Feasibility of Sampling Hair for Cortisol Analysis in High-Risk Mothers and Their Toddlers
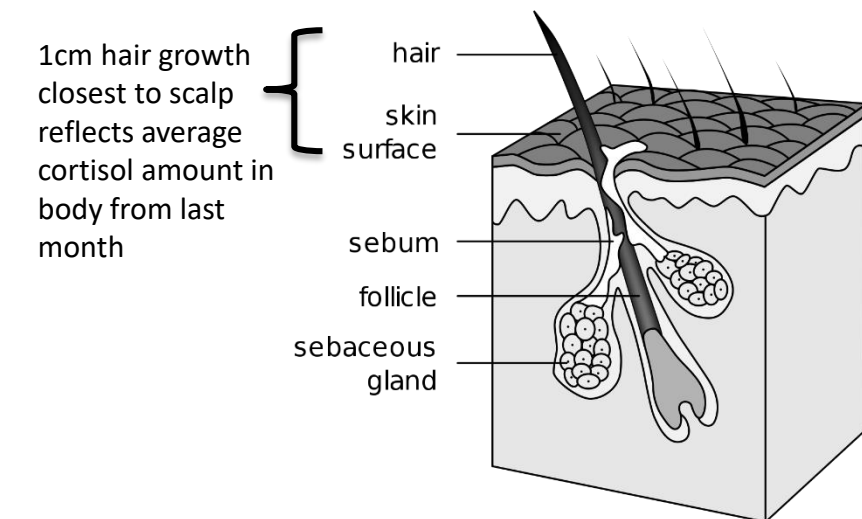
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INTRODUCTION

- Chronic stress in young children and toddlers is associated with later life poor health, socioeconomic status (SEC), and academic outcomes,[1] in line with life course health development theory[2]

- Chronic stress in young children is associated with exposure to low SES environments[3]

- Difficult to identify chronic stress in toddlers, but the collection of hair samples for cortisol measurement may improve assessment[4]

- Research examining hair cortisol concentration (HCC) in adults is burgeoning, but little is known about HCC in toddlers or the mother-toddler dyad, particularly if collection is feasible from dyads living in low SES environments

Hair Cortisol Concentration (HCC)

- Cortisol released in blood from hypothalamus – pituitary – adrenal (HPA) axis to manage internal clock[5] and in response to stress[6]

- HCC likely from hair absorbing cortisol in blood[7]

- In adults, very high and very low levels of HCC associated with chronic stress[7]

- Hair grows ~1 cm/month and each cm of hair growth closest to scalp contains average amount of cortisol secreted in blood over past month[7]

- Cortisol can wash out of the hair over time, thus HCC most reliable in up to 3-6 cm of hair proximal to posterior vertex (PV) of scalp[7]

1cm hair growth closest to scalp reflects average cortisol amount in body from last month

hair
skin surface
sebum
follicle
sebaceous gland

AIM

Describe characteristics of the sample of low-SES mother-toddler dyads who consented to sampling hair for cortisol analysis

METHODS

Sample

- Mothers participating in 5th time point (TP5) of the Kids in Columbus Study (KICS), when toddlers were 20-24 months of age

- KICS is a longitudinal research project on child development and use of community resources within low-income environments

- Mother-toddler dyads eligible to participate if toddler had at least 1cm of hair growth and provided informed consent for hair sampling from at least their toddler

- Mothers provided $10 gift card for participation

Technique

- Hair sampled from the PV of scalp or from nape of the neck when unable to sample from PV (e.g. due to hair style such as braids). Hair cut with thinning shears to reduce appearance that hair was sampled

- Sampled ~150 hairs (~shoelace tip size)

- Demonstrated hair sampling technique to mothers prior to consent with hair styling dolls, such as Barbie™

- Distracted toddlers from sampling by asking toddler to brush the doll's hair and/or by having the mother hug the toddler during hair sampling

- Hair sample attached to aluminum foil with painters' tape if >3cm length or placed in sealed envelope if ≤ 3cm in length and stored at room temperature prior to analysis

RESULTS

- 149 toddlers at target age during their TP5 participation
  - Hair sampled primarily by RAB; other data collectors primarily uncomfortable sampling hair
  - 6 dyads ineligible due to toddler hair <1cm
  - **65.7% (94/143) participated**
    - 2 mothers refused collection on themselves due to hair style concerns, but consented for toddler
    - Sampled hair from nape of neck from 10 mothers and 3 children

- Of the 49 dyads that did not participate, 41 refused. Reasons for refusal included (could pick >1 reason):
  - 17/41 refused due to hairstyle concerns
  - 10/41 children fearful or mothers did not want child to be touched
  - 6/41 concerns about biomaterial collection
  - 14/41 other or unknown reason

Participant Demographics: Full KICS vs. HCC

	KICS: n = 322	HCC: n = 94
Annual household income (%)		
≤ $10,000	50.3	44.8
$10,001 - $30,000	35.8	42.5
> $30,000	13.8	12.6
Mean age of mother at enrollment (SD)	26.3 (5.4)	26.5 (5.3)
Main language spoken at home (%)		
English	92.5	96.8
Spanish (some mothers also selected English)	3.7	8.5
Mother's education (%)		
Not a high school grad	19.8	15.0
High school diploma or GED	31.1	34.4
High school diploma or GED & technical certificate	8.8	8.6
Some college, no degree	29.9	35.5
College degree (Associates and up)	10.9	6.7
Mother married or living with partner at enrollment (%)	50.6	56.1
Toddler race (% [n])		
Unknown	4.3 (14/322)	5.3 (5/94)
Black/African American	54.5 (168/308)	44.9 (40/89)
Non Black/African American	45.5 (140/308)	55.1 (49/89)
% White/Caucasian only	90 (126/140)	95.9 (47/49)
Toddler ethnicity Latino/Hispanic	7.4	10.6
Toddler gender male (%)	43.5	43.3

CONCLUSIONS

- Collecting hair from mother-toddler dyads living in low SES environments for HCC is feasible

- Participation rates adequate

- Demographics of full KICS vs. HCC participation sample similar

- Researchers should be aware of participant refusal due to hair style

- Strategies to help improve participation are to:
  - Train data collectors to feel comfortable sampling hair (which may have increased participation rates and/or number of TP5 participants approached for hair collection during their TP5 home visit
  - Determine if HCC sampled from nape of neck reliable and accurate, to see if appropriate to offer dyads this option for participating if hair style a concern

- Analysis of HCC underway at The Ohio State University College of Nursing under RAB and JLF

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