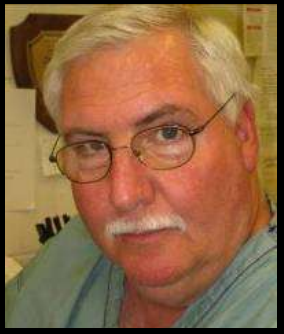

RV Systolic Pressure (mmHg)
70
60
50
40
30
20
10
0
P=0.0002 vs. Control
*P<0.05 vs. Dry Rest
*P<0.05 vs. Dry Rest
*P<0.05 vs. Dry Rest
*P<0.05 vs. Dry Rest
Control Susceptible
Control Susceptible
Control Susceptible
E/e'
16
14
12
10
8
6
4
2
0
P=0.001 vs. Control
P=0.001 vs. Control
P=0.001 vs. Control
*P<0.05 vs. Dry Rest
*P<0.05 vs. Dry Rest
Control Susceptible
Control Susceptible
Control Susceptible
Dry Rest
Immersed Rest
Immersed Exercise

No Difference in LV Thickness



Conclusions

- During immersed exercise ‘comet tails’ are more prevalent in the lungs of SIPE-susceptible individuals
- Higher RV systolic pressure (PA systolic pressure) in SIPE-susceptible confirmed
- High E/e’ supports the notion of LV diastolic properties as a major determinant of SIPE-susceptibility



Owen Doar

Aaron Walker

Dionne Peacher

Eric Schinazi

Mike Natoli

Ivy Forkner

Anne Cherry

Claire Otteni

Jennifer Fraser

Marty Lynch

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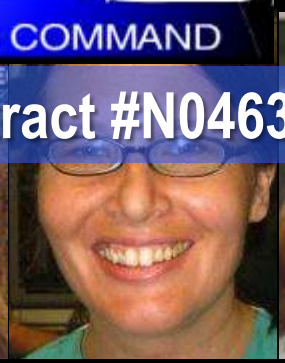
Supported by NAVSEA Contract #N0463A-10-0005

Rick Roller

Sonny Boso

Stefanie Martina

Jenna Wiley



Dawn Kernagis

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