



Institutionalization and indiscriminate social behavior: Differential-susceptibility versus diathesis-stress models for the 5-HTTLPR and BDNF genotypes

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HIGHLIGHTS

- We use a GXE approach to understand indiscriminate attachment disordered.
- We focus on 5-HTTLPR and BDNF in children reared in distinct relational contexts.
- We employed a confirmatory model-fitting strategy.
- A vulnerability-model for the s/s genotype emerged for institutionalized children.

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ABSTRACT

Institutionalization adversely impacts children's emotional functioning, proving related to attachment disorders, perhaps most notably that involving indiscriminate behavior, the subject of this report. In seeking to extend work in this area, this research on gene X environment (GXE) interplay investigated whether the serotonin transporter (5-HTTLPR) and val66met Brain-Derived Neurotrophic Factor (BDNF) polymorphisms moderated the effect of institutional care on indiscriminate behavior in preschoolers. Eighty-five institutionalized and 135 home-reared Portuguese children were assessed using Disturbances of Attachment Interview (DAI). GXE results indicated that s/s homozygotes of the 5-HTTLPR gene displayed significantly higher levels of indiscriminate behavior than all other children if institutionalized, something not true of such children when family reared. These findings proved consistent with the diathesis-stress rather than differential-susceptibility model of person × environment interaction. BDNF proved unrelated to indiscriminate behavior. Results are discussed in relation to previous work on this subject of indiscriminate behavior, institutionalization and GXE interaction.

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1. Introduction

Institutionalization of children at risk, whose parents, for various reasons, cannot guarantee sufficiently supportive care, remains a major intervention in many countries. In 2012, more than 8500 children younger than age 20 were living in residential institutions in Portugal, where the research reported herein was conducted. Of these, 13.9%

were younger than age 5, with the majority (55.6%) spending more than one year in the institution [1].

Such early and extensive use of residential institutions occurs despite six decades of research compellingly documenting adverse impacts of such relational experience on children's development, particularly social-emotional functioning, including emotional/behavioral and attachment problems. Indeed, clinicians and researchers have repeatedly chronicled associations between institutional rearing and strikingly atypical attachment behavior that departs markedly from what is routinely observed in family-reared children (for review, see [2,3]). The absence of sensitive and responsive care, especially provided by consistent and reliable caregivers, is characteristic of these institutional settings and contributes to the emergence of attachment-

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disordered behavior (ADB), which is known to be associated with maladaptive developmental trajectories (for review see [4]).

Disinhibited social engagement disorder (DSED) is one frequently observed ADB among institutionalized children and is the focus of this report. It is characterized by a pattern of diffuse attachment, indiscriminate sociability, and by overfriendly attention, comfort seeking and affectionate behavior directed toward unfamiliar people [5] (for review see [2]). Even after several years of placement in adoptive families, a significant number of children who spent their early years in depriving orphanages continue to show mild to high levels of indiscriminate behavior [6].

Although strong empirical evidence showing that adverse contextual conditions – like institutionalization – promote attachment disorders, not all institutionalized children develop DSED. This calls attention to the need to consider non-institutional factors as contributors to the development of DSED. This is exactly the issue Drury and her colleagues [7] pursued upon raising the possibility that the child's genetic make-up, in interaction with institutionalization, might account for why some institutionalized children but not others develop DSED [7]. Indeed, their randomized control trial (RCT) revealed that children with two short alleles (*s/s*) of the serotonin transporter gene, *5-HTTLPR*, and, separately, with a met allele of the *BDNF* polymorphism, manifest the *most* indiscriminate friendliness of all children if they were institution reared, but the *least* if they were randomly assigned to high-quality foster care; indeed, effects of rearing condition in this investigation of Romanian children did not emerge for those with other genotypes. Such results were in line with the differential-susceptibility hypothesis, which stipulates that some children are more susceptible to environmental influences than others, “for better and for worse”; that is, while they are more likely than others to develop poorly under adverse conditions, they are also more likely to benefit developmentally from supportive ones [8–11].

As it turns out, the gene-X-environment (GXE) interaction results of Drury and collaborators [7] differ from those of a small-sample, observational study reported by Bakermans-Kranenburg and colleagues [12] who compared children raised in Ukrainian institutions with children raised in their biological families. Although carriers of the *l/l* genotype of *5-HTTLPR* proved less vulnerable to the adverse institutional environment when attachment disorganization was the outcome to be explained, no such GXE interaction emerged when observed indiscriminate behavior was the focus of inquiry. Even if RCT designs afford the most compelling tests of GXE interaction, given their ability to discount gene-environment correlation (*rGE*) [13,14], it remains unclear given the contrasting findings just cited, whether *5-HTTLPR* moderates the effect of institutional rearing on indiscriminate behavior in the case of institutionalized children. Thus, we seek to extend current research on this topic.

Toward this end, we investigate the determinants of individual differences in indiscriminate friendliness among institutionalized children, employing a non-experimental design like that of Bakermans-Kranenburg and collaborators [12], one which involves the comparison of children growing up in Portuguese institutions with home-reared children, while taking into account their genetic make-up with regard to *5-HTTLPR* and *BDNF*. Because of the specific focus here on differential susceptibility, we employ the genotypic coding and comparisons used by Drury and collaborators [7], comparing children homozygous for short alleles with all other children in the case of *5-HTTLPR* and those with and without met alleles in the case of *BDNF* [7].

Although there is considerable GXE evidence, including meta-analytic work [15], that *5-HTTLPR* moderates diverse environmental effects in a differential-susceptibility-related manner in the case of children [9,10], it is also the case that some GXE evidence is more consistent with diathesis-stress thinking which conceptualizes *s* alleles as “vulnerability” or “risk” genes, predisposing individuals carrying them, perhaps especially homozygotes, to problematic functioning in dangerous, risky or otherwise harmful contexts [16,17]. Met-allele

carriers of the *BDNF* gene have also been found to be especially vulnerable to adversity, consistent with the diathesis-stress framework, but, in some instances, to also benefit disproportionately from supportive conditions [18], consistent with the differential-susceptibility model of person-X-environment interaction [19]. No meta-analytic work of such GXE interaction has been carried out in the case of this polymorphism, however.

In the current inquiry, a core issue is whether children carrying putative susceptibility genes will prove (a) particularly vulnerable to adversity or (b) especially susceptible to the adverse effects of institutionalization and the presumed beneficial effects of family rearing vis-à-vis indiscriminate social behavior. Thus, we evaluate whether children homozygous for the *5-HTTLPR* short allele and/or whether those who carry the *BDNF* met allele (i) display the highest levels of indiscriminate behavior when institutionalized, but not when home reared, or (ii) are the most likely of all children to behave in an indiscriminate friendly fashion when institutionally reared, but engage in the least such behavior when family reared. Given this comparative focus, we employ the competitive model-fitting strategy of Widaman et al. [10, 20]. It affords means of testing predictions derived from alternative theoretical frameworks – differential susceptibility vs. diathesis stress. Indeed, it enables evaluation and thus comparison of “weak” and “strong” versions of each model, the difference being that in the weak model the less susceptible group still proves somewhat susceptible, just less so than the more susceptible one, whereas in the strong version of each model only the hypothesized susceptible group proves susceptible. That is, in strong models the relation between predictor (i.e., institutionalization) and outcome (i.e., indiscriminate behavior) proves not significantly different from zero in the case of the predicted less susceptible group.

2. Method

2.1. Participants

Participants included 85 institutionalized children and 135 children living with their biological parents. All children were enrolled in two larger research projects on pre-school-age Portuguese children. Criteria for exclusion of participants were the existence of moderate to severe mental or physical impairments, genetic syndromes or autism spectrum disorders. None of the children had entered elementary school when the data for this report were collected; all were Caucasian.

2.1.1. Institutionally-reared children

Eighty-five institutionalized children (50 boys, 58.8%) were recruited from 23 Portuguese institutions, along with their institutional caregivers. Children were 36 to 77 months old ($M = 54.72$, $SD = 10.52$) at the time of assessment. Their age at admission to the institution varied from 3 to 69 months ($M = 34.98$; $SD = 16.59$), with 12% admitted by 12 months of age. The reasons for children being withdrawn from their families and placed in the institution were varied, including negligence, physical and sexual abuse, parental psychopathology and substance abuse, and severely limited socioeconomic resources. Thirteen children had been previously institutionalized and one had been placed in foster care. However, at time of admission to the participating institutions all children had been living with their biological families, with the exception of two children, who were living in another institution. Length of time in institutional care ranged from 6 to 56 months ($M = 19.41$, $SD = 12.69$), with 61.2% ($n = 52$) institutionalized for more than one year.

Sixty-four institutional caregivers also participated in the study. Fourteen (21.9%) of the 64 participating caregivers provided care for more than one child. In this study, the maximum number of children with the same assigned caregiver was 4. All caregivers were female, ranging in age from 21 to 59 years ($M = 37.47$, $SD = 10.87$). Thirty-nine caregivers (45.3%) did not receive specific training to perform

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