Translation of the Frailty Paradigm to Children with Heart Disease

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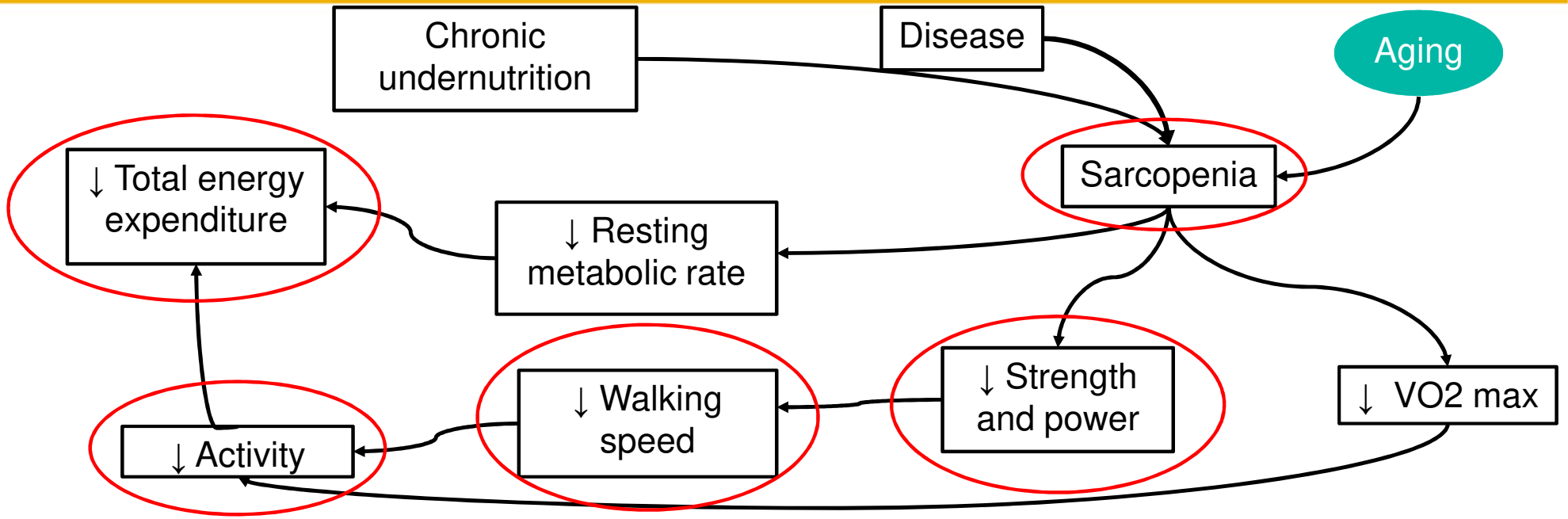
What is Frailty?

Frailty is a biologic syndrome of decreased reserve and resistance to stressors, resulting from cumulative declines across multiple physiologic systems, and causing vulnerability to adverse outcomes.

Frailty in Elderly- Pathophysiology



Adapted from Fried et al, Journal of Gerontology. 2001

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Operationalizing a Phenotype of Frailty

Characteristics of Frailty

1. Shrinkage
2. Weakness
3. Exhaustion
4. Slowness
5. Low activity

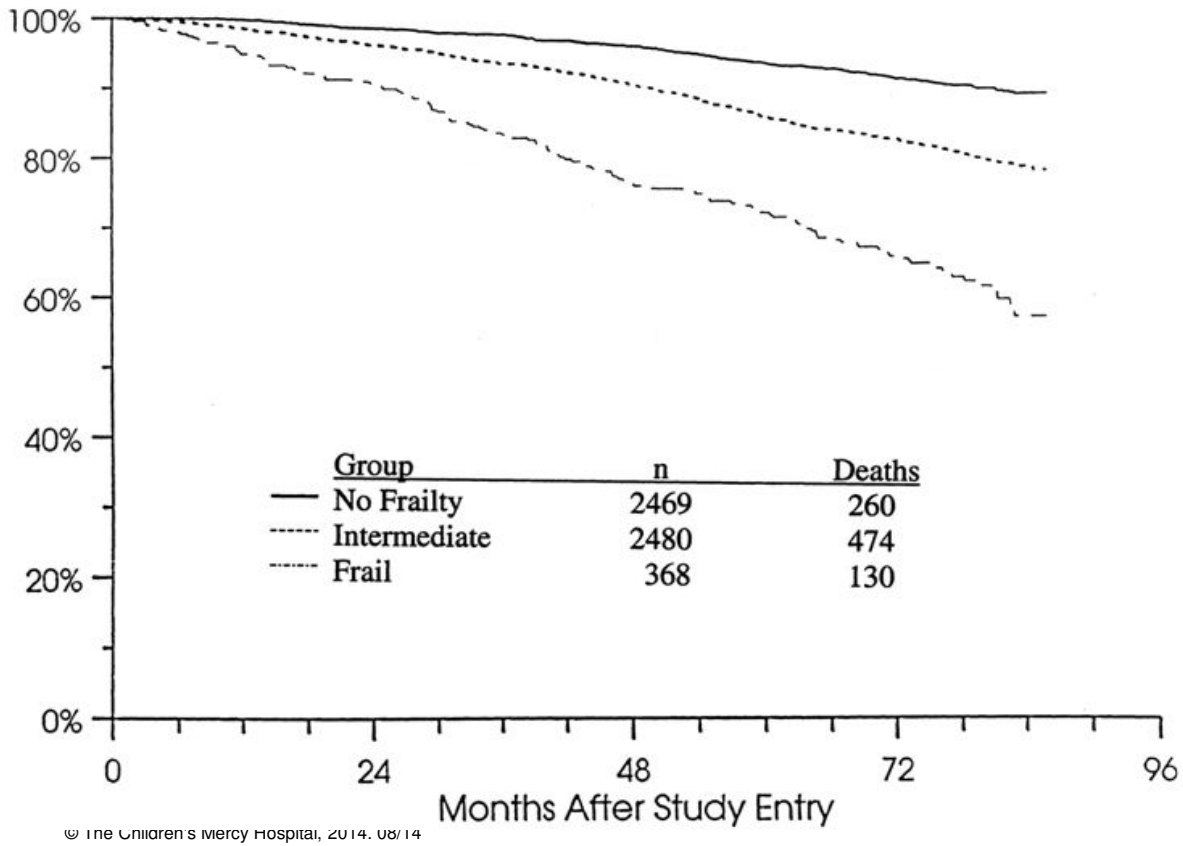
Fried et al, Journal of Gerontology. 2001

Frailty Phenotype

0 criteria- No frailty

1 or 2 criteria- Intermediate

≥ 3 criteria- Frail



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Frailty in the Young?

Physiologic Frailty As a Sign of Accelerated Aging Among Adult Survivors of Childhood Cancer: A Report From the St Jude Lifetime Cohort Study

Results

The prevalence of prefrailty and frailty were 31.5% and 13.1% among women and 12.9% and 2.7% among men, respectively, with prevalence increasing with age. Frail CCS were more likely than nonfrail survivors to have a chronic condition (82.1% *v* 73.8%). In models adjusted for existing chronic conditions, baseline frailty was associated with risk of death (hazard ratio, 2.6; 95% CI, 1.2 to 6.2) and chronic condition onset (relative risk, 2.2; 95% CI, 1.2 to 4.2).

Conclusion

The prevalence of frailty among young adult CCS is similar to that among adults 65 years old and older, suggesting accelerated aging.

J Clin Oncol 31:4496-4503. © 2013 by American Society of Clinical Oncology

Frailty in Children with Cardiac Disease?

Current tools-

- History and physical exam
- EKG
- Echo
- ? Exercise test
- ? Lab test

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Research Hypothesis

Children with significant cardiac disease will perform worse in the frailty phenotype

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Research Objectives

- To assess the feasibility of measuring the components of frailty phenotype in children using developmentally appropriate methods
- To compare indices of frailty in children with significant cardiac disease (CCD) with healthy controls

Inclusion Criteria

- Ages 8-17.5 years
- ≥ 1 of the following:
  - Status post Fontan
  - Heart failure
  - Pulmonary hypertension
- Age and gender matched healthy controls

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Frailty Measures

Frailty Domain	Adult Measures	Proposed Pediatric Measures
Slowness	15 feet walk test	6 minute walk test (Z score)
Weakness	Hand grip strength	Hand grip strength (percentile)
Exhaustion	CES-D	Peds QL multidimensional fatigue scale/ Peds QL
Shrinkage/ body composition	Weight	Height, weight, BMI, MUAC, triceps skin fold thickness (percentiles)
Diminished physical activity	Activity recall questionnaire	PAQ/ MAQ/ accelerometer

Statistical Methods

Two tailed T-tests to compare Z-scores/ percentiles of raw scores between the 2 groups

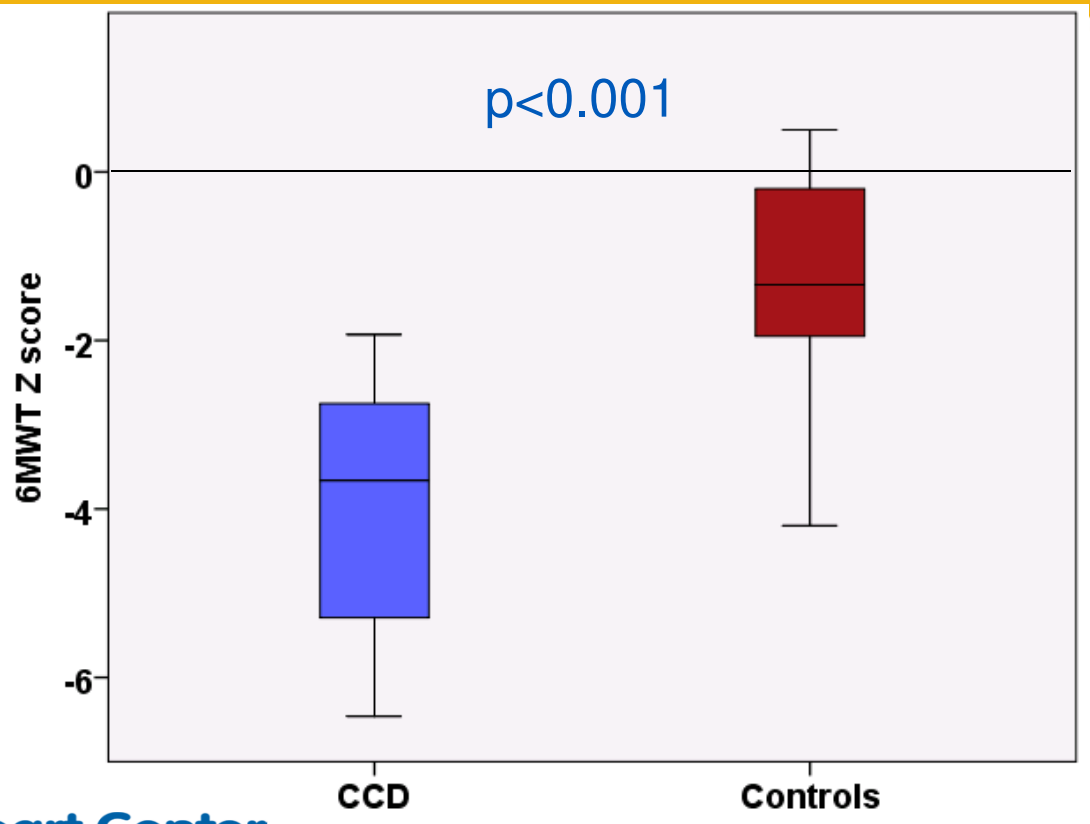
Results

	CCD n = 34	Controls n = 22	p-Value
Fontan	24 (70%)	0	
Heart failure	9 (27%)	0	
Pulmonary hypertension	4 (12%)	0	
NYHA 1	16 (47%)	22 (100%)	<0.01
NYHA 2	15 (44%)	0	
NYHA 3	3 (9%)	0	
Age	12.3 ± 2.8	11.9 ± 2.3	0.58
Male Female	21 (62%) 13 (38%)	13 (59%) 9 (41%)	0.84
White African- American	32 (94%) 2 (6%)	22 (100%) 0	0.74

Results

		CCD n(%)	Controls n(%)	
Household annual income	< $60k	11 (32)	3 (14)	< 0.01
	$60k- 150k	19 (55)	8 (36)	
	> $150k	1 (3)	11 (50)	
Participant school grades	Above average	6 (18)	14 (64)	< 0.01
	Average	22 (64)	8 (36)	
	Below average	6 (18)	0	
IEP or 504	No	12 (35)	21 (95)	< 0.01
	Yes	14 (41)	1 (5)	
	Unknown	8 (24)	0	
School days missed in the past year due to illness	0-5	20 (59)	21 (95)	< 0.01
	6-10	8 (24)	1 (5)	
	11-15	1 (3)	0	
	>15	5 (14)	0	

Slowness: 6 Minute Walk Test (Z score)



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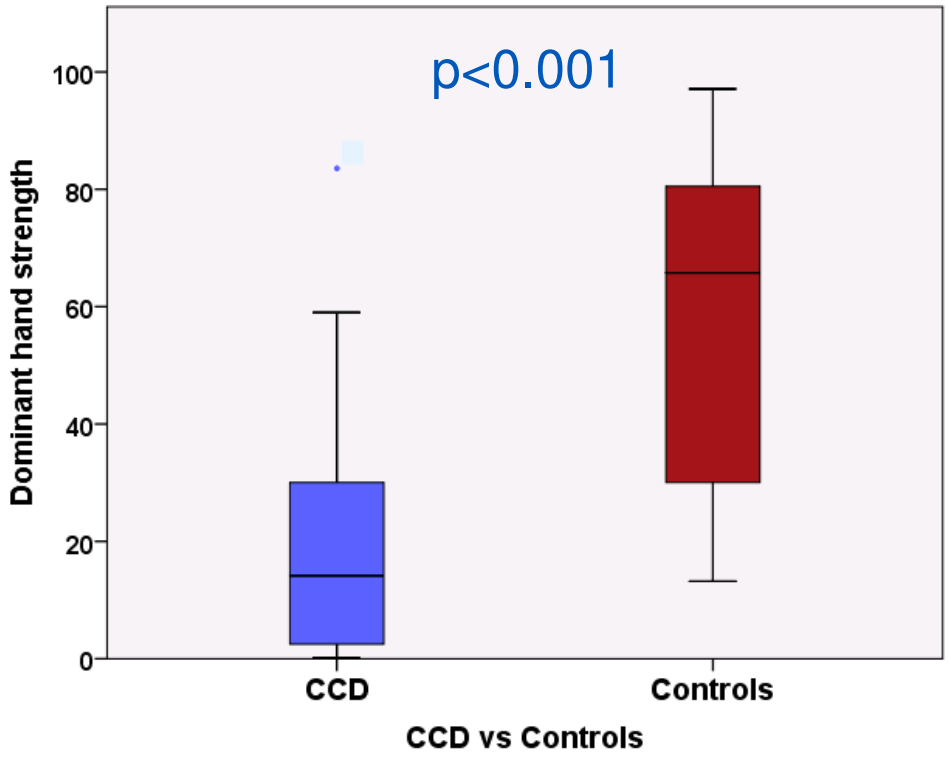
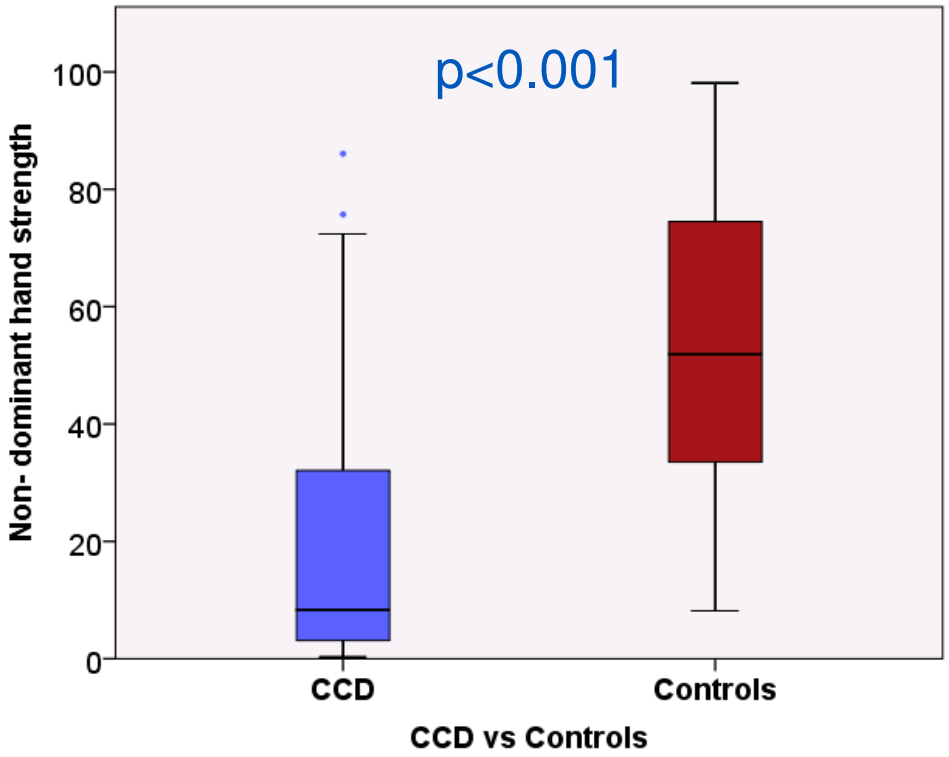
Weakness: Hand Grip Strength (%tile)





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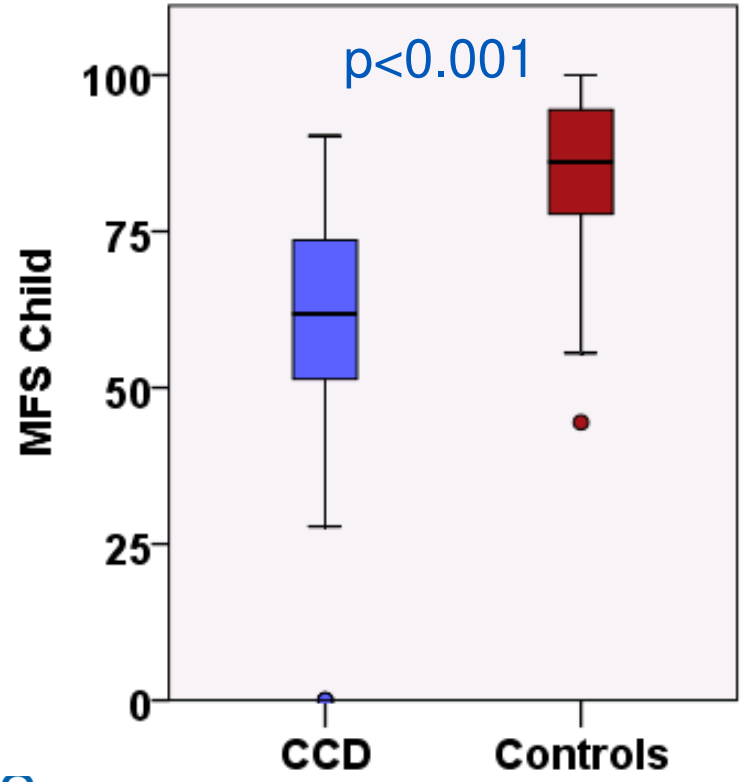
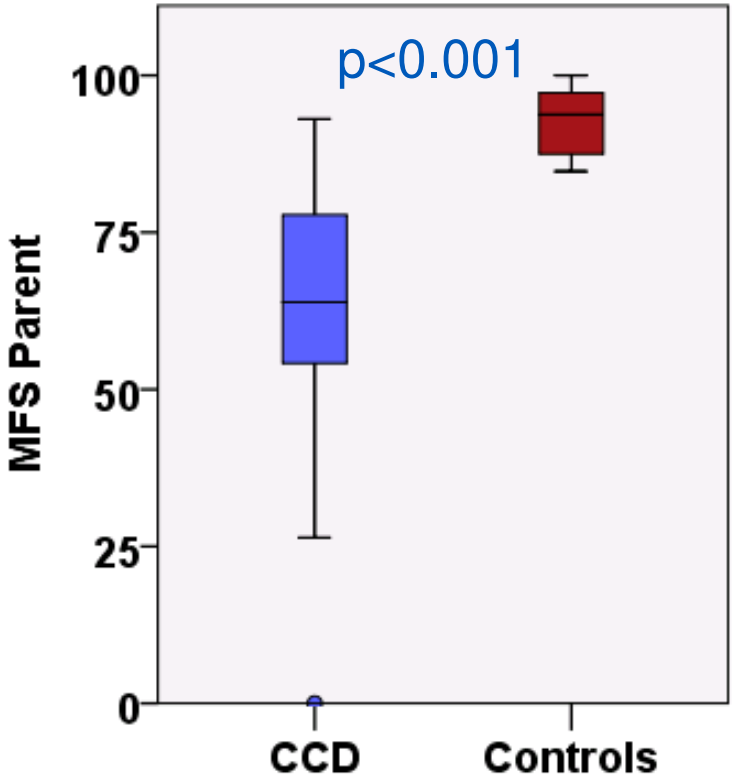
Exhaustion- Peds Multidimensional Fatigue Scale





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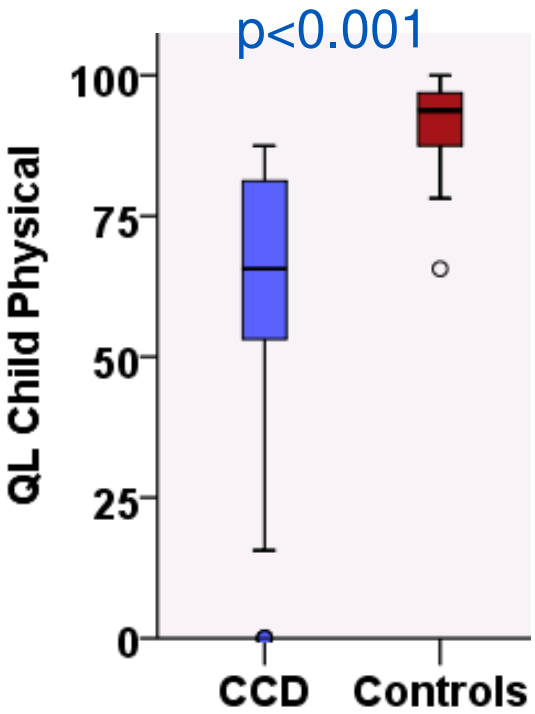
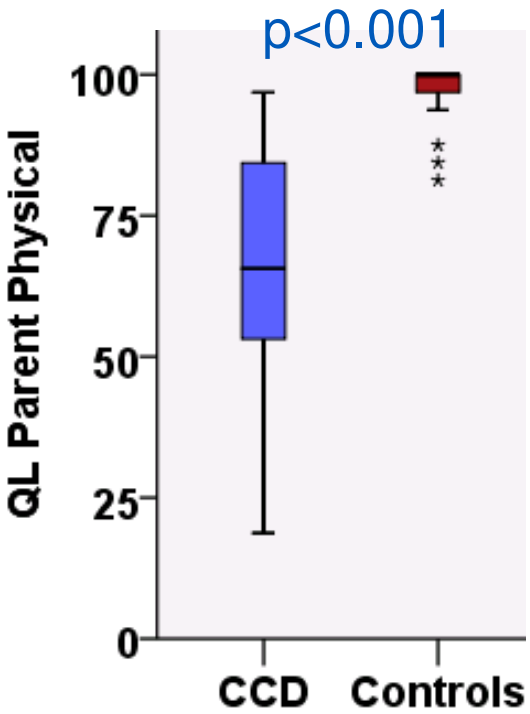
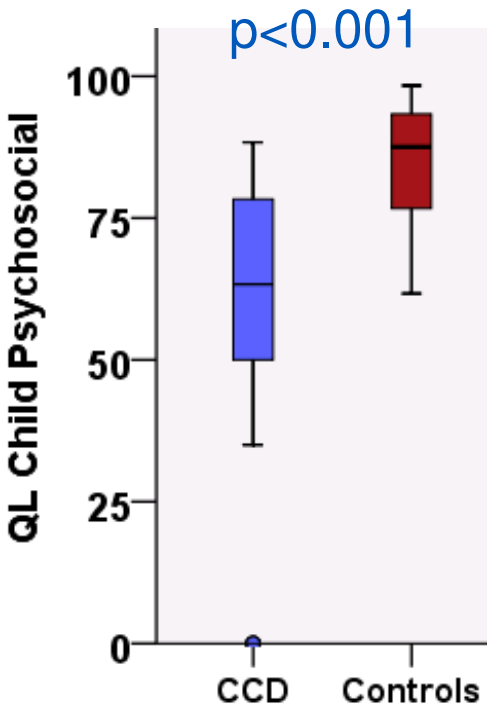
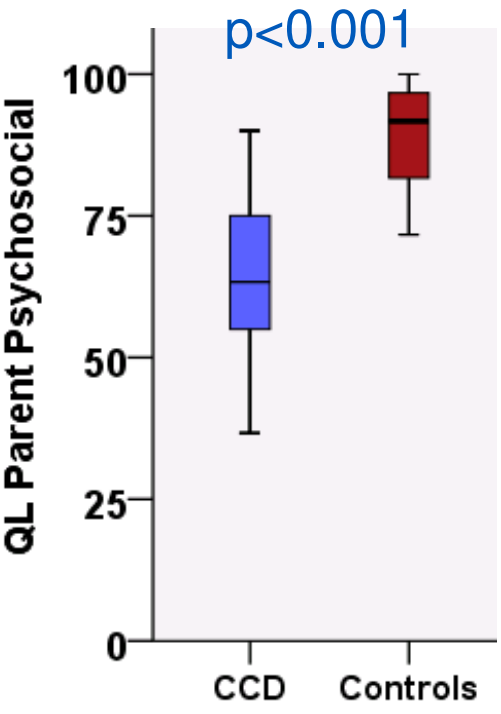
Peds QL









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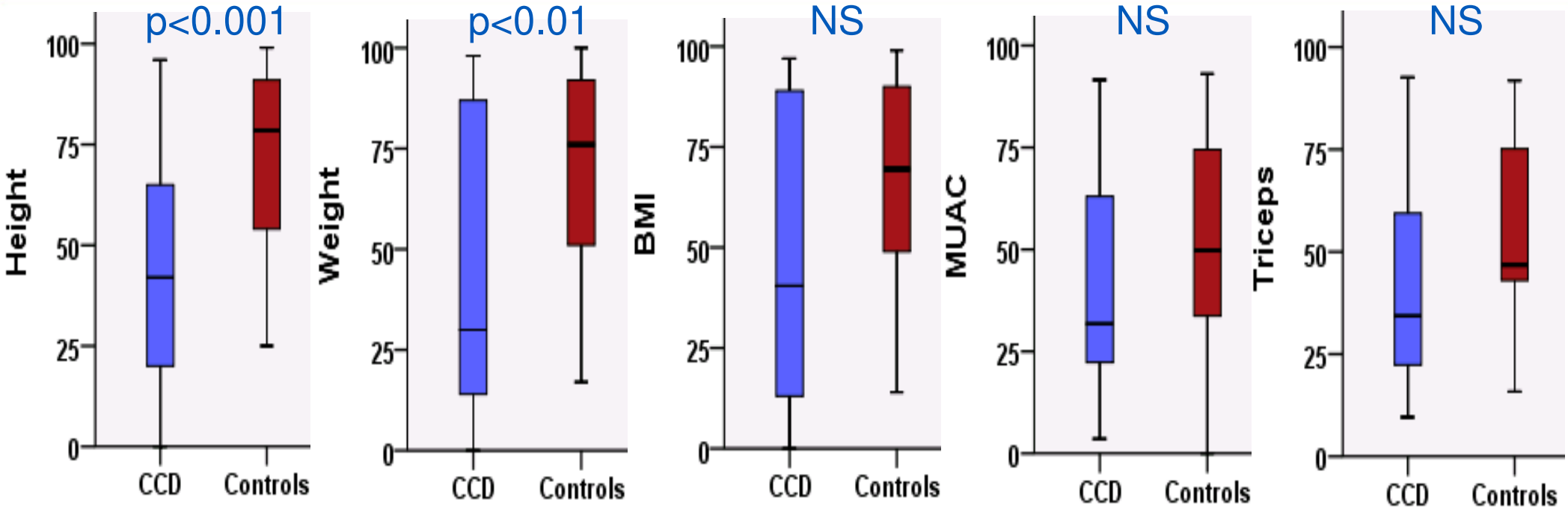
Body Composition



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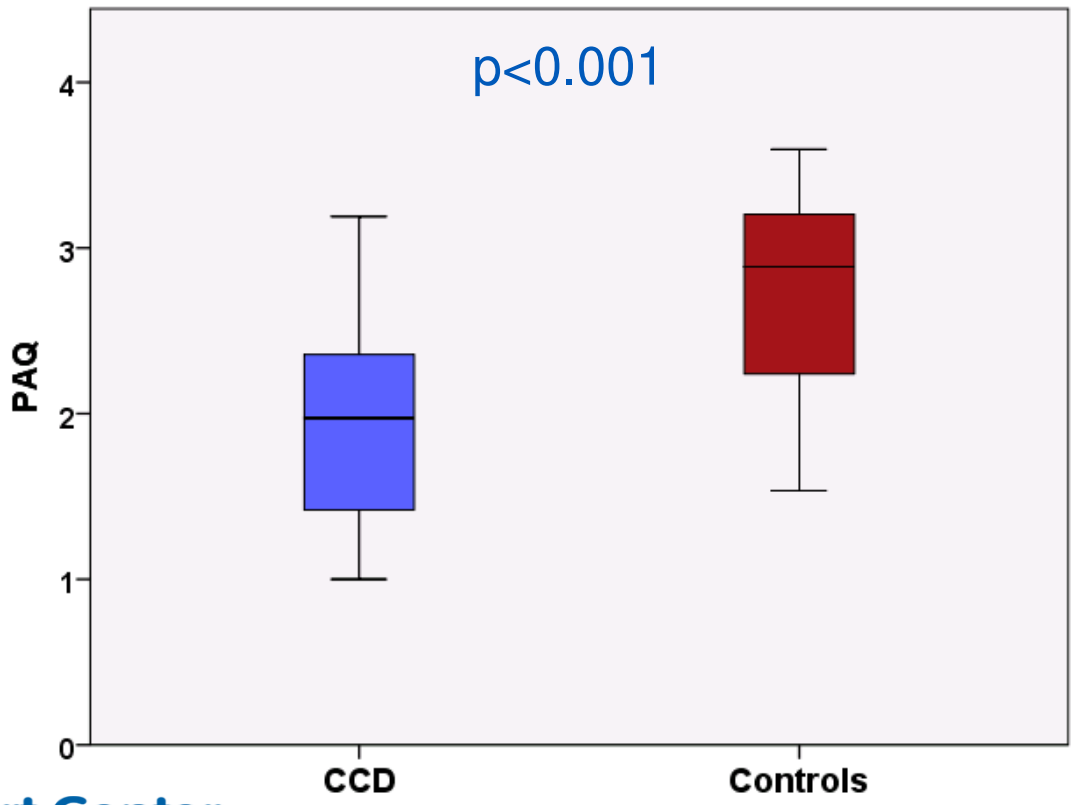
Activity: Physical Activity Questionnaire



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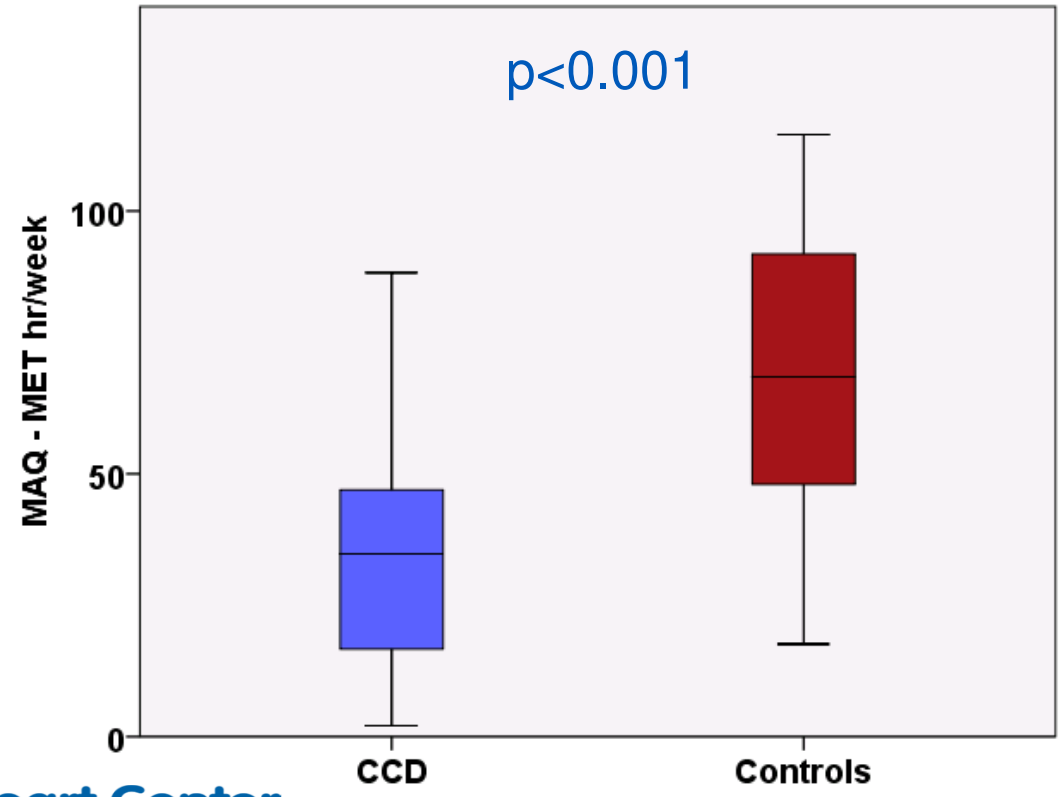
Activity: Modifiable Activity Questionnaire



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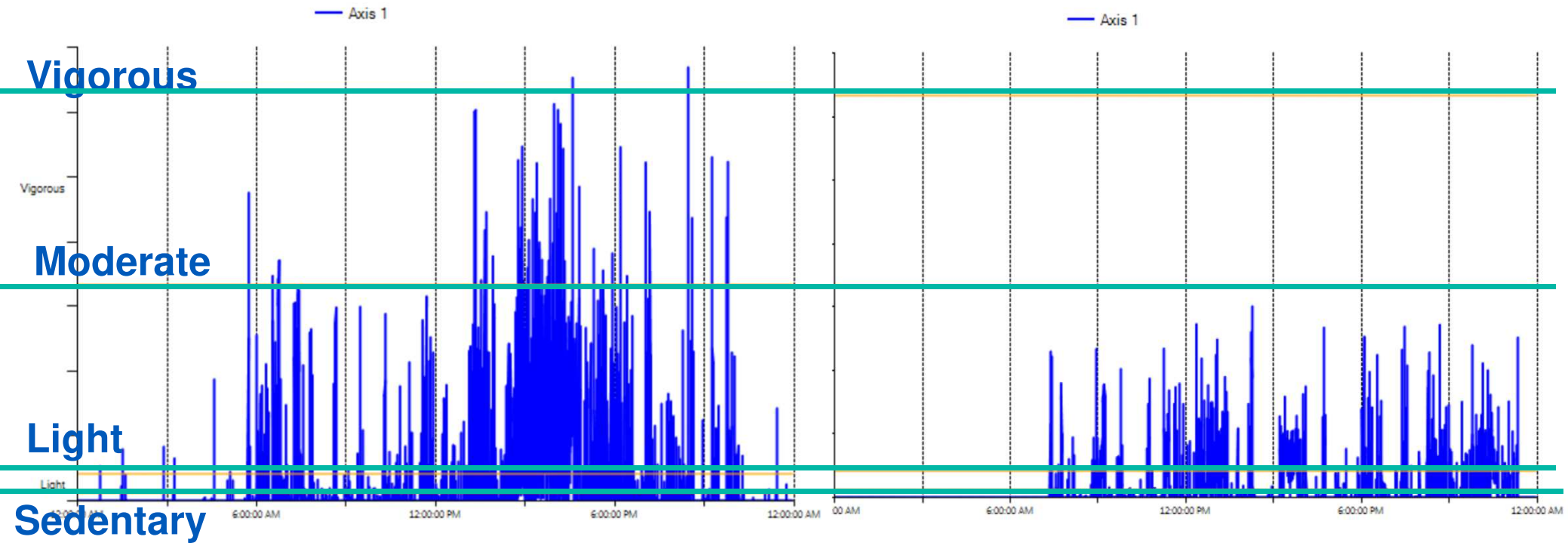
Activity: Accelerometer



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Conclusions

- The components of frailty can be assessed in children by using the developmentally appropriate methods described in this study
- Children with heart disease differ significantly from controls in all 5 domains of frailty- slowness, weakness, height and weight, self-reported exhaustion and physical activity levels

Limitations

- Cross-sectional study. So, no longitudinal data
- ? Prevalence of frailty
- Small sample size
- Single center study
- Selection bias for controls

Future Directions

- Larger and longitudinal studies with retrospective and prospective data to correlate frailty measures with morbidity and mortality
- Defining frailty phenotype in children with heart disease
- Interventional studies to see if reversing frailty measures can improve morbidity

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