Toxic stress in children

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Toxic stress

- Toxic stress: “the excessive or prolonged activation of the physiologic stress response systems in the absence of the buffering protection afforded by stable, responsive relationships”
  American Academy of Pediatrics (2012)
- Toxic stress in childhood disrupts brain circuitry and other regulatory systems
  - Impacts can continue throughout the lifespan
- Toxic stress is a concept increasingly used in the scientific and humanitarian literature
- It explains how our stress responses are activated and stay activated for long periods of time
Toxic stress

- Need to be wary!
  - Damaged bodies and poisoned brains?
  - Label the sources of adversity and the effects, but not the children → not categorical and irreversible
- Toxic stress describes the exposure, not the response

**Resilience:** individual, interpersonal, contextual resources

- **Adversity:** trauma, insecurity, toxic stress
  - Mental health (mind)
  - Physiological stress (body)
  - Cognitive function (brain)
Measuring adversity and response

- Biomarkers
  - Cortisol - chronic stress
  - C-reactive protein (CRP) - inflammation
  - Epstein-Barr virus antibodies (EBV) - cell-mediated immunocompetence

- Self-report → trauma exposure, insecurity, depression, anxiety, etc
Hair cortisol as a stress biomarker

- Measures chronic stress
  - Over weeks to months rather than day-to-day variation
- Grows at rate of 1 cm/month
  - Each 1 cm provides a ‘stress diary’ reflecting average cortisol concentrations over the past month
- Provides a biological signature of adverse experiences, given that neuroendocrine changes may result from exposures to lifetime traumatic events and/or ongoing psychosocial stressors

Meyer and Novak (2012)
Variability in baseline cortisol levels (e.g., due to genotype)

→ Lower baseline cortisol increases risk for subsequent PTSD development

Trauma-induced attenuation of cortisol may predispose to PTSD development upon new-onset traumatization

Steudte-Schmiedgen, Kirschbaum, Alexander, and Stalder (2016)
CRP as a marker of inflammation

- C-Reactive Protein
  - Direct, objective measure of inflammation
  - High levels of CRP in the blood are a marker of inflammation
- Measured through a blood spot
- Mixed evidence about the link between adversity and inflammation in adolescence
- Associations between maltreatment and CRP at age 12, but only for those who developed depression (Danese et al., 2011)
- Associations between victimization and CRP at age 18, but only for girls, not boys (Baldwin et al., 2018)
- Null associations between SES and CRP for 10-11 year-old British school-children (Cook et al., 2000), Finnish children and adolescents (Gimeno et al., 2008), and Canadian 15-29 year olds (Miller et al., 2009), or even inverse associations (Thomas et al., 2005)
EBV as a marker of immune function

- Epstein-Barr virus
  - A type of herpes virus
  - Infects approximately 90% of the world’s population (Cohen, 2000)
  - EBV titers rise with acute or chronic stressors, due to a suppression of immune function
    - Status incongruity among teenagers in Western Samoa associated with increased EBV (McDade, 2002)
    - EBV levels differ by gender in Afghanistan - higher for women and mapping onto the intensity of family-level stressors (Panter-Brick et al., 2008)
  - Heightened EBV leads to susceptibility to ill health
  - Measured through a blood spot
Collection and analysis

- **Cortisol**
  - ~100 strands collected from the vertex posterior scalp by professional hairdressers
  - Stored at room temperature
  - Analysed in lab using modified, commercially available kit

- **CRP and EBV**
  - Fingers cleaned with alcohol wipes, pricked with disposable lancets, and 2-5 drops of blood collected on filter paper
    - Collected by fieldworkers
  - Blood spots dried and stored at room temperature
  - Analysed in lab using modified, commercially available kit
Background

- 68.5 million people forcibly displaced
  - 1 person displaced every 2 seconds
  - 52% of refugees worldwide are <18
  - 57% from 3 countries: Syria, Afghanistan, South Sudan

- Syrian refugee crisis
  - 6.15 million internally displaced
  - 5.63 million refugees
    - 672,000 in Jordan
    - 7.1 refugees per 100 people in Jordan

UNHCR, 2018
Effects

- Syrian refugee children have significant mental health issues
  - 45% had PTSD (in Islahiye)
  - 20% had clinically diagnosable levels of depression (in Islahiye)
- Psychosomatic symptoms are also common
  - 25% have daily pain in the arms and legs (in Islahiye)
  - 20% have daily headaches (in Islahiye)
  - 71% have frequent bedwetting and involuntary urination (in Syria)
  - 80% of the children have become more aggressive (in Syria)

- This is consistent with other areas: refugees tend to have more psychological problems than local populations
Study design

- 449 Syrian refugee, 371 Jordanian host-community
  - 14.4 years old at baseline
  - 56.8% male
  - Sampled from: Irbid, Mafraq, Jarash, and Zarqa
  - Syrians in Jordan for an average of 2.8 years ($SD = .95$, range: 0.3 - 8.0 years)

- 3 waves

- Types of data collected:
  - Psychosocial
  - Biomarkers
  - Cognitive function
  - Genetic
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Biomarkers
Intervention can affect cortisol production!

- When participants took part in the intervention, they had lower hair cortisol content.
Participants with fewer post-traumatic stress symptoms were less likely to be in the hyposcretion class.

Participants with more insecurity were more likely to be in the hypersecretion.

No effects of gender or perceived stress.

Intervention predicted increases in cortisol for the hyposcretion group.
Cortisol dysregulation for traumatized kids?

- High-trauma youth showed hair cortisol concentrations that were prospectively unrelated, and possibly dysregulated, at each time-point.

- These findings may be specific to groups experiencing many frightening and distressing experiences: in our sample, 92.0% in the high-trauma exposure group were forcibly displaced Syrian refugees.

- Most research so far has focused on those with limited trauma exposure.

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<td>Low trauma exposure</td>
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<tr>
<td>T2 Cortisol</td>
<td>.42**</td>
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<td>T3 Cortisol</td>
<td>.28*</td>
<td>.23*</td>
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<td>High trauma exposure</td>
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<td>T2 Cortisol</td>
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<td>T3 Cortisol</td>
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CRP

- CRP trajectory was predicted by BMI
  - Adolescents with higher BMI were more likely to have a High trajectory than a Low trajectory

- CRP trajectory was not predicted by age, gender, poverty, trauma exposure, or refugee status
EBV

- EBV trajectory was predicted by refugee status
  - Syrians were less likely to belong in the High EBV trajectory than the Low EBV trajectory
- EBV trajectory was not predicted by poverty, trauma exposure, age, gender, or BMI
Summary

- Evidence of calibration/malleability rather than irreversible damage
- Kids show sensitivity to changes in the environment
- Biomarkers
  - Relatively easy to collect
  - Useful as objective measures
  - Can track responsiveness to intervention
  - More work needed to evaluate the usefulness of multiple biomarkers to track the differential effects of mental health problems and psychosocial stress on physiological systems, over short and longer timescales, and in responses to interventions
Many war-affected youth do not develop any mental health problems and, indeed, thrive despite their adversity.

Building resilience is a key feature of humanitarian interventions for refugees.

When exposed to adverse events, there are hypothesized to be several pathways to recovery:

- But there is limited empirical evidence for what these might look like.
- Available research tends to be either cross-sectional, define resilience as absence of mental health difficulties, and/or assume a universal response to adversity.
Development of an Arabic-language CYRM

**Process**
- Qualitative work
- Translation, back-translation
  - Focus group with 20 girls
  - Focus group with 16 boys
  - Expert panel review (bilingual)
  - Focus group with 16 youth
- CFA on half of the sample, shortening of the scale, then CFA other half
- Multi-group analyses by gender and country of origin
- Test-retest reliability
- Convergent validity

**Result**
- 12 item measure
- Modern standard Arabic
- Individual, relational, and contextual factors

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<th>Item</th>
<th>Internal Consistency</th>
<th>Reliability</th>
<th>Validity</th>
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