Trauma exposure and hair cortisol in youth affected by the Syrian crisis.

Sancilio A[1], Greff M[2], Wiley KS[1], Dajani R[3], Eggerman M[1], Elzagallaai A[2], Van Uum S[2], Rieder M[2], Panter-Brick C[1]

[1]Department of Anthropology, Yale University [2]Robarts Research Institute, The University of Western Ontario [3]Department of Biology, Hashemite University

Introduction

Syrian refugees and Jordanian host-community youth live side by side in urban centers along the Syrian-Jordanian border. They represent two cohorts of adolescents with strikingly different exposures to trauma and insecurity (1). We examined whether biomarkers tracked lifetime exposure to trauma, self-reported stress, and mental health symptoms for these youth, before and after participation in a structured psychosocial intervention.

Biomarkers such as scalp hair cortisol have the potential to provide a biological signature of adverse experiences by tracking their impacts on the body (2). We measured self-reported stress and mental health, together with cortisol as a measure of chronic stress exposure.

Research Questions and Hypothesis

Do cortisol levels map onto levels of trauma exposure?

Do cortisol levels track changes in psychosocial stress over time?

Do associations differ for refugee and non-refugee samples?

We hypothesized that chronic levels in scalp hair would be positively associated with self-reported measures of lifetime trauma exposure and of perceived stress, for both refugees and non-refugees.

Methods

Cohorts: N=817 youth (11-18 years old), living in 5 cities of northern Jordan, were recruited for baseline measures (T1). This baseline sample represented 48% of all youth enrolled in Mercy Corps programming during the two intervention cycles captured by the study (spring 2015 and winter 2015). Youth were enrolled from the general population, on the basis of mental health difficulties and poor access to services. For the purposes of our study, they were allocated to intervention and wait-listed control groups (1).

We retained N=533 youth at T2 and N=302 youth at T3 assessments. There was no attrition bias with respect to variables of interest, except for a higher majority (61%) of Syrians at T3. Engagement with the community was very high; specifically, fewer than 30 families declined participation in the survey.

Measures of lifetime adversity and psychosocial burden:

- The Trauma Event Checklist, used in comparable studies of conflict-affected youth.
- the Perceived Stress Scale (international measure) and the Human Distress scale (regionally-relevant measure) as primary outcomes of psychosocial stress.
- the Strength and Difficulties Scale (international measure) and the Arab Youth Mental Health (regional measure) as secondary outcomes of mental health difficulties.
- Other outcomes, such as posttraumatic symptom CRIES scores.

Biomarkers: We measured cortisol concentrations of scalp hair (0-2 cm at T1 baseline, 0-1 cm at T2 and T3 follow-up). Hair samples were cut in segments and cortisol extracted in methanol, dried, and reconstituted in phosphate buffer. Cortisol values were quantified using modified commercial ELISA kits. We excluded 31 outliers (values over 93 ng/g) from analysis (5 at T1, 0 at T2, and 26 at T3).

Field team in Amman, undertaking the survey

Results

Table 1: Descriptives

	Cohort at T1	Cohort at T2	Cohort at T3
Demographics, n	817	533	302
Gender, male	56.92%	55.09%	56.00%
Refugee status, Syrian	54.59%	55.70%	60.60%
Age	14.37 (1.72)	14.30 (1.70)	14.21 (1.74)
Psychological Outcomes, n			
Lifetime Trauma events	3.95 (3.73)	3.95 (3.68)	4.35 (3.65)
Perceived Stress Scale	27.46 (6.23)	27.32 (6.21)	27.45 (6.11)
Human Distress Scale	37.78 (20.83)	37.63 (20.85)	37.75 (21.25)
Human Insecurity Scale	64.41 (21.29)	64.74 (20.95)	66.88 (20.71)
Arab Youth Mental Health	34.09 (8.56)	34.13 (8.71)	34.47 (8.79)
SDQ Total Difficulties	14.87 (6.17)	14.87 (6.14)	14.96 (5.88)
Post-trauma CRIES	13.10 (12.67)	13.21 (12.76)	14.28 (12.62)
Biomarkers, n	613	132	238
Log Cortisol	0.82	0.66	0.92

Figure 2: Lifetime Trauma Events and Hair Cortisol Concentration

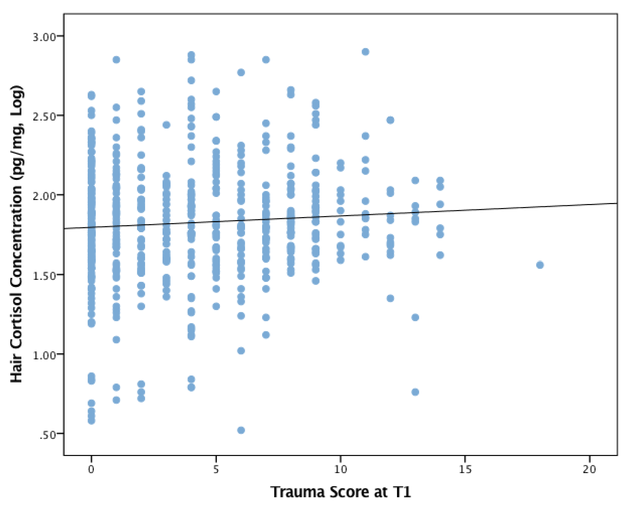
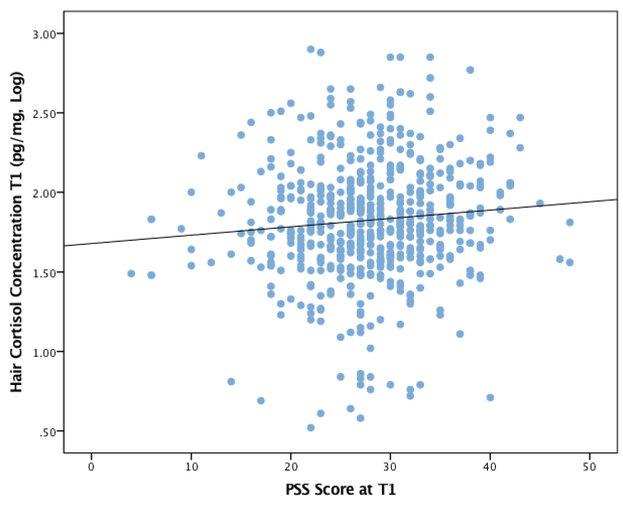


Figure 1: Perceived Stress (PSS) and Hair Cortisol Concentration



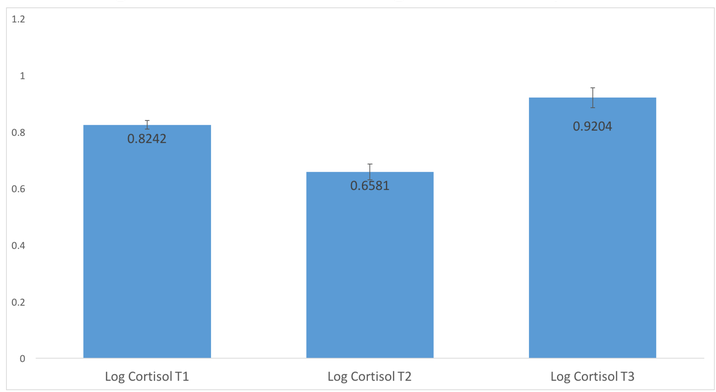
Note: For Figures 1 and 2, cortisol is Log + 1

Table 2: Correlations with Hair Cortisol

	Syrian	Jordanian	Overall
	Log Cortisol T1	Log Cortisol T1	Log Cortisol T1
Trauma events	.05	.03	.07
Perceived Stress	.06	.10	.09*
Human Distress	.07	.16**	.12***
Human Insecurity	.15**	.09	. 13***
AYMH	.09	.24***	.16***
SDQ	.13*	.05	.10*
CRIES	.10*	0	.08*

Two-tailed tests, * p<0.05, ** p< 0.01, *** p<0.005

Figure 4: Hair Cortisol Change Across Study Period



Lifetime trauma exposure averaged 3.95 (SD 3.73) events for the cohort (Table 1). As expected, Syrian refugees and Jordanian hosts differed substantially in trauma exposure (6.36 (SD 3.25) vs 1.08 (SD 1.63) events respectively, p<0.0001). They also differed substantially in self-reports of psychosocial stress and mental health difficulties (data not shown).

At baseline, correlations between log cortisol and trauma exposure were non-significant (Figure 1). Those between log cortisol and self-reported PSS scores were weak (Figure 2), but in the expected direction. Associations between log cortisol and the regional measures of distress, insecurity, and mental health difficulties were strong for the overall cohort (Table 2), while dissimilar across refugee/non-refugee samples: we found significant associations with Human Insecurity scores for Syrian refugees, and significant associations with Human Distress and AYMH scores for Jordanians. The different measures of stress, distress, and insecurity overlap, but tap different dimensions of human experience.

Over time, log cortisol levels dipped at T2, but rose substantially to T3 levels (Figure 3). Growth curve models showed that youth increase their cortisol scores by .012 log cortisol units per month. By contrast, the sub-sample of youth retained to T3 reported stress and mental health symptoms that decreased over time (data not shown).

Conclusions

Cortisol levels did not significantly map onto lifetime trauma exposure, even among Syrian refugees. This contradicted preliminary analyses based on the first cycle of program implementation (3) - youth enrolled in this first cycle were more vulnerable than those enrolled subsequently. Our next analytical step will therefore need to account for cycle-specific variation. To-date, one study has shown positive associations between hair cortisol and lifetime trauma events (n=27, r=.41, p<0.05) (4), and one examined chronic cortisol levels before, during and after war (5).

We observed cross-sectional associations between cortisol levels and reported symptoms of psychosocial stress and mental health difficulties. Going forwards, the trajectories over our three time-points will need close examination; for now, we conclude that cortisol levels rise by .012 log units over time. Future analyses will examine whether cortisol levels differ for treatment and control youth, in response to the psychosocial intervention, and for low-trauma (Jordanian) and high-trauma (Syrian) cohorts.

This work contributes to evaluating the utility of multiple biomarkers for tracking physiological stress in humanitarian contexts. It has value for understanding how toxic stress may disrupt health and developmental trajectories for youth affected by war and forced displacement.

References

1. Panter-Brick C, Dajani R, Eggerman M, Hermosilla S & Ager A (under review). Insecurity, Distress, and Mental Health: Experimental and Randomized Controlled Trials of a Psychosocial Intervention for Youth Affected by the Syrian Crisis.
2. Russell E, Koren G, Rieder M & Van Uum S (2012). Hair cortisol as a biological marker of chronic stress: current status, future directions and unanswered questions. *Psychoneuroendocrinology, 37*, 589–601.
3. Sancilio A, Dajani R, Eggerman M, Van Uum S, Wiley K & Panter-Brick C. (2015, April 13-14). *Can stress biomarkers demonstrate the effectiveness of a humanitarian intervention? An evaluation with Syrian refugee youth.* Paper presented at the Human Biology Association, 41st Annual Meeting, Atlanta.
4. Steudte S, Kolassa IT, Stalder T, Pfeiffer A, Kirschbaum C & Elbert T (2011). Increased cortisol concentrations in hair of severely traumatized Ugandan individuals with PTSD. *Psychoneuroendocrinology, 36*(8), 1193-1200.
5. Etwel F, Russell E, Van Uum S & and Koren G (2014). Hair cortisol as a biomarker of stress in the 2011 Libyan war. Clin Invest Med 37(6), E403-408.