



*1st Invitational Workshop on
Body Area Network Technology and Applications
Future Directions, Technologies, Standards and Applications
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Worcester Polytechnic Institute*

Physiological Health Assessment System for Emergency Responders

PHASER

Introduction and Specific Aims

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Homeland
Security

Science and Technology

PHASER primary national objective

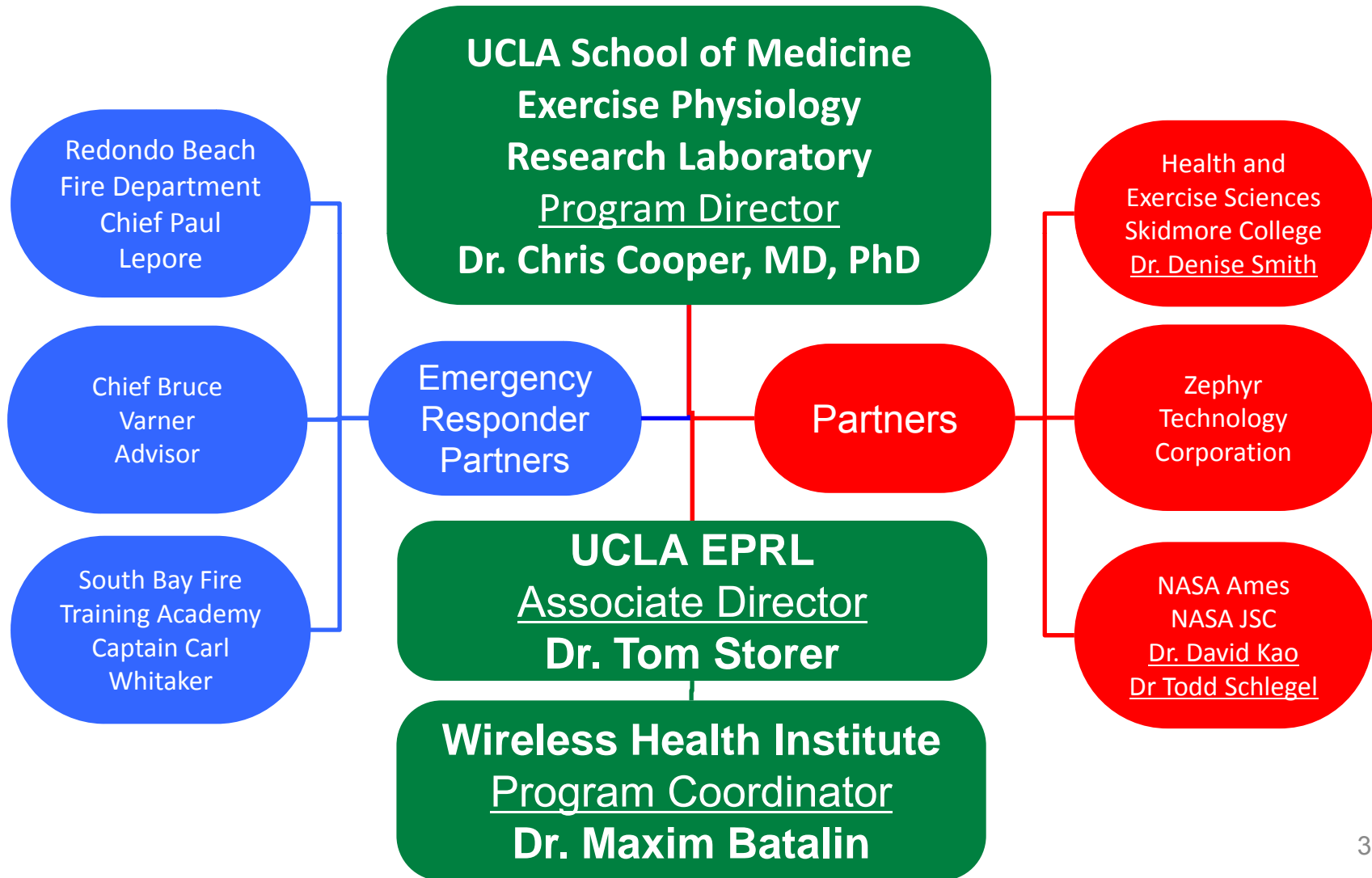
- Firefighters - highest occupational rate LODD due to sudden cardiac events
- USFA Goal – decrease LODD by 25% in 5 years and 50% in 10 years
- A primary national objective is the development of a breakthrough in assuring health and safety for the emergency responder community.
- Requires state-of-the-art approach combining medical science with technological innovations



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PHASER organizational chart





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PHASER specific aims

1. Comprehensive risk identification and prioritization
2. Sensor selection and evaluation
3. Laboratory-based physiological experiments
4. Field-based monitoring and risk stratification
5. Implementation of a low-cost networked system for physiological monitoring and intervention
6. Outreach to emergency responders, the public, academic institutions, industry and other government agencies



PHASER: Safety objective

To enhance the safety and to protect the well-being of emergency responders

- ♥ Safety of the individual emergency responder
- ♥ Safety of the emergency responder team
- ♥ Safety of the victims



Risk factor prioritization

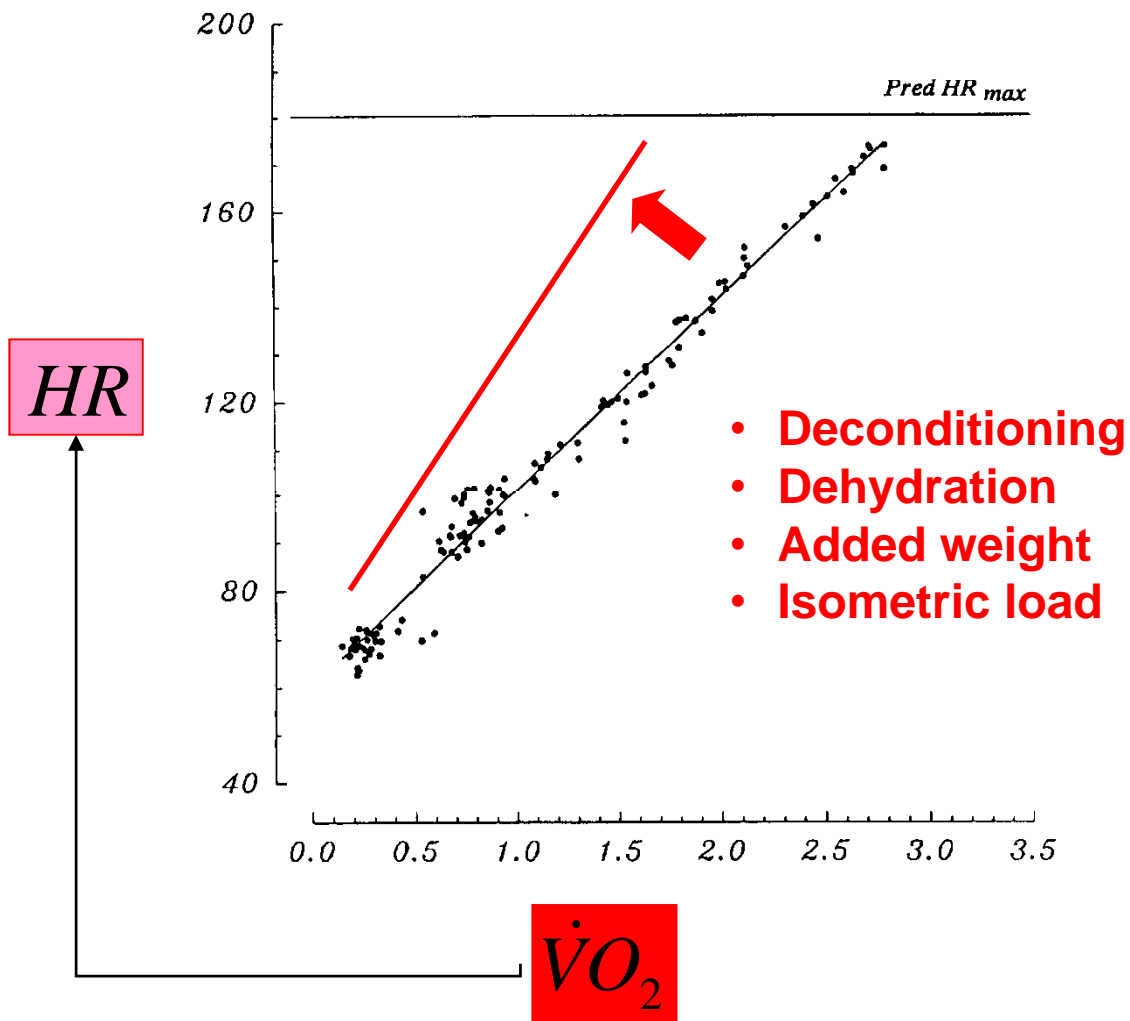
Major Risk Factors (the big 5!)

- Deconditioning/Fatigue
- Dehydration/Heat stress
- Added weight/isometric load
- Exposure time
- Traditional cardiovascular risk factors

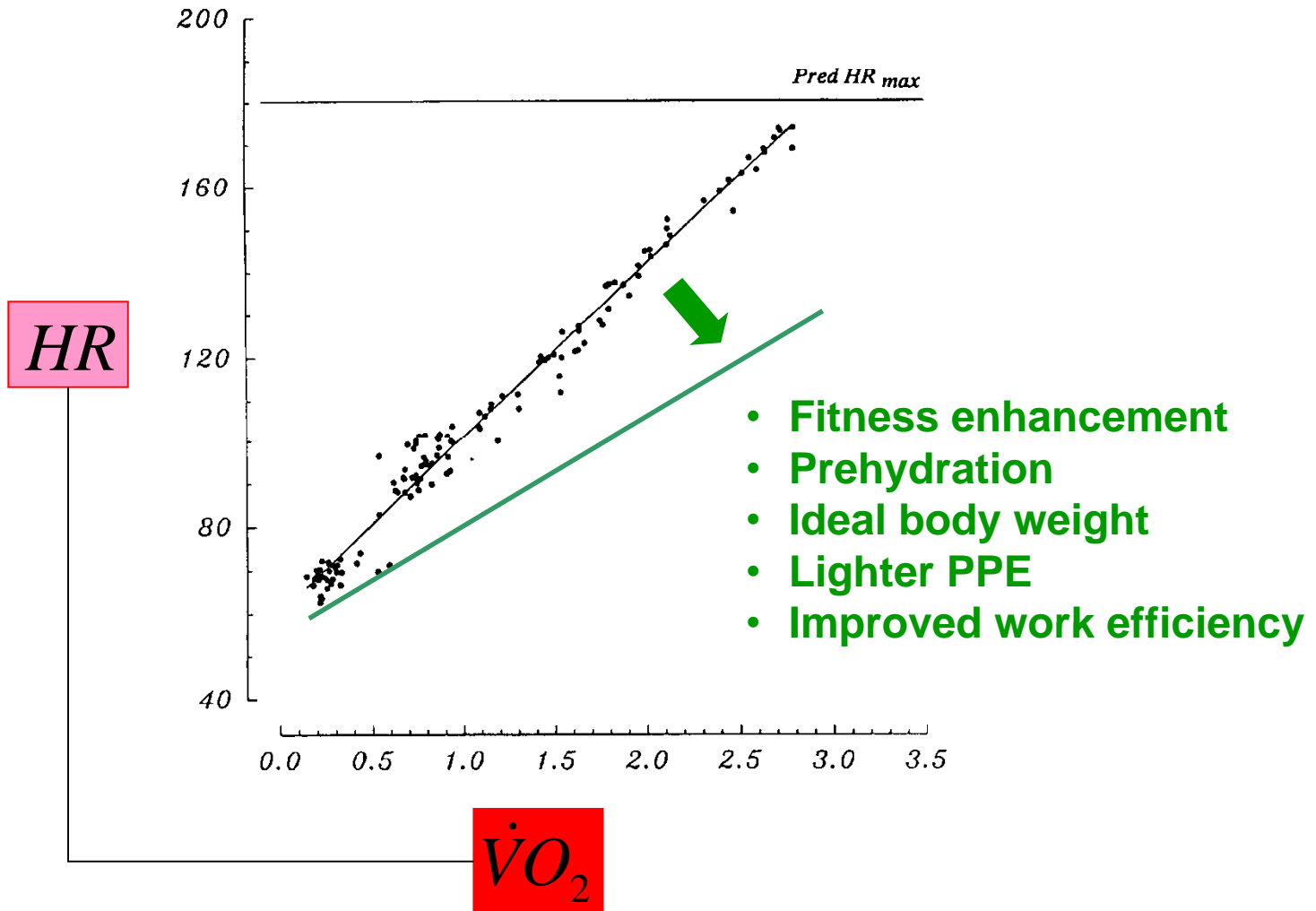
Risk Mitigation

- Fitness training
- Pre-hydration/Fitness training
- Ideal body weight/Lighter PPE
- PPE modification/Fitness training
- Screening/Lifestyle modification/Fitness training

Factors increasing cardiovascular stress

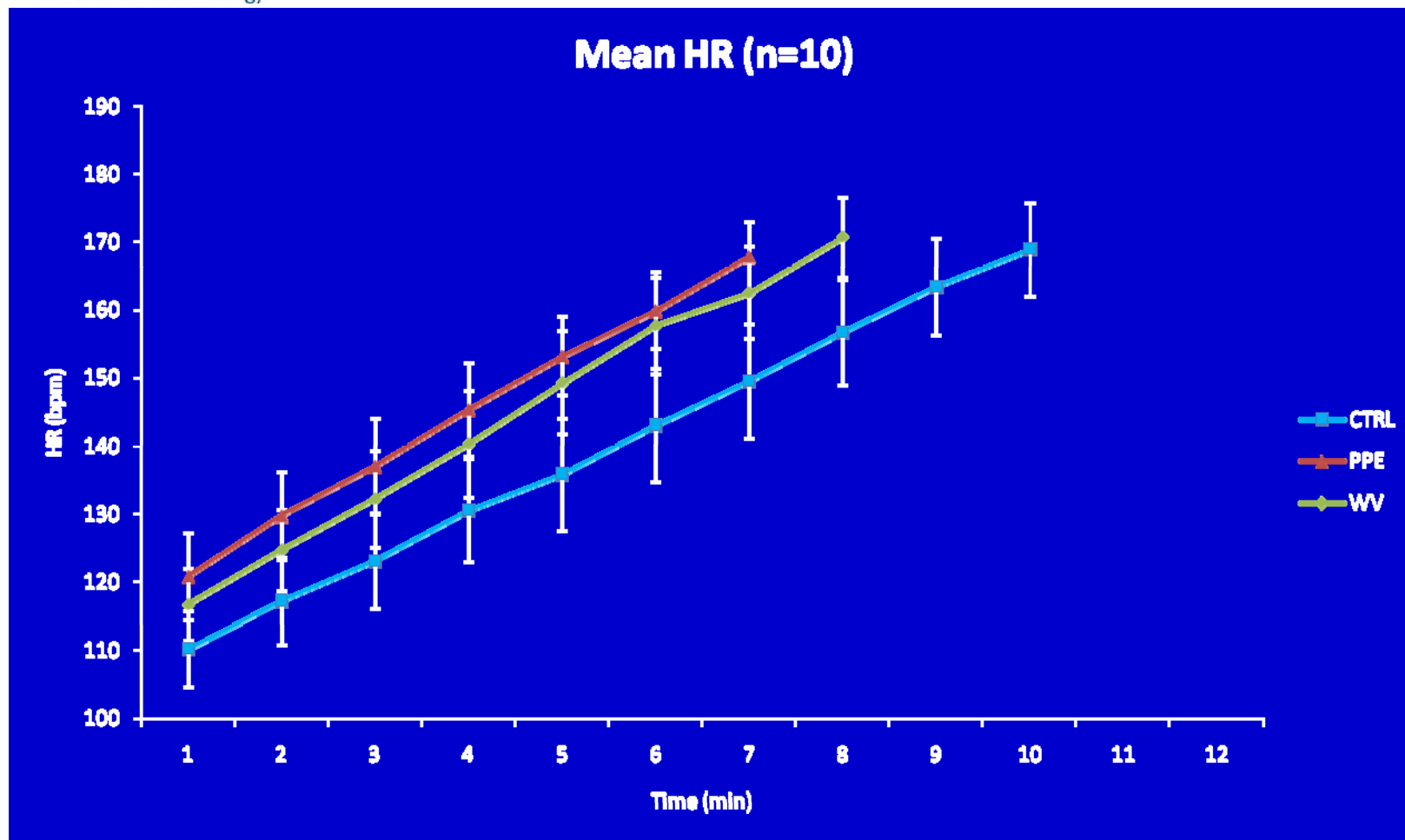


Factors reducing cardiovascular stress





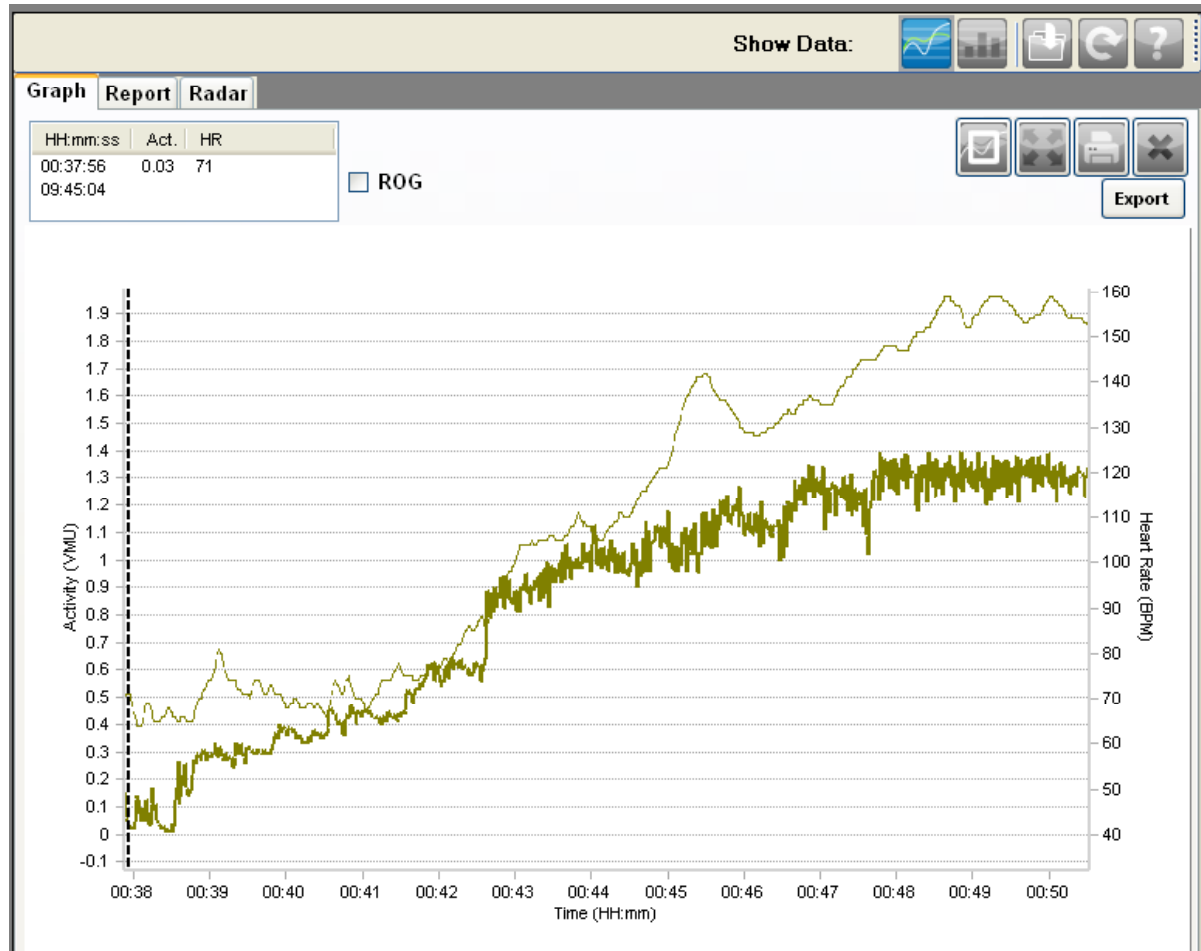
Effect of added weight on cardiovascular strain



*Ctrl < WV, PPE; p < 0.05



Heart rate and activity level: Incremental treadmill test



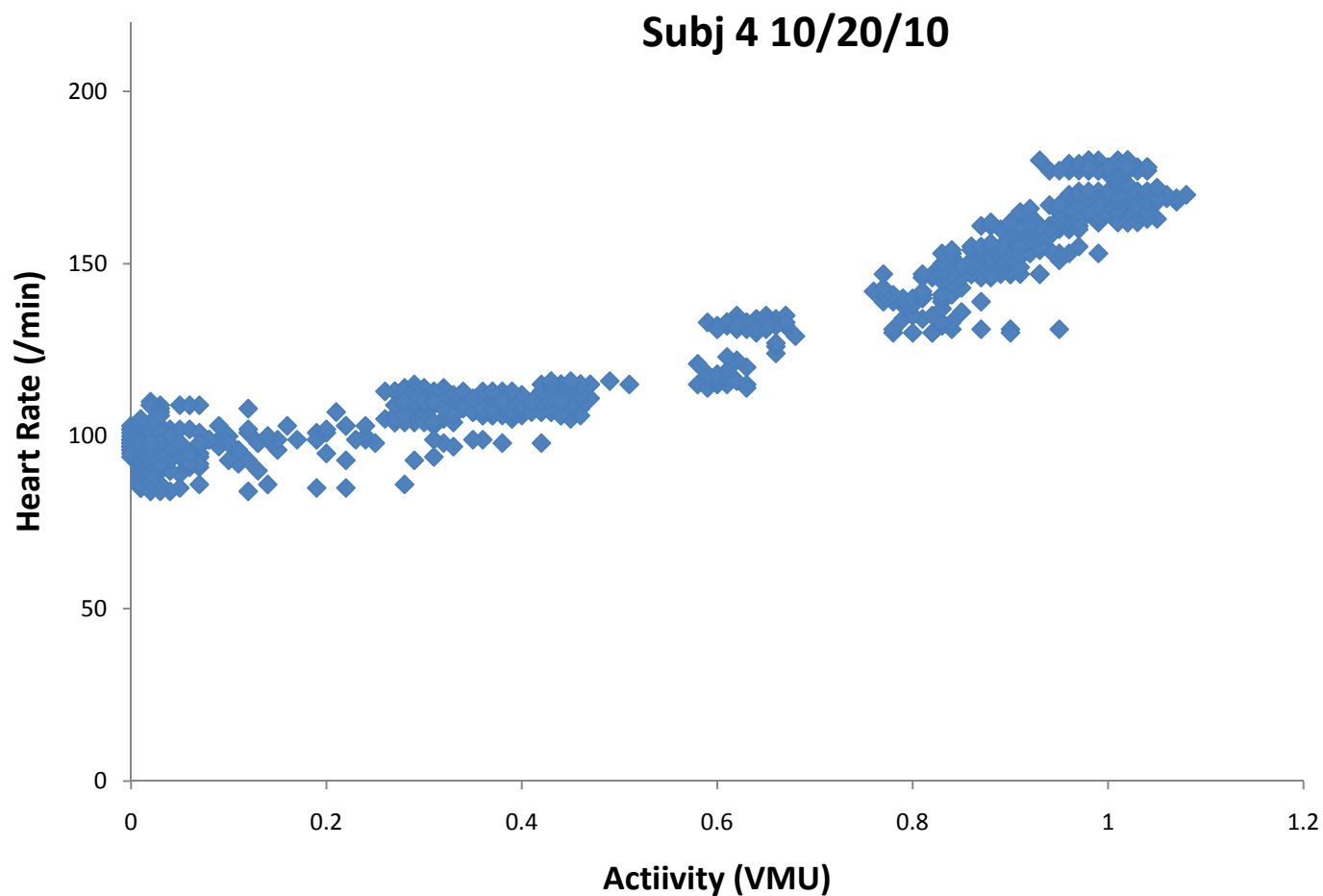
Data obtained using Zephyr Bioharness™



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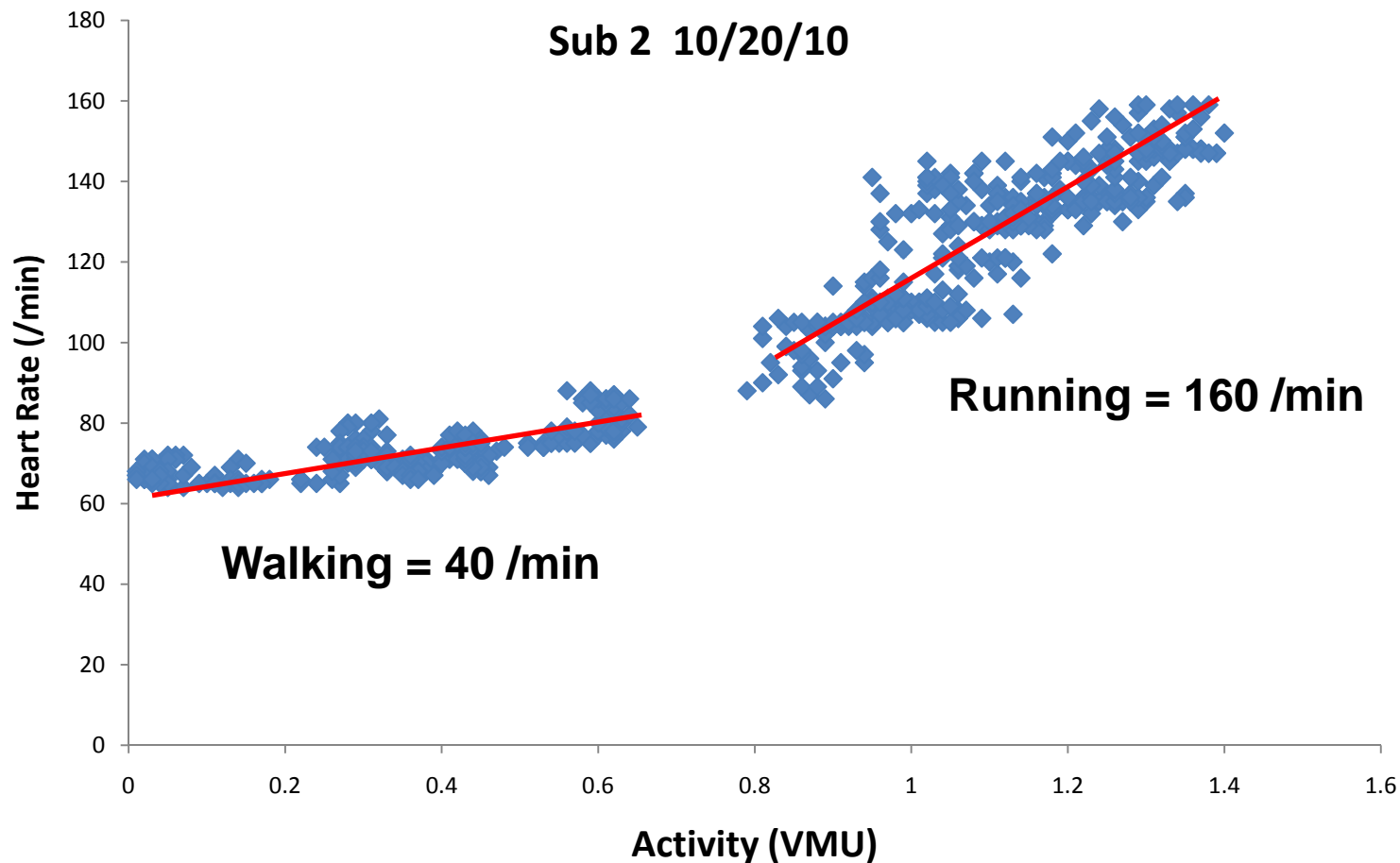
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“Cardiocaloric index”: proof of concept





“Cardiocaloric index”: proof of concept

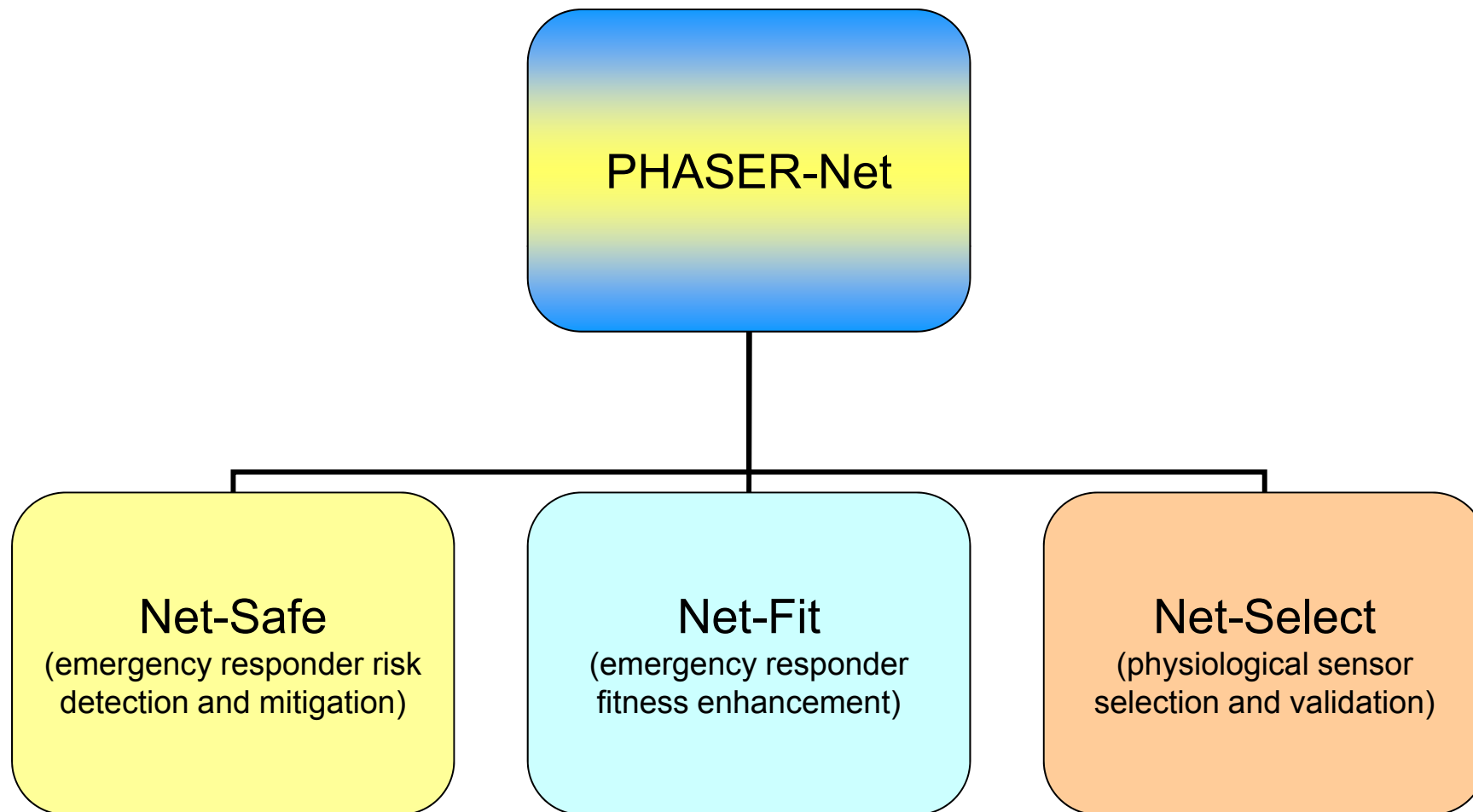


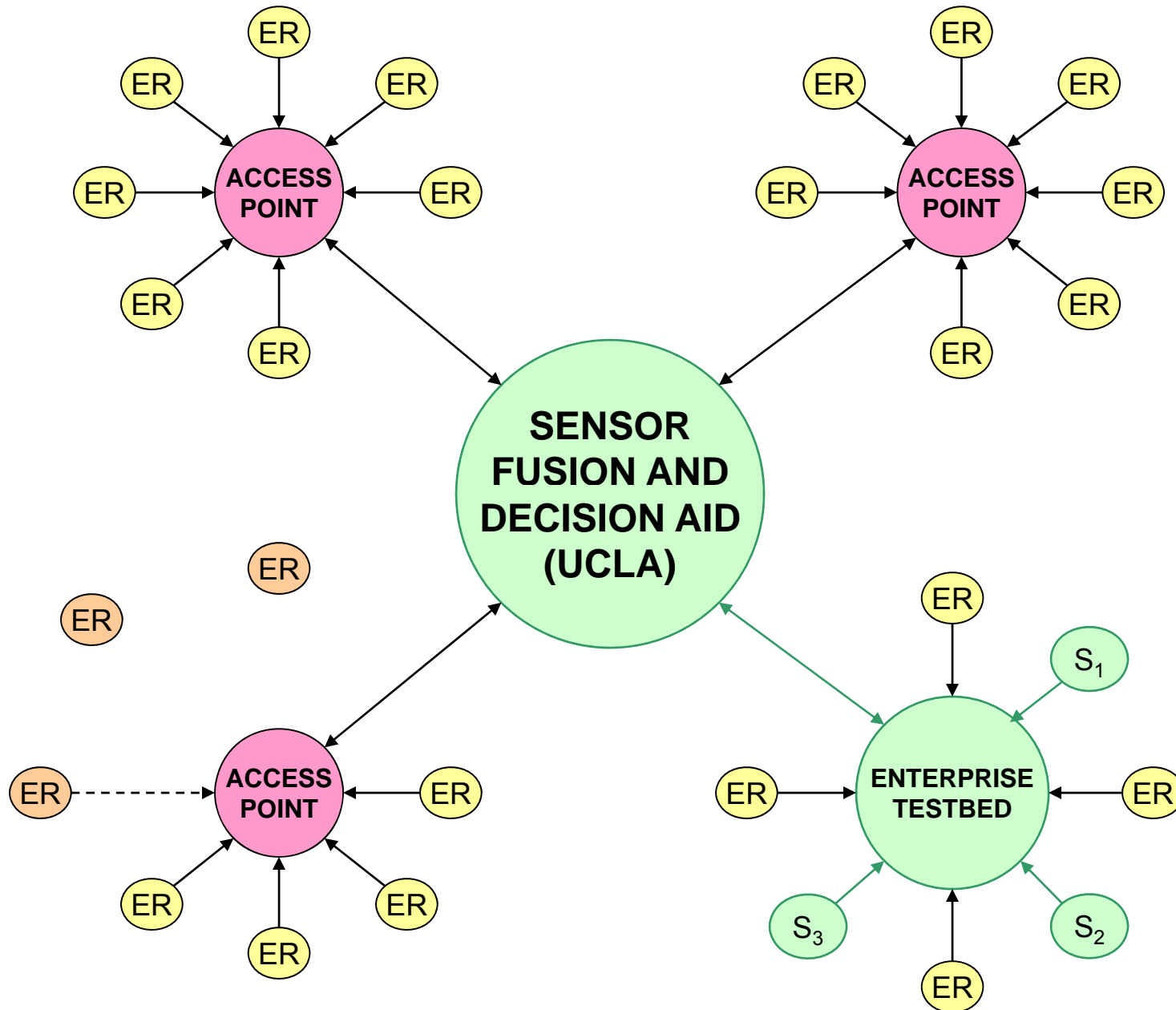


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ER = Emergency Responder

S = Sensors/Systems being Tested



Opportunities for physiological monitoring

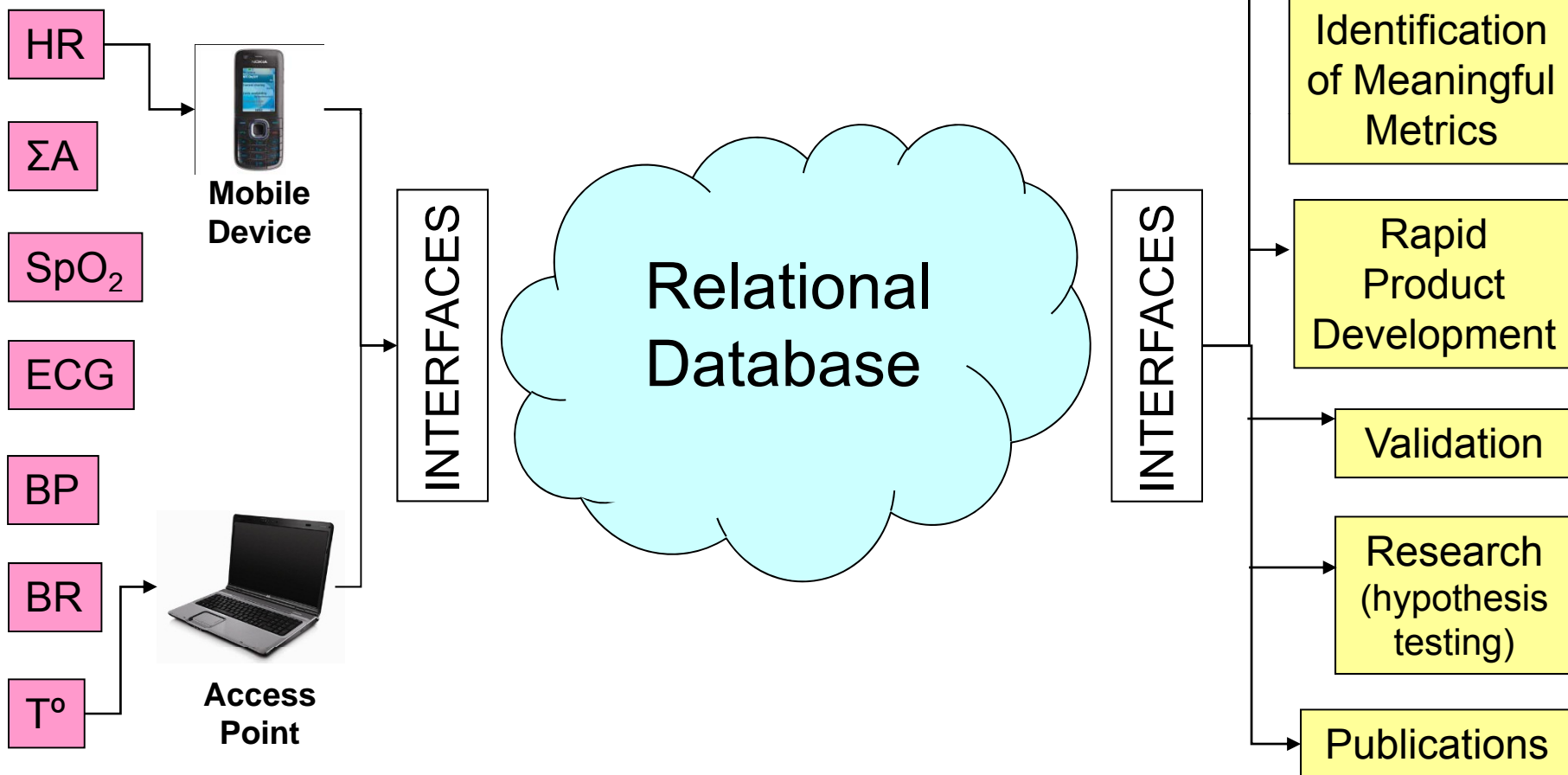
Baseline	Training	Emergency Operations (on mission)	Rehabilitation (on mission)
Heart rate, rhythm 12-lead ECG Category of activity Intensity of activity Breathing frequency Ventilation Oxygen uptake Carbon dioxide output Blood pressure	Heart rate, rhythm Category of activity Intensity of activity	Heart rate, rhythm Category of activity Intensity of activity Breathing frequency Body temperature	Heart rate, rhythm Heart rate recovery 12-lead ECG Category of activity Intensity of activity Breathing frequency Oxygen saturation Exhaled carbon monoxide Body temperature Blood pressure Electroencephalogram (EEG)



PHASER Net

Data Processing →

Data Integrity →





PHASER: Collaborations



Please visit our website: <http://phaser.med.ucla.edu/>



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Thank You