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Impact of early childhood adversities on adult psychiatric disorders

A study of international adoptees

■ **Abstract** *Background* This study investigated international adoptees who were taken out of their problematic environments as a consequence of their adoption to determine the effects of early adversities on adult psychiatric disorders, and to study whether these effects emerged de novo after childhood. *Methods* A total of 1,364 adoptees (63.5% of the baseline sample) were followed. Parents provided information about early adversities prior to adoption, and mental health problems in childhood and adolescence. In adulthood, adoptees completed a standardized interview, generating DSM-IV diagnoses. *Results* Children who experienced multiple adversities had an increased risk of having anxiety disorders (OR = 2.22; 95% CI: 1.11–4.45), mood disorders (OR = 2.20; 95% CI: 1.00–4.86) or substance abuse/dependence (OR = 3.81; 95% CI: 1.62–8.98) in adulthood. Several effects remained significant after correction for mental health problems in childhood and adolescence. *Conclusions* Severe early adversities increase the risk of adult psychopathology, even when children are taken out of their problematic environments. Results suggest that psychiatric disorders may arise de novo after childhood due to early experiences.

■ **Key words** child abuse – child neglect – long-term effects – DSM-IV – adoption

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Introduction

Several studies conducted in the general population have found a strong relation of childhood adverse experiences, such as neglect and abuse, with psychiatric disorders in adulthood [14, 22, 25, 37]. In his review of the relation between child maltreatment and adult psychiatric outcomes, Arnow [3] concluded that childhood maltreatment is a major risk factor for a wide range of adult psychiatric conditions, which lead to a high utilization of care. The more severe the maltreatment was, the stronger the association with psychiatric disorders in adulthood.

However, these studies have an important limitation. Childhood adverse experiences occur more often in environments characterized by low socio-economic status and inadequate family functioning [14, 17, 22, 26]. These problematic environments by themselves increase the risk for later psychiatric problems [9, 18, 26]. Children who experience abuse or neglect, for example, often continue to live in these risk-increasing environments. Thus, in most studies on psychiatric disorders, the effects of adverse experiences early in life cannot be disentangled from the effects of long-lasting disadvantages. The attenuation of effect after adjustment for problematic environmental factors, suggests that some effects ascribed to the early adversities are actually a consequence of more chronic disadvantages [10, 14, 21, 27].

The specific contribution of early adversities on adult psychiatric disorders can be studied in some samples of internationally adopted children. In par-

ticular, in those samples of internationally adopted children that include many persons who experienced severe early adversities [16, 42]. Yearly, over 30,000 children are internationally adopted over the world by non-relatives [34]. Children born outside the country have been adopted into the Netherlands since the 1970s. Between about 300 and 1,600 children a year are internationally adopted by Dutch parents; 782 children in 2007 alone [11]. All were subsequently taken out of their problematic environments in childhood and raised in presumably better rearing circumstances within supportive families. Samples of international adoptees provide a natural experiment in which the psychiatric consequences of adverse experiences that are limited to early life, can be observed.

Previous studies on international adoptees have found that early adversities comprised a risk for later mental health problems (see for a review of the literature: [13]). These studies, however, mainly focus on children and adolescents. To our knowledge, the only study on childhood adversities that included adults who were internationally adopted as children was conducted by Cederblad et al. [8]. Within a sample of Swedish international adoptees, aged 13–27 years, an association was found between the pre-adoption situation and mental health problems in general and internalizing problems in particular. Unfortunately, the pre-adoption situation was not specified further than duration in an orphanage or foster home that was shorter or longer than 7 months. Furthermore, the number of cases was very small (N = 20) and the age-range at outcome encompassed adulthood as well as adolescence.

The aim of the present study is twofold. First, we want to determine the effects of adversities that were restricted to early life, on psychiatric disorders in adulthood. Second, we want to study whether early adversities resulted in problems that continued into adulthood (chronic effects) or caused problems that emerged de novo later in life (late effects). To determine the presence of late effects we control for mental health problems in childhood or adolescence in additional analyses. We hypothesize that in the present study the effects of early adverse experiences on adult psychiatric disorders are significant, though less marked than those observed in many earlier studies. Furthermore, we postulate that the effects present in adulthood are mainly chronic, while few late effects can be detected because of the long period between the experience of the early adversities and the presence of psychiatric disorders.

Materials and methods

■ Sample and procedure

For the original sample, children were selected from the central adoption register of the Dutch Ministry of Justice. The sample consisted of all children legally adopted by nonrelatives in the Netherlands and born outside the Netherlands between January 1,

Table 1 Characteristics of the participants

Characteristics	Values
Gender, N (%) male	758 (55.6)
Age, mean in years ± SD	26.3 ± 1.4
SES[a] of the adopting family, mean ± SD	4.6 ± 1.4
SES of the adoptee, mean ± SD	4.0 ± 1.3
Age at placement, mean in months ± SD (range)	27.6 ± 24.1 (1–115)
Native countries	
Korea, N (%)	426 (31.2)
Colombia, N (%)	177 (13.0)
India, N (%)	140 (10.3)
Indonesia, N (%)	112 (8.2)
Bangladesh, N (%)	94 (6.9)
Lebanon, N (%)	71 (5.2)
Austria, N (%)	63 (4.6)
Other European countries, N (%)	56 (4.1)
Other non-European countries, N (%)	225 (16.5)
CBCL	
Total Problems score at baseline, mean ± SD	20.0 ± 18.8
Total Problems score at Time 2[b], mean ± SD	20.6 ± 18.8
s-EMBU[c]	
Rejection, mean ± SD regarding to mother; father	10.4 ± 4.2; 9.8 ± 3.6
Emotional Warmth, mean ± SD regarding to mother; father	18.1 ± 4.2; 17.6 ± 4.2
(Over)protection, mean ± SD regarding to mother; father	20.5 ± 5.0; 18.7 ± 4.5

SD standard deviation, *SES* socioeconomic status, *CBCL* child behavior checklist, *s-EMBU* short version of the egna minnen beträffande uppfostran
[a]SES of the adoptee on a 6-point scale with 1 indicating the lowest socioeconomic status
[b]Missing scores on Time 2 were imputed with mean difference scores between baseline and Time 2
[c]Information on the s-EMBU could be used from 1,242 participants (91.1%)

1972, and December 31, 1975. Adoptive parents of the international adoptees were approached in 1986 (baseline) and 1989–1990 (Time 2) when their children were on average 12.4 and 15.5 years old. Of the parents that could be reached, 2,148 (64.9%) participated at baseline and 1,538 (74.3%) at first follow-up. Between 1999 and 2002 the adopted children of the parents who had participated at baseline were contacted (Time 3). Of the approached subjects, 1,521 participated (80.7%). Details on the sampling procedures at baseline, Time 2 and Time 3 are reported elsewhere [36, 40, 41].

Questionnaires were mailed to the adoptive parents at baseline, to assess early adverse experiences prior to adoption and demographic variables. Mental health problems of the children were measured using parental questionnaires at baseline and first follow-up. At Time 3, psychiatric diagnoses of the adoptees were obtained through home interviews. Furthermore, parental rearing behavior was assessed using a questionnaire filled out by the adoptees. The Erasmus Medical Center ethical committee approved the study and after the procedures were fully explained, informed consent was obtained from all participants. In the present study, participants with missing information on all early adversities were excluded (N = 120). An additional number of participants was excluded because of missing information on outcome variables (N = 37). This left 1,364 participants for analyses (63.5% of the baseline sample). Characteristics of the participants 1,364 subjects are described in Table 1.

■ Measures

Early childhood adversities

Adverse experiences prior to adoption were assessed using single questions to parents on abuse, neglect and number of placements.

Because the Dutch term for abuse used in the wording of the question does not cover sexual or emotional abuse equally well as physical abuse, abuse encompassed mainly physical abuse. Other forms of abuse, however, were not explicitly ruled out. Neglect was specified as physical neglect. Abuse and neglect were measured on a 3-point scale indicating "no", "somewhat", or "severe" abuse or neglect. Number of placements was assessed using a 4-step scale with answering categories "0", "1 or 2", "3 or 4" or "5 or more" changes in caretaking environment prior to adoption. The third and fourth categories were combined in the analyses into "3 or more" placements, because of small numbers of cases. Furthermore, an overall score ("total number of early childhood adversities") was created as an indicator of multiple early adversities. Abuse, neglect and number of placements were therefore each re-grouped in two categories "0" and "1" and subsequently summed into: "0", "1", "2" or "3" early adverse experiences. Because of small numbers of persons in the third and fourth category, these groups were combined in "2 or 3" early adversities.

Information on early adverse experiences can be missing or uncertain [13, 42]. Therefore, after every question on an early adversity adoptive parents were asked if they were certain of their answer. Parents based their information on early adversities on official documents provided by the adoption organization or (in a minority of cases) on their own observations. In our analyses on separate early adverse experiences, only information of which parents were certain was used. In our analyses on the total number of early childhood adversities, information of parents was used if they provided certain information on at least two early adverse experiences. Furthermore, the prospective validity of the severity of maltreatment was demonstrated in a previous study on the same sample that showed a relation between the level of early maltreatment and the level of later maladjustment [38, 42].

Psychiatric disorders in adulthood

Information regarding DSM-IV disorders was obtained using the computerized version of the composite international diagnostic interview (CIDI) [44] and three parts of the National Institute of Mental Health diagnostic interview schedule (DIS) 31]. The CIDI provides over 300 questions to cover criteria for DSM-IV disorders. Good reliability and validity have been reported [2]. In addition, the DIS was used to determine diagnoses for disruptive behaviors, which are not incorporated in the CIDI.

We combined the diagnostic categories and report the major DSM-IV axis I psychiatric disorders: anxiety disorders (including obsessive-compulsive disorder, posttraumatic stress disorder, panic disorder, agoraphobia, social phobia, generalized anxiety disorder and specific phobia), mood disorders (including major depressive episode, bipolar disorder and dysthymia), and substance abuse/dependence (including alcohol abuse, alcohol dependence, drug abuse and drug dependence). The small number of cases within the category of disruptive disorders (including attention deficit hyperactivity disorder, antisocial personality disorder and oppositional defiant disorder) precluded analyses on this group of psychiatric disorders. Furthermore a variable named "any disorder" was created, which included participants with at least one of the aforementioned psychiatric disorders, a diagnosis of eating disorder, schizophrenia or other psychosis, or somatoform disorder. The 12-month prevalence of DSM-IV disorders in the year preceding the interview was used.

Demographic variables

Gender, age (in years), age of placement (in months) in the adoptive family, country of origin and parental socioeconomic status of the child were derived at baseline. Information on the socioeconomic status of the adoptee was derived at Time 3.

Socioeconomic status was measured on a 6-point scale with 1 indicating the lowest occupational level, in accordance with Van Westerlaak et al. [39].

Mental health problems prior to adulthood

The child behavior checklist (CBCL) is a parental questionnaire for assessing emotional and behavioral problems in 4-to-18-year-olds. The questionnaire contains 118 problem items on which parents can score their child's behavior in the preceding 6 months according to the following categories: "not true", "somewhat or sometimes true", "very true or often true". Scores on all items add up to an overall Total Problems score and a cut-off score is provided above which scores are considered clinical. The good reliability and validity of the American version of the CBCL were confirmed for the Dutch translation [1, 43]. CBCL scores were obtained for all 1,364 participants at baseline and for 1,055 adoptees at Time 2. Missings were imputed with mean difference scores between baseline and Time 2. In our analyses we used the Total Problems score of the CBCL at baseline and Time 2 and the cut-off score for the clinical range.

Parental rearing after adoption

The short version of the egna minnen beträffande uppfostran (s-EMBU) [4, 28] is a standardized questionnaire to measure parental rearing retrospectively. The 23 items can be scored on a 4-point scale and summarized in three reliable and valid scales: Rejection, Emotional Warmth and (Over) Protection [4]. Items and scales are determined for mothers and fathers separately.

■ Attrition

Selective attrition was investigated by comparing gender, age, age of placement in the adoptive family, parental socioeconomic status, early adverse experiences, and baseline mental health problems of the 1,364 included participants in this study with non-responders. Significantly more men than women did not respond during follow-up (41.3 vs. 32.0%; $\chi^2 = 19.53$, $df = 1$, $P < 0.001$). Furthermore, age of placement (in months) differed between the two groups, with a higher age of placement for dropouts (mean = 33.1, SD = 25.4, vs. mean = 27.6, SD = 24.1, $t = 4.9$, $df = 2,146$, $P < 0.001$). As can be expected the mean CBCL Total Problems score was significantly higher for non-responders than for the included participants (mean = 25.2, SD = 22.8, vs. mean = 20.0, SD = 18.8, $t = 5.4$, $df = 1,388.2$, $P < 0.001$). Non-responders did not differ significantly from the included participants with respect to the other tested variables.

■ Statistical analyses

We conducted logistic regression analyses, using SPSS 12.0, to determine if early adverse experiences predict the presence of psychiatric disorders in adulthood. The specific early adversities and the total number of early adverse experiences were entered separately as categorical variables. Odds Ratios (ORs) were derived, with 95% confidence intervals (95% CIs), adjusted for age, age of placement, gender, country of origin and parental socioeconomic status. To separate the late effects of early adverse experiences in adolescence or adulthood from effects at mean ages of 12.4 and 15.5 years, the CBCL Total Problems score at baseline and Time 2 were subsequently included in the logistic regression analyses as covariates. This way, corrections were made for mental health problems in childhood or adolescence. In an additional analysis, we

excluded participants whose CBCL Total Problems scores at baseline were in the clinical range to study late effects of early adversities in a symptom free subsample.

Furthermore, if the most severe category of maltreatment had the highest OR for psychiatric problems, we ran analyses entering the early adversities as a continuous variable to test for a dose–response relation. This way, we could determine if the chance to develop a psychiatric disorder was higher if the experienced early maltreatment was more severe. Finally, we additionally adjusted the analyses for the scores on the s-EMBU scales to control for the effect of parental rearing after adoption and for the socioeconomic status of the adoptees.

Results

In Table 2 the effects of early adversities on psychiatric disorders in adulthood are shown after adjustments were made for age, age of placement, gender and parental socioeconomic status. For each of the early adversities we found a significant effect on one or more adult psychiatric disorders. Severe abuse was related to the 12-month prevalence of anxiety disorders (OR = 3.02; 95% CI: 1.37–6.64) and any disorder (OR = 2.21; 95% CI: 1.07–4.56) in adulthood. Adoptees were more likely to have substance abuse or dependence (OR = 1.70; 95% CI: 1.01–2.87) and any disorder (OR = 1.63; 95% CI: 1.19–2.22) when they experienced some neglect, whereas severe neglect was not significantly associated with the presence of psychiatric disorders. Three or more placements increased the risk to have mood disorders (OR = 2.74;

95% CI: 1.22–6.12) and substance abuse or dependence (OR = 3.69; 95% CI: 1.55–8.77). Multiple early adversities were related to all adult psychiatric disorder groups in adulthood. In addition, several significant dose–response effects were found: the chance to develop a psychiatric disorder was higher if the experienced early maltreatment was more severe.

Table 3 presents the late effects of early adverse experiences on adult psychiatric disorders. For this aim, the relation between early adverse experiences and psychiatric disorders in adulthood was additionally adjusted for mental health problems at baseline and at Time 2. As a consequence of these additional adjustments, virtually all effects that were found in the prior analyses were reduced, but most associations remained significant. Only the relation between severe abuse and any disorder, between some neglect and substance abuse and between multiple early adversities and anxiety or mood disorder disappeared. Similarly, most dose–response effects remained significant. In an additional analysis we included only participants whose CBCL—Total Problems score at baseline were in the normal range. The same effects of early adversities were found, although the risk of adoptees with multiple early adversities to have any disorder did not reach significance anymore (P = 0.08).

Corrections for the quality of parental rearing in the adoptive family and the socioeconomic status of the adoptees resulted in very minor changes only (data not shown).

Table 2 Relation between early childhood adversities and psychiatric disorders in adulthood

	Anxiety disorders (N = 218[a])		Mood disorders (N = 138[a])		Substance abuse/dep (N = 112[a])		Any disorder (N = 402[a])	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Abuse								
No (N = 863)	Ref.		Ref.		Ref.		Ref.	
Some (N = 81)	1.52[b]	0.77–3.01	0.56	0.20–1.51	0.96	0.33–2.82	1.36[b]	0.78–2.36
Severe (N = 34)	3.02**[b]	1.37–6.64	1.26	0.45–3.49	1.92	0.60–6.14	2.21*[b]	1.07–4.56
Neglect								
No (N = 622)	Ref.		Ref.		Ref.		Ref.	
Some (N = 311)	1.31	0.88–1.94	1.32	0.83–2.11	1.70*	1.01–2.87	1.63**	1.19–2.22
Severe (N = 220)	1.24	0.80–1.94	1.36	0.81–2.27	1.48	0.83–2.65	1.23	0.86–1.75
Number of placements								
0 (N = 477)	Ref.		Ref.		Ref.		Ref.	
1 or 2 (N = 530)	0.70	0.48–1.03	1.34[b]	0.84–2.14	1.39[b]	0.81–2.39	0.96	0.71–1.29
3 or more (N = 63)	1.00	0.47–2.11	2.74*[b]	1.22–6.12	3.69**[b]	1.55–8.77	1.60	0.88–2.89
Total number of early childhood adversities								
0 (N = 646)	Ref.		Ref.		Ref.		Ref.	
1 (N = 407)	1.01	0.70–1.46	1.18[b]	0.77–1.82	1.74*[b]	1.04–2.83	1.30[b]	0.97–1.73
2 or 3 (N = 55)	2.22*	1.11–4.45	2.20*[b]	1.00–4.86	3.81**[b]	1.62–8.98	2.33**[b]	1.28–4.23

Odds Ratios were calculated with logistic regression adjusted for age, age of placement, gender, country of origin and parental socioeconomic status. *OR* odds ratio, *95% CI* 95% confidence interval, *dep* dependence. No separate ORs are given for disruptive disorders because of the small number of participants with disruptive disorders for which certain information of at least one early childhood adversity was available (N = 47)
*P < 0.05; **P < 0.01
[a] The numbers of participants with anxiety disorders, mood disorders, substance abuse or dependence and any disorder for which certain information of at least one early adverse experience was available. The numbers of participants in the first three disorder groups do not add up to any disorder, because of additional included disorders (disruptive disorders, eating disorder, schizophrenia or other psychosis and somatoform disorder) and comorbidity
[b] The increasing ORs showed a significant dose–response effect from the severity of early maltreatment to the risk for a psychiatric disorder

Table 3 Relation between early childhood adversities and psychiatric disorders in adulthood additionally adjusted for child and adolescent behavioral and emotional problems

	Anxiety disorders (N = 218[a])		Mood disorders (N = 138[a])		Substance abuse/dep (N = 112[a])		Any disorder (N = 402[a])	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Abuse								
No (N = 863)	Ref.		Ref.		Ref.		Ref.	
Some (N = 81)	1.28[b]	0.63–2.59	0.52	0.19–1.42	0.77	0.25–2.35	1.14	0.65–2.02
Severe (N = 34)	2.35*[b]	1.05–5.24	1.12	0.39–3.17	1.41	0.43–4.64	1.68	0.80–3.54
Neglect								
No (N = 622)	Ref.		Ref.		Ref.		Ref.	
Some (N = 311)	1.28	0.86–1.91	1.31	0.82–2.09	1.67	0.99–2.82	1.59**	1.16–2.18
Severe (N = 220)	1.07	0.68–1.68	1.28	0.76–2.16	1.26	0.69–2.28	1.01	0.70–1.47
Number of placements								
0 (N = 477)	Ref.		Ref.		Ref.		Ref.	
1 or 2 (N = 530)	0.69	0.47–1.01	1.32[b]	0.82–2.11	1.40[b]	0.81–2.41	0.93	0.69–1.26
3 or more (N = 63)	0.88	0.41–1.89	2.54*[b]	1.13–5.73	3.42**[b]	1.41–8.29	1.40	0.76–2.58
Total number of early childhood adversities								
0 (N = 646)	Ref.		Ref.		Ref.		Ref.	
1 (N = 407)	0.94	0.65–1.37	1.14	0.74–1.76	1.60[b]	0.95–2.71	1.18[b]	0.89–1.59
2 or 3 (N = 55)	1.84	0.91–3.75	2.01	0.90–4.49	3.12*[b]	1.30–7.51	1.86*[b]	1.01–3.45

Odds Ratios were calculated with logistic regression adjusted for age, age of placement, gender, country of origin, parental socioeconomic status, CBCL Total Problems scores at baseline and Time 2. *OR* odds ratio, *95% CI* 95% confidence interval, *dep* dependence, *CBCL* child behavior checklist. No separate ORs are given for disruptive disorders because of the small number of participants with disruptive disorders for which certain information of at least one early childhood adversity was available (N = 47)

*$P < 0.05$; **$P < 0.01$

[a] The numbers of participants with anxiety disorders, mood disorders, substance abuse or dependence and any disorder for which certain information of at least one early adverse experience was available. The numbers of participants in the first three disorder groups do not add up to any disorder, because of additional included disorders (disruptive disorders, eating disorder, schizophrenia or other psychosis and somatoform disorder) and comorbidity

[b] The increasing ORs showed a significant dose–response effect from the severity of early maltreatment to the risk for a psychiatric disorder

Discussion

In a sample of international adoptees we studied the effects of early childhood adversities on psychiatric disorders in adulthood. We found that abuse, neglect and number of caretaking places each increased the risk of certain psychiatric disorders. Furthermore, when multiple early adversities were experienced, risks for all psychiatric disorders in adulthood were increased. Adjustments for mental health problems prior to adulthood only slightly attenuated effects. This indicates that de novo effects of early adversities are observable in adolescence or adulthood.

■ Relation between early adversities and adult psychiatric disorders

Although methodological differences between studies make it difficult to compare results, the present findings confirm general population studies that found effects of early childhood adversities on psychiatric disorders in adulthood [3, 14, 22, 25, 37]. However, these studies could not disentangle the impact of childhood adversities from the additional effect of a problematic environment later in life. Indeed, some general population and twin studies found that the effects of child maltreatment on adult psychiatric problems decreased when other problematic environmental factors were controlled for [10, 14, 21,

27]. Nevertheless, the impact of child adversities on later psychiatric disorders in these studies remained significant and could not be fully explained by the problematic environmental factors. In addition, other researchers demonstrated that the effects of childhood sexual abuse on psychiatric problems were reduced if protective factors such as a supportive family were taken into account [5, 24]. The present study suggests that even when adversities are limited to a certain period in life and children are subsequently taken out of their problematic environment, the risk for psychiatric disorders in adulthood increases. Moreover, effects were largely independent of the quality of parental rearing in the adoption family.

A wide range of psychiatric disorders seems to arise as a consequence of childhood adversities, suggesting little specificity [21, 22]. Compatible with these findings, we observed that anxiety disorders, mood disorders and substance abuse or dependence in adulthood were all related to maltreatment early in life. Possibly, this is a consequence of the rather broad and general measurement of pre-adoption adversity. Moreover, we found that the negative effect of multiple adversities on these psychiatric disorders add up [12, 22].

Again, in line with the literature, we observed several dose–response effects [14, 21, 25, 29]. The risk for a psychiatric disorder was highest when early adversities were experienced in their most severe form. In general, moderate childhood adversities did not sig-

nificantly increase the likelihood of an adult psychiatric disorder. Adopted children seemed relatively resilient if maltreatment was not extremely severe. Possibly, this reflects the influence of environmental change after a limited period of maltreatment. The only exception was neglect: significant effects on psychiatric disorders were observed for some neglect, but not if neglect was severe. This lack of a dose–response effect could be a chance finding. Another plausible explanation is that it is hard to quantify "some" and "severe" neglect, which may result in some misclassification of the severity of neglect.

Late effects

Our results suggest that several effects of early adversities on psychiatric disorders are late effects. Consequences of early adversities could appear de novo in adolescence or adulthood. This is in accordance with the results of Jaffee et al. [19], for example, who found sexual abuse in children to be a risk factor for adult-onset depression. Because of the long period between the experience of the early adversities and the appearance of psychiatric disorders, this is striking, especially since participants of the present study were placed in an enriched environment after their adversities. A possible explanation for the substantial effects that remained in our sample could be the timing of the adversities. Early in life, the experience of severe adversities could have a higher and more long-term impact, as is found in several studies [6, 20]. Because of this timing of the maltreatment, we assumed that maltreatment caused the presence of psychiatric disorders later in life. The late effects that were found support this direction of effects. However, although unlikely in view of the mean age at adoption, we cannot rule out the possibility that difficult children experienced more early adversities.

Possible mechanisms

The question arises how early adversities can have such prolonged effects. Several explanations can be put forward. Being subjected to early childhood adversities may interfere with normal development of psychological functions, such as the formation of secure attachment relationships or the formation of self-concept. For example, adult women who were sexually abused in childhood showed an increased vigilance to interpersonal rejection, which may make them prone to developing depression [23].

Furthermore, early adverse experiences could cause biological adaptations within the developing child, which lead to psychiatric problems later in life. Early adversities are associated with changes in the brain, including the emergence of an epileptiform electroencephalogram (EEG), a reduced volume of the hippocampus, and changes in the corpus callosum (see for a review: [35]). Early adversities are also related to alterations in the hypothalamic-pituitary-adrenocortical (HPA) axis, the stress-system, which is related to mental health problems [15, 32, 35]. The timing of the adversities seems to be very important in these biological explanations, because the biological constitution of an individual is less determined early in life.

Early adversities seem to convey vulnerability, biologically or psychologically, which could be enhanced or modified by genetic variability. For example, individuals who carry at least one short allele of the serotonin transporter gene polymorphism exhibit larger cortisol responses to psychosocial stressors and are at higher risk for depression following early childhood adversities [7, 33]. This vulnerability can be expressed under certain circumstances. When these conditions are met for the first time in adolescence or adulthood, this could explain why psychiatric disorders can arise de novo later in life. Unfortunately information about possible mediators, like current stressors, is not available in the present sample. Furthermore, early adversities might be more common in adoptees who have birthparents with psychiatric disorders. Genetic heritability could then play a role in the emergence of psychiatric disorders in the adoptees, even in adulthood. In parallel with the increasing resemblance of the adopted child's intelligence quotient (IQ) with that of their birthparents [30], adoptees might—as they grow older—become more alike their birthparents with respect to psychopathology. Unfortunately, no information about psychiatric disorders of the birthparents of the adopted sample was available in our study.

Limitations

This study has some limitations that have to be considered. First, information on early adverse experiences was gathered retrospectively by asking adoptive parents at baseline single questions. This could introduce reporting bias in the measurement of early adversities [17]. However, because early adversities were assessed many years before the measurement of psychiatric disorders and since different informants were used, little distortion of the relation between early adverse experiences and psychiatric disorders is expected. Furthermore, we took great care to increase the reliability of information on early adversities by using only answers of which parents reported they were certain. Obviously, this does not guarantee accuracy of the information. In addition, because the Dutch term for abuse used in the wording of the question does not cover sexual or emotional abuse equally well as physical abuse, abuse encompassed mainly physical abuse. Other forms of abuse may also be difficult to assess with any certainty. However, they were not explicitly ruled out, and therefore sexual and emotional abuse might play a role in the relation

between maltreatment and adult psychiatric disorders.

Second, a selective attrition was observed, in which persons who were lost to follow- up had higher levels of mental health problems in childhood or adolescence than participants. They did not differ significantly from participants with respect to the level of early adverse experiences, only with respect to age of placement. It cannot be ruled out that these children developed more psychiatric disorders in adulthood, while they did not differ on early adversities. In this case, true results would be somewhat less significant.

Third, the adjustment for prior mental health problems was limited. In the present study, the adjustment for mental health problems in childhood or adolescence was based on two assessments only, when children were on average 12.4 and 15.5 years old. Furthermore, mental health problems in childhood and adolescence are measured using a parental questionnaire, whereas psychiatric problems in adulthood are assessed with a structured interview of the participants. Most likely, the effect of adjustment for psychiatric problems prior to adulthood would be stronger, had psychopathology been measured with the same instrument prior to adulthood. In addition, no information was available on the use of mental health services. Therefore, we could not take into account possible effects of the awareness of any problems at a clinical level.

Finally, to what extent results can be generalized is debatable. The international adoption sample used in this study constitutes a sample in which severe early adverse experiences were common and a transition to an enriched environment occurred. Although changes in the life of non-adopted children are probably less pronounced, our results seem indicative for many adults who have experienced adversities early in life.

Conclusion

In conclusion, children seemed resilient to the experience of a moderately severe early adversity. However, when the adversities early in life were severe or multiple, individuals have an increased likelihood of a psychiatric disorder in adulthood. This increased risk was observed even though children were taken out of their problematic environment through adoption when they were on average two years old. Moreover, our study suggests that psychopathology due to early adverse experiences can appear de novo in adolescence or adulthood.

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