The role of cortisol reactivity in the translation of callous-unemotional traits to aggression: evidence for sex specific pathways

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CU traits

- Downwards extension of concept of psychopathy applied to adults
- Callous-unemotional (CU traits)
  - Lack of guilt, empathy and concern for others, shallow and deficient emotions (Frick et al., 2014)
- Psychopathy associated with more severe violent and antisocial outcomes in adults
- Findings replicated in childhood and adolescents (Frick et al., 2014)

CU traits

- HOWEVER - associations between CU traits and aggression modest
- Why do some individuals with CU traits develop aggression and others not?

Cortisol reactivity

- Cortisol indexes activity of the hypothalamic-pituitary-adrenal axis (HPA axis) – key component of the human stress response
  - Stress activates the HPA axis ➡ releases cortisol
  - Individual differences in cortisol reactivity
- Cortisol reactivity and aggressive behavior
  - Inverse relationship proposed
    - Sensation seeking – seeking stimulation to increase low arousal, which is experienced as aversive (Zuckerman, 1979)
    - Fearlessness theory (Raine, 1997) low arousal marker for low fear, lack of fear allows antisocial behaviour
  - Evidence inconsistent
    - Alink (2008) meta-analysis of all child samples – no association between cortisol reactivity and aggression

Cortisol reactivity and externalizing behaviour

- Sex differences could explain the inconsistent findings
  - Positive association **increased** cortisol awakening response and aggression in girls (Dietrich et al., 2013; Marsman et al., 2008)
  - Boys but not girls with behavioural problems **decreased** basal cortisol (Dorn et al., 2009)
- Consistent with findings examining vagal reactivity (Tibu et al., 2014; Hinnant & Sheikh, 2013; Morales et al., 2015; Vidal-Ribas et al., 2017).

Cortisol reactivity and CU traits

- Two pathways to conduct problems (Frick & Morris, 2004)
  - Without CU: High emotional and physiological reactivity
  - With CU: Low emotional and physiological reactivity
- CU traits and cortisol findings
  - Decreased cortisol reactivity in high CU traits group in clinical sample (Stadler et al., 2011) and decreased basal cortisol community sample (Loney et al., 2006) of adolescents (but see Poustka et al., 2011)
  - Significant inverse association boys not girls (Loney et al., 2006).
- Reduced cortisol reactivity may be involved in the translation of CU traits to aggressive behaviour
  - CU traits and cortisol reactivity failures of inhibition? (Tremblay, 2000)

Hypotheses

Increased CU traits and decreased cortisol reactivity at age 5 years will be associated with increased aggression at age 7 years in boys only

CU traits: Measurement issues

- APSD downwards extension of the PCL
  - Some items not appropriate for young children
  - Poor psychometric properties
- We subjected items from multiple measures to EFA and CFA at age 2.5, 3.5 and 5 years
  - Demonstrated factorial invariance by sex
  - Tested validity by examining prospective associations with aggression (Wright et al., submitted)

Sample

- 283 children with complete data from age 5 and 7 years
  - From ‘intensive’ subsample
  - 153 boys and 141 girls
  - Child mean age at age 5: 57.59 months (SD = 2.44)
  - Child mean age at age 7: 88.19 months (SD = 3.75)
  - 96% White British
  - 80% married/cohabiting with partner

Measures

- Cortisol reactivity
  - Standard lab stressor – exposure to an argument
  - Salivary cortisol
    - First baseline taken after consent
    - Second baseline taken 20 minutes later
      - Both averaged to create mean baseline
    - One post-stressor sample 20 minutes after stressor
    - **Reactivity score = Post-stressor – Baseline**
- Physical aggression
  - Baillargeon et al. (2007) **physical aggression** measure
  - Mother report at age 5 and mother and teacher report at age 7
- CU factor score age 5
  - Mother report

Analysis Plan

- Stata version 14 used to examine 3-way interaction (sex X CU traits X reactivity) predicting aggression
- Linear regression with robust standard errors used
- Confounders:
  - High/low risk allocation to sample
  - Mothers age
  - Deprivation
- Residual cortisol score after accounting for time of day and medication use

Bivariate associations between key study variables.
Boys on top diagonal/girls on bottom

	Age 5 aggression	Age 7 aggression	Age 5 CU traits	Age 5 cortisol reactivity
Age 5 aggression		.47 P<.001	.39 P<.001	-.01 P=.867
Age 7 aggression	.30 p<.001		.35 P<.001	-.03 P=.750
Age 5 CU traits	.20 p<.001	.32 p<.001		.09 P=.281
Age 5 cortisol reactivity	.06 P=.453	.13 P=.153	-.034 P=.683	

Three-way interaction predicting age 7 aggression

	β	p
CU factor score	.51	.002
Reactivity	.14	.443
Sex	-.17	.002
Cu X reactivity	-.52	.001
Reactivity X sex	-.03	.881
Sex X CU	-.20	.282
Sex X CU X reactivity	.41	.005

R2 = .24

Regression predicting age 7 aggression in boys and girls separately

Age 7 mother and teacher report aggression	β	p	β	p
	Boys		Girls	
CU factor score	.32	<.001	.33	<.001
Reactivity	.11	.179	.14	.148
Cu X reactivity	-.23	<.001	.03	.732

R2 = .21

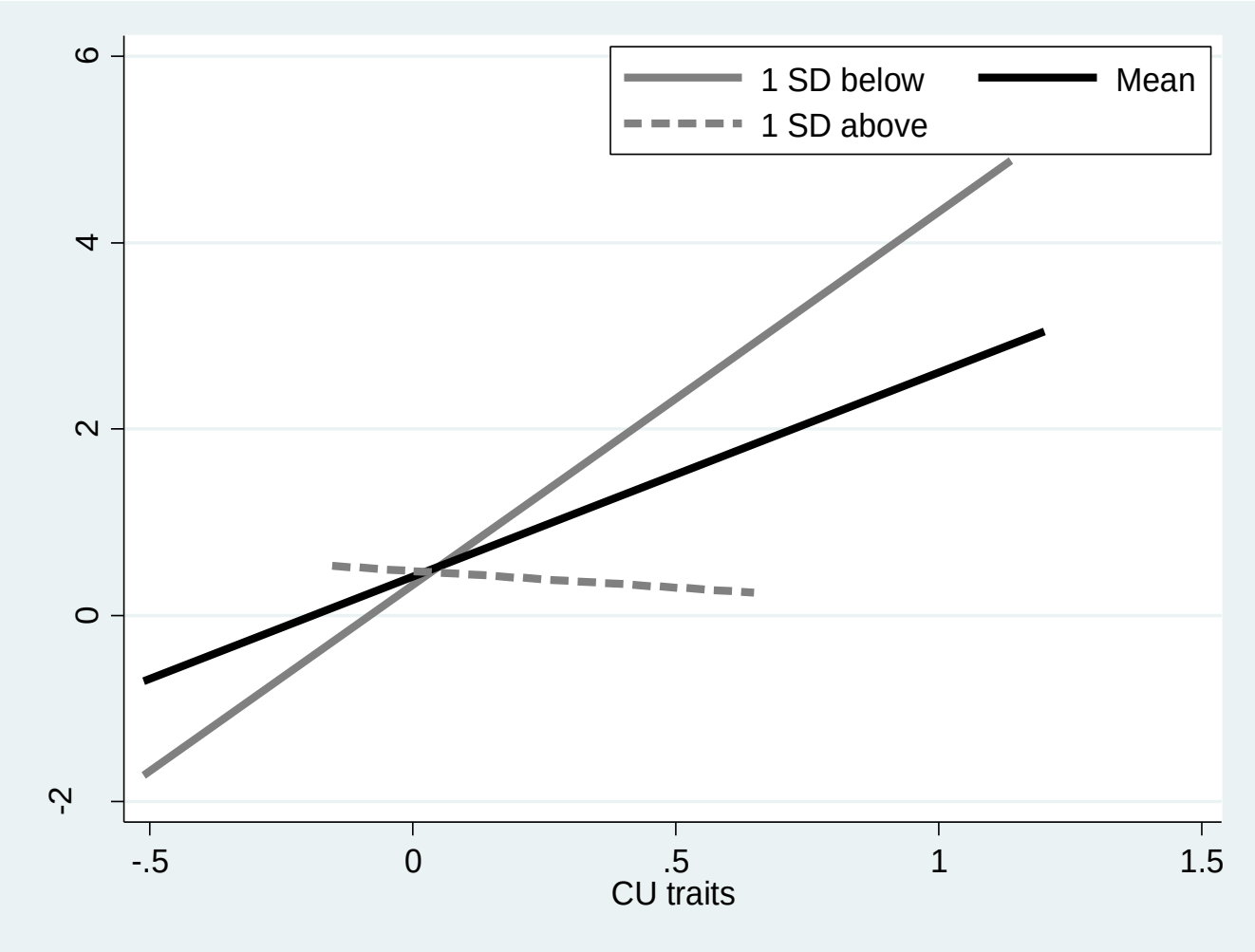
R2 = .17

Regression predicting age 7 aggression in boys and girls separately after accounting for age 5 aggression

Age 7 mother and teacher report aggression	β	p	β	p
	Boys		Girls	
Age 5 aggression	.42	<.001	.10	.329
CU factor score	.20	.015	.33	<.001
Reactivity	.04	.599	.13	.153
Cu X reactivity	-.14	.034	.03	.750

R2 = .34

R2 = .17



Association between CU traits and aggression at ‘low’, ‘medium’ and ‘high’ cortisol reactivity in boys

Summary and conclusions

- Cortisol reactivity moderated the association between CU traits and later aggression in boys
  - In boys with CU traits decreasing cortisol reactivity was associated with increasing aggression
  - In girls no evidence for moderation
- Supports reduced cortisol reactivity as a mechanism through which CU traits translate to aggressive behaviour in boys
- Consistent with broader literature documenting a reduced physiological reactivity pathway to externalising in males

Limitations and Future Directions

- Limitations
  - Sample size
  - Only one post-stressor sample
- Future directions
  - Identify mechanisms involved in translation of CU traits to aggression in females
  - Replicate in samples of different ages

WCHADS team

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