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Original Investigation | March 2015

Effect of Early Institutionalization and Foster Care on Long-term White Matter Development: A Randomized Clinical Trial

Johanna Bick, PhD¹; Tong Zhu, PhD²; Catherine Stamoulis, PhD³; Nathan A. Fox, PhD⁴; Charles Zeanah, MD⁵; Charles A. Nelson, PhD⁶

[+] Author Affiliations

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ABSTRACT

ABSTRACT | INTRODUCTION | METHODS | RESULTS | DISCUSSION | CONCLUSIONS | ARTICLE INFORMATION | REFERENCES

Importance Severe neglect in early life is associated with compromises in brain development and associated behavioral functioning. Although early intervention has been shown to support more normative trajectories of brain development, specific improvements in the white matter pathways that underlie emotional and cognitive development are unknown.

Objective To examine associations among neglect in early life, early intervention, and the microstructural integrity of white matter pathways in middle childhood.

Design, Setting, and Participants The Bucharest Early Intervention Project is a randomized clinical trial of high-quality foster care as an intervention for institutionally reared children in Bucharest, Romania, from 2000 through the present. During infancy, children were randomly selected to remain in an institution or to be placed in foster care. Those who remained in institutions experienced neglect, including social, emotional, linguistic, and cognitive impoverishment. Developmental trajectories of these children were compared with a group of sociodemographically matched children reared in biological families at baseline and several points throughout development. At approximately 8 years of age, 69 of the original 136 children underwent structural magnetic resonance imaging scans.

Main Outcomes and Measures Four estimates of white matter integrity (fractional anisotropy [FA] and mean [MD], radial [RD], and axial [AD] diffusivity) for 48 white matter tracts throughout the brain were obtained through diffusion tensor imaging.

Results Significant associations emerged between neglect in early life and microstructural integrity of the body of the corpus callosum (FA, $\beta = 0.01$ [$P = .01$]; RD, $\beta = -0.02$ [$P = .005$]; MD, $\beta = -0.01$ [$P = .02$]) and tracts involved in limbic circuitry (fornix crus [AD, $\beta = 0.02$ ($P = .046$)] and cingulum [RD, $\beta = -0.01$ ($P = .02$); MD, $\beta = -0.01$ ($P = .049$)]), frontostriatal circuitry (anterior [AD, $\beta = -0.01$ ($P = .02$)] and superior [AD, $\beta = -0.02$ ($P = .02$); MD, $\beta = -0.01$ ($P = .03$)] corona radiata and external capsule [right FA, $\beta = 0.01$ ($P = .03$); left FA, $\beta = 0.01$ ($P = .03$); RD, $\beta = -0.01$ ($P = .01$); MD, $\beta = -0.01$ ($P = .03$)]), and sensory processing (medial lemniscus [AD, $\beta = -0.02$ ($P = .045$); MD, $\beta = -0.01$ ($P = .04$)] and retrolenticular internal capsule [FA, $\beta = -0.01$ ($P = .002$); RD, $\beta = 0.01$ ($P = .003$); MD, $\beta = 0.01$ ($P = .04$)]). Follow-up analyses revealed that early intervention promoted more normative white matter development among previously neglected children who entered foster care.

Conclusions and Relevance Results suggest that removal from conditions of neglect in early life and entry into a high-quality family environment can support more normative trajectories of white matter growth. Our findings have implications for public health and policy efforts designed to promote normative brain development among vulnerable children.

Trial Registration clinicaltrials.gov Identifier: [NCT00747396](https://clinicaltrials.gov/ct2/show/study/NCT00747396)



Figures in this Article

Topics

child development ; child rearing ; child, institutionalized ; institutionalization ; romania ; emotional neglect of child ; foster care ; white matter ; diffusion tensor imaging ; foster child

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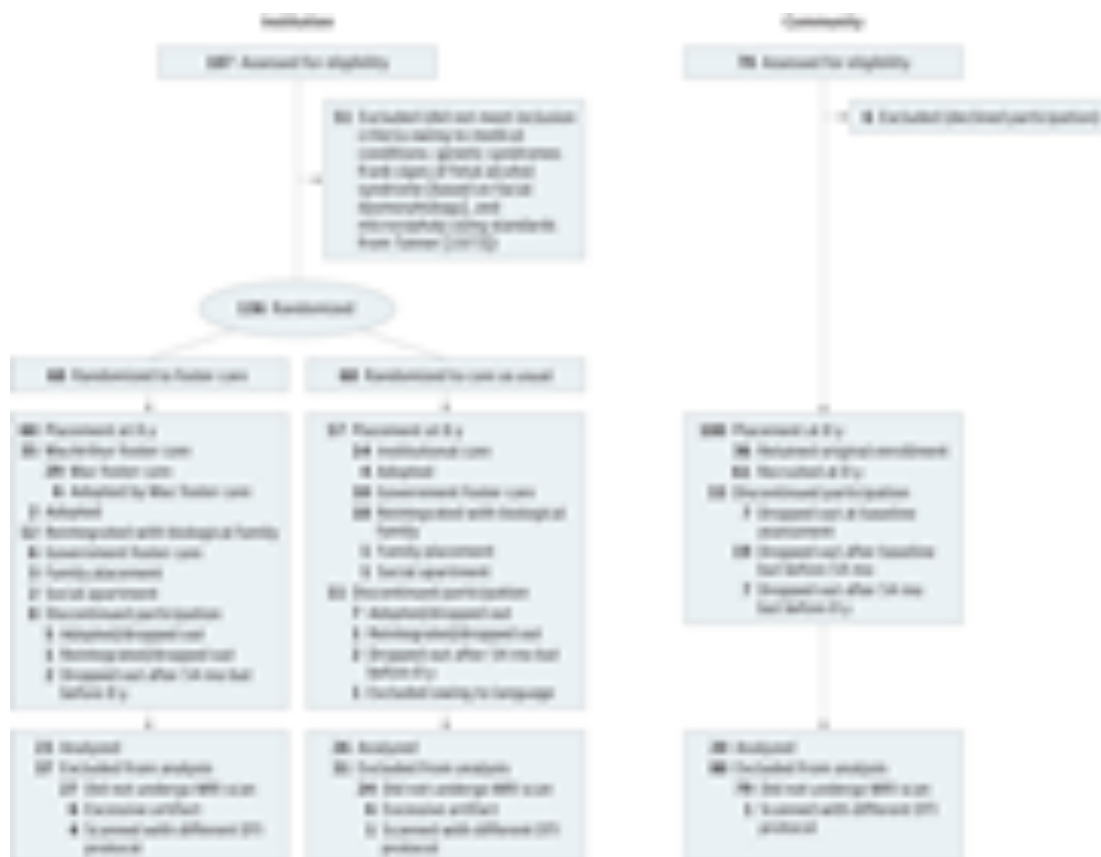
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Figures

Figure.

CONSORT Flow Diagram

DTI indicates diffusion tensor imaging; MRI, magnetic resonance imaging.



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