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News

Stress can shorten telomeres in childhood

Children in orphanages have chromosome changes that could affect future health.

Marian Turner

A long-term study of children from Romanian orphanages suggests that the effects of childhood stress could be visible in their DNA as they grow up.

Children who spent their early years in state-run Romanian orphanages have shorter telomeres than children who grew up in foster care, according to a study published today in *Molecular Psychiatry*¹. Telomeres are buffer regions of non-coding DNA at the ends of chromosomes that prevent the loss of protein-coding DNA when cells divide. Telomeres get slightly shorter each time a chromosome replicates during cell division, but stress can also cause them to shorten. Shorter telomeres are associated with a raft of diseases in adults from diabetes to dementia.

The study is part of the Bucharest Early Intervention Project, a programme started in 2000 by US researchers who aimed to compare the health and development of Romanian children brought up in the stressful environment of an orphanage with those in foster families, where they receive more individual attention and a better quality of care.

When the study began, state orphanages were still common in Romania, and a foster care system was established specifically for this project. The study focused on 136 orphanage children aged between 6 and 30 months, half of whom were randomly assigned to foster families. The other half remained in orphanages.

The researchers obtained DNA samples from the children when they were between 6 and 10 years old, and measured the length of their telomeres. They found that the longer the children had spent in the orphanage in early childhood - before the age of four and half - the shorter their telomeres.

"It shows that being in institutional care affects children right down to the molecular level," says clinical psychiatrist Stacy Drury of Tulane University in New Orleans, Louisiana, one of the lead authors on the study.



The shortened telomeres found in Romanian orphans could lead to health problems later in life.

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Newborn field

Other studies have found **short telomeres in adults who said they had experienced childhood psychological stress^{2,3}**, but telomere biology in children is still a new field. Drury and her team cannot yet make any comparisons with the telomeres of non-institutionalized children because "we don't yet have a normative template for telomere length in young children", explains paediatrician and senior study author Charles Nelson of Harvard Medical School and the Children's Hospital in Boston. Drury, Nelson and their colleagues are currently measuring telomere length in children who experienced less stress in early childhood.

The team says that **many aspects of a child's health can improve if they are moved from institutional care to a family environment**. But could this extend to children regrowing their telomeres? Although telomeres usually shorten with age, they can lengthen through the action of an enzyme called telomerase.

Iris Hovatta of the Research Program of Molecular Neurology at the University of Helsinki, who was not involved in the Romanian study, suggests that shortened telomeres might not be permanent. "Studies in adults have shown that telomere length in some individuals increases over time, and this tends to occur in those people who have shorter telomeres to begin with," says Hovatta.

Telomeres and health

We might soon know. Drury and her colleagues last week received funding from the US National Institutes of Health to do a follow-up study of the Romanian children as they turn 12. It could be that the orphanage environment led to epigenetic programming — chemical, rather than sequence, changes to DNA — that has caused the children's telomeres to continue to shorten at a faster rate than normal, or their telomeres may even have lengthened again, say the authors.

The follow-up study might also help to answer the question of whether shorter telomeres are a cause or an effect of poor health. The researchers have cognitive and physical health records from the children from multiple ages and are analysing whether children from the two groups differ in terms of mental development and physical health. They will soon be able to compare these medical histories to their telomere lengths as 12-year olds.

"Stress is hard to define", says Drury. "These data might show us if telomere length can be used as a fundamental biomarker for all of the cumulative factors that we call adverse experiences."

References

1. Drury, S. S. *et al. Mol. Psychiatr.* advance online publication doi:10.1038/mp.2011.53 (2011).
2. Kananen, L. *et al. PLoS ONE* **5**, e10826 (2010). | [Article](#) | [ChemPort](#) |
3. Tyrka, A. R. *et al. Biol Psychiatr.* **67**, 531-534 (2010). | [Article](#) | [ISI](#) | [ChemPort](#) |