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

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Introduction: Early childhood chronic stress is known to have an effect on later adult health, particularly if experienced before toddlerhood, or around two years of age. Per life course health development theories, early stress exposures can result in chronic stress and become “embedded” within a developing child’s psychoneurobiological framework, shifting developmental trajectories towards adverse adult health outcomes. Very early in life, early childhood chronic stress may be related to exposures associated with chronic maternal stress and poverty. As such, it is important to understand hair cortisol concentration relationships between mothers and their toddler (within the mother-toddler dyad). Chronic stress has been reliably and validly measured in adults through hair cortisol concentration, and recent research suggests accuracy of this method in young children as well. For optimal reliability in hair cortisol analysis, hair is cut at the skin of the posterior vertex portion of the scalp. However, mothers may object to sampling hair from their toddler and the general feasibility of sampling hair in mother-toddler dyads is not well reported in the literature. The purpose of this presentation is to report the feasibility of collecting hair samples for cortisol analysis in mother-toddler dyads.

Methods: We approached a subsample ($n = 148$) of mother-toddler dyads for consent to sample their hair for cortisol analysis for improving understanding of toddler chronic stress. The dyads were originally participating in a longitudinal parent study ($n = 322$) on understanding relationships between community resource use and child development in urban and low-income settings. The parent study dyads were originally recruited in a quota sampling fashion from Women, Infant, Children (WIC) clinics in an urban, Midwestern metropolis of the United States when the children were in utero or were less than 3 months of age. Trained data collectors obtained data from dyads approximately every 6 months, typically during home visits, and were known to the dyads either through biannual contact or through mailed flyers on study updates. Dyads were eligible to participate in the hair sampling substudy if they: a) participated in time point five of the parent study (when the toddler was between 20-24 months of age, occurring from 2016 to early 2018); b) the toddler had at least 1cm length of hair; and c) provided consent to sample hair from at least their toddler and fill out a short survey on health history and hair care practices. The parent study and hair sampling substudy received approval from the institutional review board of The Ohio State University. After obtaining consent, we sampled hair from mothers and their toddler at the end of the regularly scheduled parent study home visit. We cut approximately 150 hair shafts (about the size of an aglet, or shoelace tip) next to the skin of the posterior vertex with thinning shears to minimize the appearance of hair sampling. If mothers or their toddler had in braids, hair extensions, or weaves, we offered to sample hair from the nape of the neck instead of the posterior vertex. To help mothers visualize this sampling process, we demonstrated the process using a hair styling doll. During hair sampling on the toddler, we asked mothers to either hug their toddler or have the toddler play with the hair styling doll. We used blue painter’s tape to secure hair samples greater than 4cm length to a piece of aluminum foil and marked the location of the root end of the hair; we avoided taping over the segment of hair that was 4cm proximal to the scalp. For hair samples less than 4cm length, we placed the hair in a sealed envelope. We stored the hair samples at room temperature prior to cortisol extraction in the laboratory.

Results: There were 148 dyads who participated in time point five of the parent study and who were within the age window of participation, but 6 toddlers had insufficient hair length, so 142 dyads were eligible for hair collection and were approached. A total of 94 dyads participated in hair collection ($94/142=66.2\%$; however two mothers refused data collection on themselves due to hairstyle concerns but consented for their child). Of the 48 dyads who did not participate, 39 dyads refused and nine dyads

did not respond to hair collection solicitation or it was unknown as to why they did not participate. Poor response information from these nine dyads occurred early in the substudy and suggested that some data collectors may not have felt comfortable approaching mothers for hair collection, so one primary data collector known to the participants conducted the majority of the remaining regularly scheduled time point five home visits. The duration of the entire parent study home visit was approximately 1.5 - 2 hours; hair sampling and health survey completion took approximately 15 minutes of this time. Of the 94 dyads that participated, 40 toddlers were of Black or African American race, 47 toddlers were Caucasian, five toddlers were of unknown race, and two toddlers were other race. Approximately 87% of the dyads had a yearly household income of \$30,000 or less. We sampled hair from the nape of the neck rather than the posterior vertex on 10 mothers and three children when we were unable to sample from the posterior vertex. Of the 39 dyads that refused participation, the primary reason was related to concerns disrupting hair appearance (17/39 = 43.5%). Additional refusal reasons included: five mothers had concerns about collection of biomaterial, five mothers said prior to collection that the child was either fearful and/or did not want to be touched, five mothers had "other" reasons for refusal, and five mothers refused for unknown reasons. Qualitative reasons for not wanting to disturb hairstyle included concerns of thinning hair for the adult, not wanting the child to get their first haircut, or not wanting to disrupt expensive or time-consuming weaves or braids.

Discussion: Participation rates for data collection were adequate. Collecting hair from mother-child dyads for cortisol analysis is feasible. Nurse researchers should be aware of mothers' concern of dyad hair style and appearance, which may impact participation rates. Strategies to help improve participation is for nurse researchers to adequately train data collectors to feel comfortable soliciting participation from mothers and for sampling hair, having one primary data collector, and/or using data collectors known to the participants. Research should also be conducted to determine the reliability of sampling hair from the nape of the neck versus the posterior vertex, which may be another viable strategy to help improve participation in sampling hair for cortisol analysis in mother-toddler dyads.

Title:

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

Keywords:

chronic stress, hair cortisol and toddler

References:

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Abstract Summary:

This poster presents the feasibility and methods of sampling hair for cortisol concentration in high-risk mother-toddler dyads. We approached 142 low-income, urban-dwelling mothers living in the Midwest for consent to cut approximately 150 hairs from the posterior vertex of the scalp from themselves and their toddler; 94 dyads participated.

Content Outline:

Introduction

1. Early childhood chronic stress is known to have an effect on later adult health
2. Early childhood chronic stress thought to be related to exposures to maternal chronic stress and poverty
3. Chronic stress can be reliably and validly measured through hair cortisol concentration (HCC) in adults and recent research suggests accuracy in young children as well
4. Little is known about the feasibility of collecting HCC in toddlers or the mother-toddler dyad
5. The purpose of this presentation is to report the feasibility of collecting hair samples for cortisol analysis in mother-toddler dyads

Methods

1. Sample
 1. Mothers and toddlers (dyads) participating in home visits during a particular time point of an ongoing, longitudinal parent study when toddlers were 20-24 months of age
 2. Data collectors from parent study known to participants from previous contact
 3. Dyads eligible to participate if toddler had at least 1cm of hair growth, if toddler was 20-24 months of age during time point home visit, and mother provided informed consent for hair sampling from at least their toddler
2. Technique
 1. Hair sampled from the posterior vertex of scalp (PV) or from nape of the neck when unable to sample from PV
 2. Approximately 150 strands of hair collected, about the size of a shoelace tip
 3. Hair cut with thinning shears to reduce appearance that hair was sampled

Results

1. 142 dyads eligible for participation; 94 dyads consented (66%)
2. About 50% of toddlers were of Caucasian or White race and about 45% of the dyads were of black or African American race
3. About 87% of dyads had a yearly household income of \$30,000 or less
4. Of the 48 dyads who did not participate, 39 dyads refused and 9 dyads did not participate due to lack of follow-up
5. Early identification of lack of follow-up from the 9 dyads suggested that data collectors may not have been comfortable soliciting consent or sampling hair from dyads, thus one data collector conducted the majority of the remaining home visits

6. Most common reason for refusal was concerns related to disrupting hair appearance

Discussion

1. Participation rate adequate
2. Collection feasible
3. Nurse researchers should be aware of certain factors to improve participation rates or reliability in future studies (e.g. adequate training of data collectors, sampling from nape of neck)

First Primary Presenting Author

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Professional Experience: 2008-2010 – Community Health Advisor, Peace Corps Dominican Republic
2011-2015 – Registered Nurse, The Ohio State University Wexner Medical Center
2015-present – Nurse Practitioner, Dennison Renal Care
2013-present – Predoctoral Fellow, The Ohio State University College of Nursing
2016-2017 – Graduate Research Associate, Crane Center for Early Childhood and Policy, The Ohio State University College of Education and Human Ecology
Numerous awards for research on identifying chronic stress in toddlers
Author of 2 publications and 1 in press related to life course health development, early childhood self-regulation, and early childhood chronic stress
Numerous presentations at scientific meetings

Author Summary: Randi Bates received her BSN and MS (nursing) from The Ohio State University. Bates will complete a PhD (nursing) in 2018 from The Ohio State University, working with primary advisors Pamela Salsberry and Jodi Ford to investigate life course health development. Bates's dissertation study examines the effects of early childhood chronic stress on self-regulation, a predecessor of later health behaviors, and if early childhood chronic stress can be accurately measured via hair cortisol concentration.

Second Author

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Professional Experience: I have over 30 years of experience in the area of maternal child health, working with women with limited resources. I am a PhD prepared nurse researcher working in the area of life course and early life influences on long-term health.

Author Summary: Dr. Salsberry has a long history of investigating the effects of disadvantage on health. Currently she is investigating life course health effects of disadvantage. She serves as a Professor at the College of Public Health and Codirector of the Institute for Population Research at The Ohio State University.

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Professional Experience: Author or coauthor of 20 publications and book chapters primarily related to language and literacy development. Numerous presentations at interdisciplinary scientific meetings. Recipient of numerous research-related awards.

Author Summary: Dr. Dynia is a Senior Research Specialist at the Crane Center for Early Childhood Research and Policy at The Ohio State University. Her work focuses on language and literacy practices and outcomes in early childhood special education classrooms. Additionally, Dr. Dynia is interested in the emergent-literacy skills of children with autism spectrum disorder. She has recently completed a yearlong externally funded project on the scalability of a book-reading intervention in early childhood special education classrooms.